Virtual Manufacturing - A Study of Some Important Issues relating to the Transformation of Traditional Manufacturing Organisations

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August 2006

Aston University

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2006

THESIS SUMMARY

This thesis starts with a literature review, outlining the major issues identified in the literature concerning virtual manufacturing enterprise (VME) transformation. Then it details the research methodology used - a systematic approach for empirical research. Next, based on the conceptual framework proposed, this thesis builds three modules to form a reference model, with the purpose of clarifying the important issues relevant to transforming a traditional manufacturing company into a VME.

The first module proposes a mechanism of VME transformation - operating along the VME metabolism. The second module builds a management function within a VME to ensure a proper operation of the mechanism. This function helps identify six areas as closely related to VME transformation: lean manufacturing; competency protection; internal operation performance measurement; alliance performance measurement; knowledge management; alliance decision making. The third module continues and proposes an alliance performance measurement system which includes 14 categories of performance indicators. An analysis template for alliance decision making is also proposed and integrated into the first module.

To validate these three modules, 7 manufacturing organisations (5 in China and 2 in the UK) were investigated, and these field case studies are analysed in this thesis. The evidence found in these organisations, together with the evidence collected from the literature, including both researcher views and literature case studies, provide support for triangulation evidence.

In addition, this thesis identifies the strength and weakness patterns of the manufacturing companies within the theoretical niche of this research, and clarifies the relationships among some major research areas from the perspective of virtual manufacturing. Finally, the research findings are summarised, as well as their theoretical and practical implications. Research limitations and recommendations for future work conclude this thesis.

KEY WORDS: Virtual Manufacturing; Alliance; Lean Operation; Performance Measurement

Acknowledgements

Among the people who have contributed to making my research at Aston enjoyable and rewarding, I would like to especially thank my supervisor, Professor Ashok K. Kochhar, for his commitment, guidance, and support throughout the course of my research. In addition to the many academic points I learnt from Professor Kochhar, I am grateful for his comments and suggestions on the preparation of this thesis.

I would also like to thank the managers of the seven case study companies, who believed in the value of this research, spent their precious time, and offered the research opportunities. Without their input, the research findings could not have been tested.

During the course of this research, I met my wife, Beili Tao, who sacrificed much, yet kept cheerful, patient, and supportive throughout these years. This thesis is dedicated to her, as well as to my parents, who encouraged me to go abroad for further study, and gave me strong support in the time of difficulties.

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Abbreviations and Terms

- **External Operation / Externalised Operation / Externalisation / Alliance / Partnership**

  Carry out tasks using external resources. Firms do not own the external resources accessed through alliances. Alliances can take different forms, e.g. outsourcing, joint venture, which differentiate from one another according to how the firm's internal resources are combined with external resources. For example, simple forms of outsourcing can be viewed as alliance without much collaboration.

  Internal Operation / Internalised Operation / Internalisation

  Carry out tasks totally depending on own resources. Firms do own the resources, although these resources might be acquired through market transaction, merger, or acquisition.

  EI

  External-Internal; Externalisation-Internalisation

  EI Decision Making

  Decision making regarding whether external or internal operation should be used to carry out a task

  Externalisation Structure

  A firm's externalisation structure is the structure of the firm's external operations

  Internalisation Structure

  A firm's internalisation structure is the structure of the firm's internal operations

  EI Structure

  A firm's EI structure is the structure of the firm's external & internal operations

  EI Management Function

  A management function (a person/team/department) to improve the holistic performance of a firm's external and internal operations

- **Virtual Manufacturing Enterprise (VME)**

  A manufacturing company which wisely uses operational externalisation to improve its performance

- **VME Performance Management System (VMEPMS)**

  A system to measure the performance of a VME

  Alliance Performance Management System (APMS)

  A system to measure the performance of an alliance

- **Value Stream**

  The set of all the specific actions required to bring a specific product (whether a good, a service, or, increasingly, a combination of the two) through the three critical management tasks

  (1) The problem-solving task running from concept through detailed design and engineering to production launch

  (2) The information management task running from order-taking through detailed scheduling to delivery

  (3) The physical transformation task proceeding from raw materials to a finished product in the hands of the customer

1 Introduction

1.1 Research Background

Proper use of alliances offers firms significant benefits. Who could ignore the chance of doubling competencies without added expense? Who could ignore the chance of becoming agile in today's ever-changing market with less investment? Who could ignore the chance of beating larger competitors with surprising strategies? The chances have always been nearby for most firms; yet difficult to seize: unawareness of the chances, fear of becoming dependent on others, lack of management expertise, dread of competency leakage, are among the reasons for missing the opportunities.

It is apparent that various forms of inter-organisational collaboration have escalated in importance during the 1990s (Cravens et al., 2000). Indeed, such collaboration is becoming increasingly common (Mathews, 2006) that the number of alliance transactions has grown by approximately 16% per year in the US since 1985 and that the number of alliances rivalled the number of mergers and acquisitions between 1985 and 1999 (Robinson, 2003). More and more firms are joining together in inter-organisational collaboration (Mathews, 2006; Cravens et al., 2000; Das & Teng, 1999). This trend of operational externalisation leads to the concept of "Virtual Manufacturing Enterprise (VME)".

It is common in the literature to define VME as networked companies through alliances (Wu & Sun, 2002; Lau et al., 2003; Huang et al., 2002; Mo & Zhou, 2003; Huang et al., 2004; Byrne, 1993; Bremer et al., 1999; Berwanger, 1999). However, in this research, **VME** is defined as "**a manufacturing company which wisely uses operational externalisation to improve its performance**". This definition differentiates from the common definition in that it refers to a single company rather than a network of companies. A great benefit gained from this definition is that the statement of "transforming a traditional manufacturing company into a VME" becomes logical, since both "a traditional company" and "a VME" now refer to a single company.

1.2 Definition of the Research Problem

The research problem addressed in this research is:

How to transform a traditional manufacturing company into a Virtual Manufacturing Enterprise?

It is argued that a tool can be developed that, if used properly, will transform a traditional manufacturing company into a Virtual Manufacturing Enterprise. This tool takes the form of a Reference Model. A Reference Model is a previously agreed upon and validated standard system (Williams & Vosniakos, 1997). A Reference Model defines system elements common to all implementation previously defined within the model's scope, but independent of the specific requirements of a particular implementation (Doumeingts et al., 1995; Williams et al., 1993). A company can then develop solutions using the Reference Model as a foundation.

This research problem thus leads to the research hypothesis:

A Reference Model can be established for the VME transformation.

Based on the literature review, the research problem raises the following high-level research questions:

(1) How to make decisions of operational externalisation?

(2) How to transform to a VME from the aspect of functional structure?

(3) How to evaluate a VME's performance?

1.3 Justification for the Research

Being a VME has great benefits. Through wise externalisation, companies can achieve tasks beyond their internal capacity (Hoffmann, 2005), focus more resources on core competencies thus becoming agile (Arnold, 2000), and gain advantages of lean operations (Hines et al. 1998; Rafuse, 1996).

However, transforming to a VME is not without difficulties. By transforming to a VME, "to use others' resources" and "to use own resources" become two parallel options. Thus, the choice between the two options becomes an important issue. Since VME is a specific kind of organisations, it should have a functional structure especially designed for it to fully explore its potential. This means some degree of functional adjustment to traditional manufacturing companies, which, without specific guidance, is difficult to achieve. In addition, traditional performance measures are no longer sufficient for assessing a VME's performance; new performance measures are needed.

These difficulties are not addressed (or not satisfactorily addressed) in the literature. Further, no research is found focusing on the transformation of a traditional manufacturing organisation into a VME. This imbalance between industrial needs and a lack of academic support justifies this research.

1.4 Research Methodology Overview

The research methodology underlying this research is based on a well established systematic approach for empirical research (Flynn et al, 1990) with a theory verification purpose.

As detailed in Chapter 3, this research consists of six phases:

- In the 1st phase ("establish theoretical foundation"), based on thorough literature reviews, a theoretical foundation is established which takes the form of a Reference Model.
- In the 2nd, 3rd, and 4th phases ("research design"; "select data collection method"; "implementation"), the research is designed, and the data collection methods (i.e. multiple case studies) are selected and implemented.
- In the 5th phase ("data analysis"), data collected are analysed to verify and refine the Reference Model.
- In the 6th phase ("publication"), the research findings are published.

The 2nd phase "research design" can be seen as a summary of the 1st phase "establish theoretical foundation", and as guidance, based on the 1st phase, of the later phases: "select data collection method", "implementation", and "data analysis". Thus, the 2nd phase "research design" can be viewed as a junction of the theory building stage and the theory verification stage.

1.5 Outline of the Thesis

An overview of the thesis and its structure can be seen in Figure 1.1. Chapter 2 goes to explain the gaps observed in the literature, and lay down the ground upon which the reference model proposed in this research is based. Chapter 3 explains the research methodology in detail. Chapters 4, 5 and 6 are designed to explain each of the three modules of the reference model respectively. Chapter 7 goes to summarise the reference model, and test its reliability and validity based on field case studies. Chapter 8 brings together all relevant issues, discusses how this research solves the research problem, and the observed strengths and limitations of the research methodology used. The last chapter concludes the research.

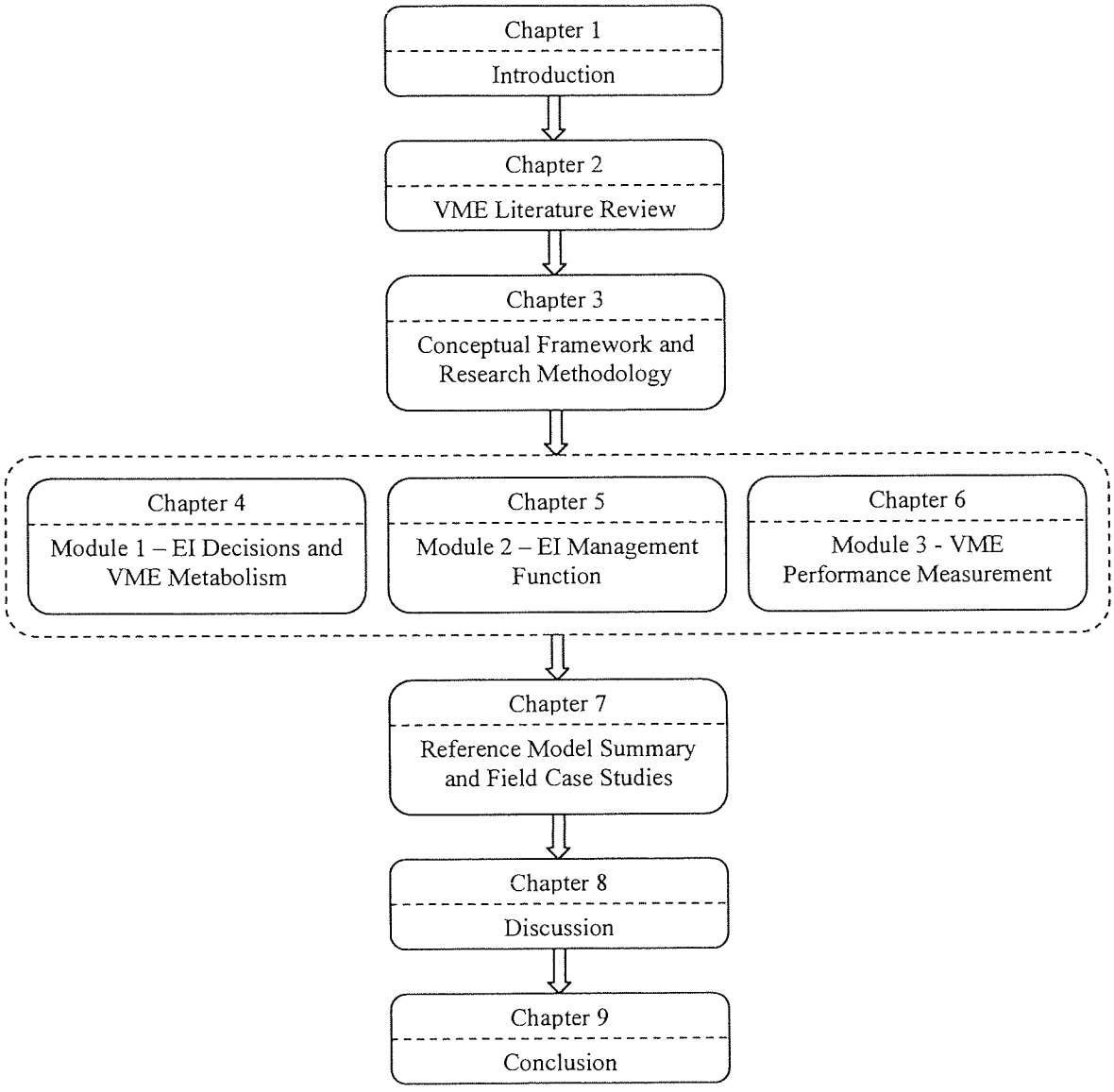


Figure 1.1 Structure of the thesis

1.6 Summary

Based on the observed trend of operational externalisation, this chapter introduced the concept of "Virtual Manufacturing Enterprise", proposed the research problem and questions, and justified this research. This chapter also gave out an overview of the research methodology used in this research, which would be explained in detail in Chapter 3.

2 VME Literature Review

2.1 Introduction

Extensive literature review before constructing a reference model helps spot any similar works done before by other researchers, identify the gaps in the literature regarding the research problem, and use existing theories as the basis upon which the new reference model could be built. This chapter explains in detail the areas of the literature reviewed in this research, and how they could help build the reference model.

2.2 Definition of Virtual Manufacturing Enterprise (VME)

Two mainstream definitions of VME are found in the literature.

One defines VME as manufacturing companies virtualised through Information Technology (Offodile and Abdel-Malek, 2002; Baykasoğlu, 2003; Olofsgård et al., 2002; Slomp et al., 2005). For example:

Offodile and Abdel-Malek (2002) named "Virtual Manufacturing" as "Telemanufacturing" or "e-Manufacturing", and proposed a Telemanufacturing test bed (for SME) which has three major IT-driven components (a decision support system for selecting equipment for manufacturing cells; a rapid prototype; a make or buy decision analysis modules), and uses the Internet as its transmission medium. The proposed Telemanufacturing test bed is one example of many emerging applications that IT offers to manufacturers.

Slomp et al. (2005) proposed a virtual cellular manufacturing system, and a design procedure for such virtual cells in real time. Virtual cells' dynamic nature is their main difference from classic cells (Baykasoğlu, 2003): whereas classic cells' physical location and identity are fixed, virtual cells are not fixed, and can vary with changing production requirements.

The majority of research on Materials Requirement Planning (MRP), Manufacturing Resource Planning (MRP II), and Enterprise Resource Planning (ERP) systems can also be included under this mainstream. ERP can be traced back to, and has evolved from Materials Requirement Planning (MRP) and Manufacturing Resource Planning (MRP II) systems (Wight, 1984). Yen et al. (2002) described the evolution of ERP as follows: "before creating ERP, inventory control system was the software

designed to handle traditional inventory processes ... the early stage of ERP was carried out through Materials Requirements Planning (MRP), a software which focused on time requirements for sub-assemblies, components, materials planning, and procurement. Manufacturing Resource Planning (MRP-II) was developed in 1970-1980, which was the software package focused on extending MRP to the shop floor and distribution management activities ... the next stage of ERP evolution was Just-in-time (JIT) methodology ... the maturity stage of ERP occurred in mid-1990. ERP was the software package focused on extending MRP-II to cover additional areas such as finance, engineering, human resources, project management, etc ... the current ERP development intends to utilize ERP to realize and sustain a competitive advantage".

The other mainstream defines VME as networks of companies through alliances (Wu & Sun, 2002; Lau et al., 2003; Huang et al., 2002; Mo & Zhou, 2003; Huang et al., 2004; Byrne, 1993; Bremer et al., 1999; Berwanger, 1999; Panteli and Sockalingam, 2005). Under this mainstream, Virtual Enterprise (VE), Virtual Manufacturing Organisation (VMO) and Virtual Corporation (VC) appear to be similar concepts to VME. For example:

Chalmeta and Grangel (2005) defined a virtual enterprise (VE) as "a temporary alliance of globally distributed independent enterprises that come together to offer a product or a service". Cao and Dowlatshahi (2005) described a Virtual Enterprise as a network of organisations/firms, from which temporary alignments were formed. Wu & Sun (2002) defined a Virtual Enterprise as a temporary alliance of enterprises created to share the core resources owned by the partners. Lau et al. (2003) indicated that "formation of virtual enterprise networks combines the advantages of the various core competencies of members of the network to deliver customer satisfaction". Huang et al. (2002) defined a Virtual Enterprise as "a temporary coalition of distributed, autonomous and cooperative member enterprises". Mo & Zhou (2003) indicated that "By participating in a virtual enterprise, companies bring along their core competency and share it with their partners". Huang et al. (2004) described that "The essence of the agile manufacturing strategy is to form a virtual manufacturing organization (VMO), which integrates the core competencies of member enterprises in order to respond to the global market and increasing customer requirements rapidly". Byrne (1993) defined a Virtual Corporation as a "temporary network of independent companies – suppliers, customers and rivals – linked by IT to share skills, costs and access to one another's market". Bremer et al. (1999) defined Virtual Enterprise as collaboration among individual organisations to explore business opportunities that one enterprise itself would not be able to work out. Berwanger (1999) defined Virtual Corporation as "a cooperation form of legally independent companies, which form a network based on mutual accepted rules ... Each partner in the network remains independent and concentrates on its own core competence".

Under this type of definition, the concepts of "VME", "VE", "VMO" and "VC" are essentially the same as the concept of "alliance".

The definition of VME adopted in this thesis is derived from the second mainstream. In this thesis, a VME is defined as:

> **A manufacturing company which wisely uses operational externalisation to improve its performance**

This definition differentiates from the second mainstream in two aspects:

(1) Under this definition, VME and alliance become two different concepts: a VME refers to a single company within a network, whereas an alliance refers to a network of two/more independent companies. Thus, the statement of "transforming a traditional manufacturing company into a VME" becomes logical, since both "a traditional company" and "a VME" now refer to a single company.

(2) Under this definition, "using alliance" and "using internal operations" become two equal alternative ways of carrying out a task. Alliance is neither an inferior nor a superior way compared with internal operations. It has to be a wise combination of alliances and internal operations that will make a VME.

2.3 Scope of the Literature Review

Although no research is found in the literature focusing on how to transform a traditional manufacturing company into a VME, the following areas in the literature are considered as particularly relevant to the discovering of the solution. These areas form the scope of this literature review.

- Alliance Life Cycle
- Decision to Alliance
- Alliance Management Function
- Alliance Performance Measurement

2.4 Literature Review of Alliance Life Cycle

Basically three stages of the alliance life cycle are agreed upon in the literature: (1) formation stage; (2) operation stage; (3) dissolution stage. Table 2.1 summarises the descriptions of alliance life cycle in the literature.

Table 2.1 Descriptions of alliance life cycle in the literature

Stages agreed upon	Nooteboom (1999)	Child & Faulkner (1998); Murray & Mahon (1993)	Ring & Van de Ven (1994)	Chan & Harget (1993)
Formation stage	Emergence	Courtship → Negotiation	Negotiation → Commitment	Search → Dialogue → Negotiation
Operation stage	Performance → Adaptation	Start-up → Maintenance	Execution	Formation → Operation
Dissolution stage	Decline	The ending		Termination

Nooteboom (1999) indicated that an alliance had a path of development or "life cycle" with stages of emergence, performance, adaptation or decline: "A comparison can be made with a marriage relationship, with its stages of engagement, marriage, children, divorce or death ... Adaptation is needed to take into account changed goals and shifting conditions of markets and technology".

Alliances were also depicted as exhibiting the following life cycle (see Figure 2.1) (Murray and Mahon, 1993; Child and Faulkner, 1998).

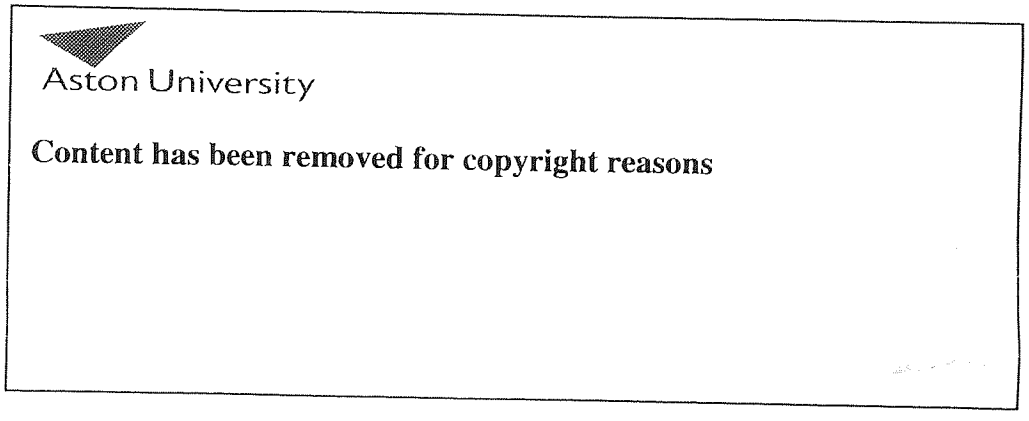


Figure 2.1 Alliance life cycle (cited from Child and Faulkner, 1998)

- The two axes of the figure indicate time and commitment of resources by alliance partners.
- Alliances begin with a courtship stage, as does any relationship.

- If this goes well, detailed negotiations follow to develop an agreement.
- Then follows stage three, the start-up phase, in which joint activity begins, and substantial resources are committed.
- The next stage, the maintenance phase, makes routine the operations and reporting relationships, as the organisations continue to work together on an operational basis.
- The fifth stage of the life cycle is described as the ending which can take a number of forms:
  - The end of the specific relationship with extensions into other areas of mutual interest
  - An amicable separation with no immediate further joint activity
  - A hostile parting, inhibiting the likelihood of any future joint activity

Ring and Van de Ven (1994) viewed the evolution of alliances, or, as they call them, Cooperative Inter-Organisational Relationships (IORs), "as consisting of a repetitive sequence of negotiation, commitment, and execution stages". In the negotiation stage, the intended partners develop joint expectations and make sense of the mission they are to embark upon. Through formal negotiations and informal sense-making they assess the various uncertainties associated with the deal, and form views on trust, commitment, respective roles, equity, and efficiency. In the commitment stage, the terms and governance structures of the alliance are established. In the execution stage, the commitments and rules of action are put into effect and business actions are initiated, such as the purchasing of materials, the production of goods, and the administration of the agreement towards an agreed set of objectives.

Chan & Harget (1993)'s "Strategic Alliance Life Cycle Model" divided formation stage into search stage, dialogue stage, and negotiation stage. Their model's "formation stage" is essentially the same as the "start-up phase" of Murray & Mahon (1993)'s model.

The alliance "formation → operation → dissolution" life cycle is one of the components of the VME Metabolism, which is explained in Chapter 4. In addition, the Alliance Performance Measurement System (APMS) proposed in this research is designed to cover all of the alliance life cycle stages.

2.5 Literature Review of Decision to Alliance

The literature provides 2 main explanations for the choice between externalisation and internalisation: the **transaction-cost** theory (Williamson, 1975, 1979, 1981, 1985, 1991, & 1994; Lacity & Willcocks, 1995; Tsang, 1998; Das and Teng, 2000; Arnold, 2000; Ireland et al., 2002; Yasuda, 2005), and the **resource-based** theory (Tsang, 1998; Das and Teng, 2000; Ireland et al., 2002; Yasuda, 2005).

Oliver Williamson (1975; 1979; 1981; 1985; 1991; 1994) is widely recognised as the major developer of transaction cost theory, as evidenced by 5371 citations of his work in the Social Sciences Index since 1981 (Lacity & Willcocks, 1995). Williamson proposes that costs comprise not only production costs (the costs of capital, labor, and materials), but also transaction costs (synonymous with coordination costs, comprising costs of monitoring, controlling, and managing transactions). Williamson's theory can be summarised as follows (Lacity & Willcocks, 1995):

In general, production costs are lower with outsourcing due to vendor economies of scale achieved through mass production efficiencies and labor specialisation. However, transaction costs are lower with insourcing, since organisations presumably administer an efficient system of reward and punishment to discourage employee opportunism, in contrast, organisations must incur transaction costs during contract negotiations/monitoring to prevent vendor opportunism. Organisations find it less costly to coordinate, monitor, control, and manage internal employees than external vendors. Thus, managers need to consider total costs (production costs plus transaction costs) when selecting among sourcing alternatives.

The resource-based theory views firms as bundles of resources, and alliances arise when firms need additional resources that cannot be purchased via market transactions (Yasuda, 2005). In contrast to the transaction-cost logic, which emphasises cost minimisation, the resource-based rationale emphasises value maximisation of a firm through pooling and utilising valuable resources (Das and Teng, 2000). The resource-based view suggests that valuable firm resources are usually scarce, imperfectly imitable, and lacking in direct substitutes (Barney, 1991; Peteraf, 1993). When efficient market exchange of resources is possible, firms are more likely to continue alone (Eisenhardt & Schoonhoven, 1996) and rely on the market (Das and Teng, 2000). However, although market transactions are the default mode, efficient exchanges are often not possible on the spot market (Das and Teng, 2000). Certain resources are not perfectly tradable, as they are either mingled with other resources or embedded in organisations (Chi, 1994). Hence, mergers, acquisitions, and strategic alliances are variously employed (Das and Teng, 2000).

Using both the transaction-cost theory and the resource-based theory, Das and Teng (2000) explained ownership decision among internalisation (merger, acquisition, or internal development), market exchange, and strategic alliance.

- **Internalisation** (merger, acquisition, or internal development): The transaction-cost theory explains that since internalisation controls transaction costs effectively, this will be preferred when transaction costs of an exchange are high. The resource-based theory explains that a firm will favour acquisition over joint venture when the assets needs are not commingled with other unneeded assets within the firm that holds them, and hence can be acquired by buying the firm or

a part of it (Hennart & Reddy, 1997). If the market is munificent or the firm is pursuing a strategy for which it has extensive resource capabilities, there is much less incentive to cooperate, and the firm is more likely to continue alone (Eisenhardt & Schoonhoven, 1996).

- **Market exchange**: The transaction-cost theory explains that market exchange bears transaction costs but avoids production costs, so that it will be used when transaction costs are low and production costs are high. The resource-based theory explains that when the purchase of the resource's service from the firm that possesses it can be efficiently conducted through the market, market exchange is preferred.
- **Strategic alliance**: The transaction-cost theory explains that if alliances are viewed as reflecting semi-internalisation, alliances can be justified when internalisation is more cost efficient, but constraints of various kinds prohibit full internalisation (Ramanathan et al., 1997). The resource-based theory explains that strategic alliances are preferred when the resources needed are owned by different parties and when these resources are inseparable from other assets of the owner firms (Ramanathan et al., 1997). Collaborations are a useful vehicle for enhancing knowledge in critical areas of functioning where the requisite level of knowledge is not in place and cannot be developed within an acceptable timeframe or cost (Madhok, 1997). While both alliance and merger/acquisition can accomplish the objective of obtaining a selected firm's resources, the distinct advantage of strategic alliances is to have access to precisely those resources that are needed, with minimum superfluity. In another kind of situations, Nelson and Winter (1982) maintain that, in order to prevent their know-how from decaying, firms sometimes need to engage in alliances, in order to avail themselves of opportunities to keep using these capabilities (i.e. remembering-by-doing). In this case, the choice between alliance and merger/acquisition is about whether one should relinquish one's resources permanently (M&A) or for a specified period only (alliances). The possible advantage of alliance over merger/acquisition is that the firm only temporarily relinquishes its resources, and the resources remain available for future internal deployment.

The transaction-cost theory and the resource-based theory were also used in the literature to explain among various alliance forms. For example, Yasuda (2005) explained 4 alliance forms using both transaction-cost and resource-based theories: technology license; joint R&D; sourcing agreement; joint venture.

Compared with the resource-based theory, the transaction-cost theory takes a controversial stand (Lacity & Willcocks, 1995; Tsang, 1998). For example, Tsang (1998) supports the resource-based theory, and indicates that the transaction-cost theory has the following weaknesses:

- A transaction is analysed in isolation: Cost minimisation in handling a transaction may in fact result in local rather than global efficiency.
- When analysing a strategic alliance, resource-based theory takes into account all the relevant resources of the firms involved. However, transaction-cost theory overemphasises cost minimisation and neglects value creation (Zajac and Olsen, 1993). By treating the maximisation of long-run profits, which is the difference between value and cost, as the fundamental motive for strategic alliance, the resource-based perspective strikes a better balance in analysing the cost and value aspects of inter-organisational collaboration than transaction cost theory does.

Similarly, through studying the Chinese partners in their international joint ventures, Philppe and Pierre (2005) found that the transaction cost theory was less suitable for Chinese partners than for foreign partners: the question of the performance of the Chinese partners was not posed in terms of the minimisation of transaction costs; instead, organisational learning theory applied to international joint ventures could provide a more appropriate framework for analysing the Chinese partners' performance. After analysing the Renault–Nissan Alliance, Segrestin (2005) also indicated that the transaction cost theory was inappropriate: "it would be almost impossible to compare the economic advantages or disadvantages of various governance structures in a project whose final parameters had yet to be determined".

From this point of view, the transaction-cost theory may well be incorporated into the resource-based theory. In other words, the transaction-cost rational can be viewed as a subset of the resource-based rational with cost minimisation as the emphasis. However, the current status of the resource-based theory is also not without deficiencies.

Das and Teng (2000)'s rationalisation of the choice among three sourcing alternatives cannot be used to rationalise the choice among different alliance forms (e.g. license, joint R&D, sourcing agreement, and joint venture). Similarly, Yasuda (2005)'s explanations of the 4 alliance forms also cannot be used to rationalise the choice between externalisation and internalisation.

Garette and Dussauge (2000) classify alliances into scale alliances (i.e. alliances for the purpose of achieving economies of scale) and complementary alliances (i.e. alliances for the purpose of accessing partners' complementary resources). They indicate that horizontal acquisitions will always outperform scale alliances because of the two features that distinguish alliances from mergers and acquisitions:

- All decisions must be made by consensus among the partner firms;
- Alliance reversibility limits the extent of rationalisation. In other words, it is difficult in an alliance to shut down facilities belonging to one of the partners and concentrate production in the

other partner's plants, which is one of the primary means to achieve economies of scale, because such shutdown makes subsequent termination of the alliance virtually impossible.

As to complementary alliances, Garette and Dussauge (2000) indicated: "Data collected on alliance outcomes (Dussauge et al., 1998 and Dussauge et al., 1999) show that complementary alliances result in capability transfers between the partners much more often than scale alliances ... Research on mergers and acquisitions shows that the success rate of these operations has proved to be quite low. According to many analysts, 80 per cent of the acquisitions carried out throughout the eighties have not benefited the acquiring firms' shareholders and should in fact never have taken place (Lynch, 1993). More specifically, acquisitions aimed at capturing new capabilities and at entering new fields of business or new markets appear to be even more hazardous ... In this context, complementary alliances are often an attractive strategic move through which to expand and capture valuable capabilities without running the very high risk of failure and without having to pay the premium attached to any acquisition".

However, Garette and Dussauge (2000)'s explanations have some limitations:

- Their explanations cannot be used to interpret other alliance alternatives (e.g. internal development, and market transactions), and also cannot be used to interpret various alliance forms (e.g. outsourcing, and joint venture).
- Achieving economics of scale is a purpose/task, for which forming alliances to access partners' complementary resources is a way. Therefore, classifying alliances into scale alliances and complementary alliances is not logical.

Lambe and Spekman (1997) explained that discontinuous technological change (DTC)-generated urgency and uncertainty motivate firms to use alliances, rather than traditional internal development or mergers/acquisitions, to source technology.

- Urgency: The need for rapid new product development often precludes internal development of critical technologies. Alliances allow firms that lack new product development technology to leverage partners' existing technological capabilities to speed new product development (Harrigan, 1985; Roberts, 1987).
- Uncertainty: Alliances allow a firm to avoid acquiring superfluous technology and assets (Hamel and Prahalad, 1994); it is industry uncertainty that truly drives firms to use alliances to acquire technology in the face of DTC, because DTC can increase the potential costs of a merger/acquisition to an unacceptable level.

However, DTC is a special industrial phenomenon, which makes Lambe and Spekman (1997)'s explanations short of generality. It is also difficult to apply their research findings to explain the choice among different alliance forms (e.g. outsourcing, and joint venture).

de Man and Duysters (2005) listed merger & acquisition's advantages and disadvantages for innovation, and concluded that "Except for the possibilities offered by M&As to reap some economies of scale in R&D, alliances outperform M&As on almost each conceivable point" in terms of their effect on innovation. M&As' advantages and disadvantages for innovation are listed as follows:

- Advantages: (1) to avoid high transaction costs, firms may be inclined to engage in an acquisition in order to solve problems related to the transmission of tacit knowledge (Bresman et al., 1999); (2) M&As may raise the overall R&D budgets of companies involved, which allows them: (i) to reap economies of scale; (ii) to tackle larger R&D projects than each individual firm could have done; (iii) to pay more attention to fundamental research, leading to more advanced technologies being developed; (iv) to enter into more research projects, thus spreading the risk of innovation.
- Disadvantages: (1) mergers require so much time of so many individuals involved that it diverts management attention away from innovation; (2) the failure rate of mergers in general is high; even when the merger is successful in terms of the integration of R&D departments, in other business areas the merger may not be a success, prompting a disintegration of the company; (3) in mergers and acquisitions, knowledge that is not required at all is acquired as well.

de Man and Duysters (2004)'s explanations subject to some limitations:

- Their research focuses on R&D only;
- Their research findings cannot be applied to the choice among different alliance forms (e.g. outsourcing, and joint venture), and among alliance alternatives other than merger & acquisition (e.g. internal development, or market exchange).

Amesse et al. (2004) identified three factors affecting the choice of externalising or internalising an operation:

- Uncertainty in relation to technology and demand (Duysters et al., 1999; Hoffmann and Schaper-Rinkel, 2001): Faced with this kind of uncertainty, companies look for the advantages of flexibility and reversibility (Mody, 1993; Glaister and Buckley, 1996; Narula and Dunning, 1999; Lundan and Hagedoorn, 2001; Hagedoorn et al., 2000). Alliances appear to be a type of arrangement more likely to bring about this advantage than internal development or acquisitions.
- Time or urgency to accomplish a specific technological development when the company does not necessarily have a lot of technological knowledge in all the fields related to the innovation: Urgency is more likely to lead to external solutions rather than to internal investments.

- Dispersal of knowledge: When the development of a technology requires pooling together and learning how to use knowledge or technologies that are not controlled by a single firm but by several, it results in the need for cooperation between complementary or even competitive players (Hoffmann and Schaper-Rinkel, 2001). This dispersal encourages alliances. Acquisitions do not allow for economical integration of knowledge dispersed across several companies (Hagedoorn et al., 2000).

However, these factors are difficult to be applied to explain the various alliance forms (e.g. license, joint R&D, sourcing agreement, and joint venture).

Another group of papers in the literature discussed motives for forming alliances or particular forms of alliances (e.g. joint venture). For example:

Harvey and Lusch (1995) indicated some fundamental motivational factors for cooperative ventures among global companies:

- Risk reduction (Awadzi, 1987; Borys and Jemison, 1989; Hamel et al., 1989)
- Economies of scale (Chowdhury, 1989; Blodgett, 1991)
- Forward-reverse technology flow (reducing duplication of technology efforts, reducing time/cost/risk of new technology development, and allowing for legal protection through patents for each strategic alliance partner) (Gibson and Smilor, 1992; Slocum and Lei, 1992; Mauri, 1993)
- Control or reduce competition (Gomes-Casseres, 1989; Gilroy, 1993)
- Avoidance of artificial trade barriers (e.g. governmental efforts to reduce free trade, such as tariffs, quotas, blocked trade and the like) (Prahalad and Doz, 1987; Chowdhury, 1989)
- Mechanism for international expansion for a truly domestic organisation (Ghemawat et al., 1986; Hergert and Morris, 1988; Ohmae, 1989)
- Complementary contributions of partners across the "value chain" (through forming a vertical alliance, different competitive advantages can be combined to permit a strategic relative advantage for the alliance) (Killing, 1983; Narus and Anderson, 1987; Slocum and Lei, 1992; Gibson and Smilor, 1992; Lynch, 1993; Gilroy, 1993)

Jagersma (2005) indicated that firms formed cross-border alliances to combine partner resources to develop new business or reduce investment, to eliminate risks, to learn, or to change the name of the competitive game.

Comparing Contractual Joint Venture (CJV) to Equity Joint Venture (EJV) in China, Folta (2005) listed some advantages of CJV over EJV: (1) allowing access to restricted sectors; (2) alleviating

capital contribution difficulties; (3) allowing more foreign management control; (4) reducing risk; (5) easier to terminate or modify; (6) resolving expense controversies; (7) offering tax advantages.

Nielsen (2003) identified the following motives for forming international strategic alliances:

- Innovation related: (i) sharing R&D costs; (ii) developing new technology; (iii) product diversification; (iv) payback on investment
- Market expansion related: (i) economies of scale; (ii) market penetration/expansion; (iii) international expansion
- Market defence related: (i) maintaining position in existing market; (ii) spreading risk of an investment
- Technology transfer related: (i) alliance with supplier/distribution channel; (ii) exchange existing technology
- Market power related: (i) alliance with competitor to reduce competition; (ii) alliance to conform to government policy

Focusing on alliances among direct rivals, Park & Zhou (2005) indicted that both the expected gains and the potential losses from missing alliances motivated firms to join alliance activities. A firm's alliance decisions involve "consideration of the potential losses of being left out while others improve their competitive positions through alliance", and "It is a rational choice that a firm forms an alliance while it does not expect any gains from the alliance" (Park & Zhou, 2005).

Yasuda (2005) identified three primary motivations for alliances: (1) access to partners' resources; (2) shortening of the time to market (or production); (3) reduction of the cost.

In observing the international R&D alliances in the Chinese IT industry, Wu and Callahan (2005) indicated that those alliances where foreign companies were seeking to nurture government relationships or to seek local market access and market share were likely to be in the form of equity-based joint ventures; those alliances formed to obtain human resources, to establish vertical linkages, to seek complementary technologies or economies of scale, are likely to be in the form of non-equity-based cooperative agreements.

This group generally exhibits a lack of fundamental explanations for alliance decision making, in other words, factors causing specific forms (e.g. outsourcing, joint venture, etc.) to satisfy specific motives. Further, no clear boundaries are in place among the factors, motives, and tasks.

In the literature, in addition to the transaction-cost theory and the resource-based theory, the core-competency theory also attracted some attention for outsourcing decisions. "Its main idea is that only

goods and services which are considered to be core competencies should be produced internally (insourcing)" (Arnold, 2000). Applying the core-competency theory, the "de-materialised company" seems to be the outsourcing optimum (Arnold, 2000):

> "The de-materialized company is a company working as a supplier management and customer management company. Its only job is to identify customer needs and to find suppliers delivering parts for a product which satisfies these needs. There are only two primary value chain activities left: purchasing and marketing. The de-materialized company delegates all manufacturing activities to suppliers. It links its supply markets with the needs of its end customer markets. Purchasing becomes the most important activity for the ability to produce physical goods. It is the 'linking pin' between marketing and manufacturing because the suppliers are now manufacturing agents for a company which does not have any physical assets at all ... Outsourcing on its highest degree and supply management of its highest level of strategic importance are linked closely together in the factory within a factory approach."

Since core competencies can be viewed as highly competitive resources, like the transaction-cost theory, the core-competency theory can also be incorporated into the resource-based theory. However, the current status of the resource-based theory doesn't exhibit such a feature. Since the core-competency theory alone is far from enough to explain various forms of alliances and various alliance alternatives, the resource-based theory needs to be further developed to incorporate this new feature.

As a conclusion, there are mainly three theories in the literature regarding externalisation-internalisation (EI) decision making: (1) transaction-cost theory; (2) resource-based theory; (3) core-competency theory. Both the transaction-cost theory and the core-competency theory can be incorporated into the resource-based theory, and the resource-based theory is likely to become fully fledged for explaining EI decision making. However, the current status of the resource-based theory is not satisfactory from the following aspects.

- Explanations for EI decision making are limited in their application, in other words, lack of generality.
- Factors causing specific forms (e.g. outsourcing, joint venture, etc.) to satisfy specific motives were not clarified. Further, no clear boundaries are in place among factors, motives, and tasks.
- The core competency perspective has not been well explained by the current resource-based theory.

This research proposes a template analysing EI decision making, which overcomes these weaknesses. This template is explained in Chapter 4.

2.6 Literature Review of Alliance Management Function

"A dedicated alliance management function within a company" is a new research area. Only one focused paper (Kale, Dyer and Singh, 2001) is found in the literature. Dyer, Kale and Singh (2001) indicated that firms with a dedicated strategic alliance function created more value from alliances than those without such a function. Hoffmann (2005) also indicated that a dedicated alliance management function was the only way to ensure that the alliance portfolio contributed to attaining the company's strategic goals. A dedicated alliance management function (Dyer et al., 2001) "coordinate(s) all alliance-related activity within the organization and (to institutionalize) processes and systems to teach, share, and leverage prior alliance-management experience and know-how throughout the company".

After studying alliance management practices in over 200 companies, Kale et al. (2001) found that "(alliance) experience alone is not sufficient ... companies enjoying greater alliance success are those that undertake a multi-pronged approach to build their alliance skills. First, they create a special alliance structure to coordinate their alliance activity. Second, they implement specific systems to capture, codify, communicate and create alliance management lessons and insights associated with their alliance experience. They also coach their managers and executives on alliance skills built through prior experience. We call it the '4Cs (capture-codify-communicate/create-coach) approach' to building alliancing skills." Draulans et al. (2003) extended "this finding by not only looking at a dedicated alliance function (the alliance specialist), but also at specific methods to gather alliance knowledge, viz. alliance training and evaluation methods". The alliance specialist, training, and evaluation mechanisms can be related to the 4Cs proposed by Kale et al. (2001) in the following way (Draulans et al., 2003):

- The presence of an alliance specialist – To store, integrate and diffuse alliance knowledge
- Alliance training – To accumulate and diffuse knowledge about alliances
- Alliance evaluation mechanisms – To accumulate knowledge based on a firm's own alliance experience with its partners

The following responsibilities of the alliance management function are identified in the literature:

- Coordinating alliances to improve their compatibility: "A firm can have various alliances with one partner which can be conflicting or synergetic." (Duysters et al., 1999) In addition, "an alliance with one partner is (quite often) in direct conflict with an alliance with another partner. Organizations remain unaware of this situation till it reaches an explosive state. Companies that set up an internal system to continuously assess and coordinate the relationships, if any, across all alliances in their portfolio are better suited to address such problems before they become serious." (Kale et al., 2001)

- Internal resource allocation for alliances: An alliance team can coordinate "availability of internal organizational resources for alliances" (Kale et al., 2001).
- Gaining stakeholders' support for alliances: Kale et al. (2001)'s research shows that gaining external support and visibility is often one of the primary responsibilities of the alliance team in companies: "Such an activity not only helps gain the operational support of external stakeholders but also helps attract more investment support".
- Evaluating alliance performance: Kale et al. (2001) identified alliance performance evaluation as one of the alliance management function's responsibilities. Draulans et al. (2003) identified two evaluation methods: (i) evaluation per alliance; (ii) cross-alliance evaluation (i.e. comparing alliances). They indicated that both methods of evaluation have positive effects on company's learning from alliances, with the latter generating more benefits for experienced companies.
- Alliance knowledge management: "Managers and executives associated with prior alliances usually possess invaluable insights and lessons based on their personal experience. Companies can benefit a great deal if they can access and capture the alliance insights and experiences of these individuals. Once the insights are captured, they are retained within the organization even if the managers/executives leave the company. More importantly, other managers in the organization can now access these insights and experiences more easily to help them in their own alliance situations. We noticed that dedicated alliance teams in some companies regularly engaged in de-briefing their alliance managers to capture such lessons and insights from their experience." (Kale et al., 2001) Draulans et al. (2003) suggested the use of alliance specialist "to accumulate the knowledge and experience of a large number of alliances and to make these accessible to the organisation. In this way he or she will enhance the alliance capability of the organisation." Bonner et al. (2004) suggested a practice of periodically collecting field experiences from alliances.

  Some companies "methodically codify and leverage the alliance management lessons and best practices from the past. They created codified tools such as alliance management guidelines, worksheets and manuals based on the prior alliance experience ... Alliance teams usually take the lead in developing such codified tools. These tools are created on the basis of regular and extensive interviews and interaction with managers associated with alliances in the past or present" (Kale et al., 2001). Bonner et al. (2004) suggested a practice of periodically analysing field experiences collected from alliances.

  "Certain companies establish forums and networks of alliance managers to facilitate sharing of alliance experience and knowledge among them. Person-to-person communication is particularly useful in disseminating alliance management know-how that is more tacit in nature. More importantly, sharing and dialogue encourage and facilitate creation of 'insights and ideas' to

manage future alliance situations more effectively ... (Managers) are able to absorb valuable alliance know-how and skills through coaching and training" (Kale et al., 2001). Draulans et al. (2003) also indicated that alliance knowledge and experience "can be transmitted to managers by such means as training. Training can either be internal (by company specialists) or external (e.g. by consultants or academics)." Bonner et al. (2004) suggested practices of transferring alliance knowledge across alliance partners, and transferring know-how on alliance "do's" and "don'ts" to key managers.

Based on the alliance management function, the concepts of "Externalisation-Internalisation (EI) Management Function" and "VME Functional Structure" are developed in this research, which intend to give clear guidance of how to transform to VMEs from the aspect of functional structure. The current literature has difficulties to answer this question:

- No boundary is clearly made between the alliance management function and other functions (e.g. production, marketing, etc.)
- Alliance management function focuses on external operations, not covering internal operations, thus has its limitation in managing a combination of external and internal operations in a VME

The EI management function overcomes these weaknesses. It is explained in Chapter 5.

2.7 Literature Review of Competency Protection in Alliances

Relational risk is unique to strategic alliances (Das & Teng, 1999). Firms might enter alliances with "secret agendas": not for mutual benefit, but for absorbing partners' valuable resources (e.g. knowledge, skills) (Duysters, 1996; de Man & Duysters, 2004). Secret agendas might exist not only in alliances with competitors, but also in alliances with seemingly unharmful parties such as suppliers (McCutcheon and Stuart, 2000). For being a VME, cooperative culture is crucial. However, a great danger exists when cooperative culture is maintained: one firm may inadvertently relinquish its unique core technology, ability, or knowledge to its partners (Brouthers et al, 1995).

When engaged in alliances, knowledge sharing is often a key to success (Crossan & Inkpen, 1995; Hutt et al., 2000). By sharing, however, a firm exposes critical skills and knowledge to alliance partners; this can lead to appropriation or imitation (Norman, 2002). Thus, strategic alliances create circumstances that lead a firm to experience the "boundary paradox", where it must be open to knowledge flows from external sources while simultaneously protecting its own firm-specific knowledge (Quintas, Lefrere, & Jones, 1997). If a firm's knowledge and skills are duplicated, its ability to create unique value for customers is diminished, and the firm's attractiveness as an alliance partner decreases, which further impacts its ability to compete (Norman, 2002). Thus, firms must

balance knowledge sharing and knowledge protection when engaged in alliances (Norman, 2002). From the resource management perspective, one key challenge for firms in strategic alliances is to effectively protect themselves from losing critical resources at the same time as they attempt the full use of their contributed resources (Das & Teng, 1999).

Norman (2001) proposed a framework for classifying knowledge protection mechanisms (Table 2.2).

Table 2.2 A Framework for Classifying Knowledge Protection Mechanisms

Areas	Categories	Knowledge protection mechanisms
Human Resources	Top Management Support	➢ Actions by top management ➢ Identify core capabilities ➢ Stress protection of core capabilities ➢ Provide resource for protecting core capabilities
	Alliance Management	➢ Actions by focal firm managers in alliance ➢ Stress protection of core capabilities ➢ Appoint a focal firm information manager ➢ Monitoring and surveillance: Carefully scrutinize critical knowledge used in the alliance and ensure that it has been classified accurately and that alliance members and other involved employees are properly informed and educated about knowledge issues. ➢ Compliance: Continuously ensure that employees are actually following the guidelines and procedures established by the knowledge protection system. ➢ Consulting/advising: Act as a consultant in cases where employees feel that the circumstances surrounding knowledge protection are vague or unclear.
	Human Resource Management	➢ Human resource management in focal firm ➢ Educate personnel about proprietary data ➢ Establish reward/evaluation program for protection of core capabilities ➢ Consult designated individuals when circumstances are unclear ➢ Report contacts with partner employees
Legal Structure	Patents	➢ Obtain patent to prevent imitation
	Contractual Mechanisms	➢ Specify proprietary information ➢ Specify what information and capabilities can be shared ➢ Specify what information and capabilities cannot be shared ➢ Provide consequences if a partner accesses off-limits information ➢ Provide consequences if a partner uses proprietary information in the wrong way ➢ Sign nondisclosure agreements (NDAs) ➢ Bar employment to partner employees ➢ Ensure that information or technology shared with partner is covered by patents
Processes	Information Flows	➢ Limit to one person (gatekeeper) ➢ Limit to a few people (communication stars) ➢ Exclude certain information deemed off-limits
	Partner Access	➢ Perform certain alliance activities separately from partner ➢ Limit partner's access to facilities ➢ Limit partner's access to non-alliance personnel

Norman (2002) identified four factors influencing risks of competency leakage in alliances:

- Core of resources contributed: How close the resources contributed are to the core of the company; the closer to the core, the bigger the risks are.
- Tacitness of resources contributed: The more tacit the resources, the bigger the risks are.

- Partners' learning intent: The higher the partners' desire to capture the competencies, the bigger the risks are.
- Resource overlap: The greater the competencies' overlap with partners' resources, the bigger the risks are.

Table 2.3 Assessment issues of intellectual capital protection

Danger Signs	Compensating factors
Assessing The Value of Intellectual Capital and its Transfer	
Skills which are critical to our competitive advantage are to be shared.	The alliance provides this firm an opportunity to internalise partner skills that could be critical to our success.
Significant investments have been made in building the critical skills that are being offered.	The value of the knowledge we are offering is expected to "decay" rapidly over time.
The potential partner is in a related line of business, Acquisition of our skills would allow the partner to move into a new line (geographic or product) of business that competes with our firm.	The size of the skills gap between this firm and the potential partner works against the ready absorption of our intellectual capital.
The partner operates on a sufficient scale or geographic scope to amortize its investment and realize experience benefits required to compete with the knowledge gained.	There are resource constraints on the partner which prevent it from making use of the knowledge gained over the course of the alliance.
The partner's capabilities are anticipated to substitute for indigenous capabilities in certain areas.	Our firm's strategy entails exiting the line of business in which we are offering competitive knowledge.
Bargaining	
The alliance being negotiated provides the partner unbalanced, unfavorable access routes to this firm's intellectual capital.	Access routes to our intellectual capital are limited by task structure, alliance form, location, and time limitations.
The potential partner has more power than we do in shaping the scope of skill transfer.	This firm has the ability to enforce alliance agreements and ensure sanctions against opportunism.
Managing and Controlling the Alliance Interface	
The partner has increased its interrogation of partner staff members for information.	Organizational gatekeepers from this firm have a sound understanding regarding the importance of knowledge control in the alliance. Knowledge regulation is supported by our selection, training, evaluation and reward practices.
The partner has developed additional access routes to this firm over the course of the partnership.	This firm has established, and is experienced in using monitoring mechanisms regarding access and breadth of shared information.
We do not know whether the partner made any plans or efforts to create duplicate production or development sites for itself.	We have sufficient information gathering abilities to provide adequate time to act if our partner were to engage in such efforts.
Alliance Evolution and Trust	
The strategic interests of the partner seem to be moving away from collaborative business activities.	The establishment of multiple alliances effectively precludes a competitive move by the partner.
The alliance has lost its technological edge because of significant advances made by other firms.	The partner has the willingness and capability to reconfigure the alliance around the new technology.
The partner has not recently contributed valuable information to the alliance.	The partner has, over the course of the relationship, provided valuable information in return for the knowledge provided by this firm.

Baughn et al. (1997) broke down the assessment issues of intellectual capital protection into four stages: (1) assessing the value of intellectual capital and its transfer; (2) bargaining; (3) managing and

controlling the alliance interface; (4) alliance evolution and trust. The issues at each stage are shown in Table 2.3; each issue is represented by a danger sign and a compensating factor counterbalancing the danger.

Fltzpatrick and DiLullo (2005) advocated the safeguarding of intellectual properties within knowledge-based alliances through a variety of contractual agreements. Das and Teng (2001) indicated that the choice of alliance structure could help firms control the level of total risk (relational risk and performance risk) they were exposed to due to alliances. They classified alliance structures into four types: (1) equity joint ventures; (2) minority equity alliances; (3) bilateral contract-based alliances; (4) unilateral contract-based alliances. Their effects on relational risk and performance risk are shown in Figure 2.2. The ideas of their model are that:

- Partner firms that perceive low relational risk and low performance risk in a prospective alliance will prefer an equity joint venture.
- Partner firms that perceive high relational risk and low performance risk in a prospective alliance will prefer a minority equity alliance.
- Partner firms that perceive low relational risk and high performance risk in a prospective alliance will prefer it to be bilateral contract-based.
- Partner firms that perceive high relational risk and high performance risk in a prospective alliance will prefer it to be unilateral contract-based.

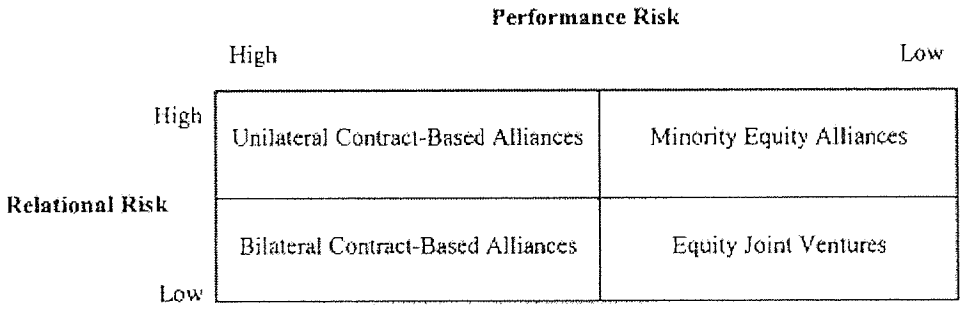


Figure 2.2 Alliance structures' effects on relational risk and performance risk

This literature review helps detail one of the responsibilities of the EI management function – "designing competency protection". This responsibility establishes a defence system for VMEs, which is a crucial function due to VMEs' heavy dependency on alliances. This responsibility will be explained in Chapter 5 along with the discussion of EI management function.

2.8 Literature Review of Alliance Performance Measurement

Importance of assessing alliance performance has been a consensus in the literature, e.g. Chalmeta and Grangel (2005), Arino (2003), Das and Teng (2003), Draulans et al. (2003), Kale et al. (2001), and Mockler (2000). There were in the literature different methodologies to develop a Performance Measurement System (PMS), e.g. Neely (1998) and Judson (1990), but most of them were focused on the problems of individual enterprises, not taking into consideration the peculiarities of partnerships, such as the assessment of the coordination mechanism among partners, the efficiency of the inter-organisational processes, or the relationships among the personnel from different firms (Chalmeta and Grangel, 2005).

On the other hand, although "alliance" is a heavily researched area, "alliance performance measurement" attracted relatively less attention compared with other alliance-related topics such as partner selection. Worse, only a few papers were found dedicated to the design of an Alliance Performance Measurement System (APMS) with detailed performance measures. A review of the literature discloses some serious deficiencies along with good practices.

Chalmeta and Grangel (2005) proposed five steps that could be used by firms to design alliance performance indicators. However, no generic alliance performance indicators were provided to complement these steps for customisation of indicators.

Mockler (2000) identified three types of systems related to alliance performance measurement:

- Enterprise strategic frameworks: defining core values for partners and risks to be avoided, such frameworks provide direction and necessary benchmarks/standards against which performance can be measured. They are generally non-quantitative.
- Interactive planning and control systems: essentially decision-support systems, facilitating the generation of optimal solutions.
- Diagnostic control and guidance systems: such systems are the essence of traditional management control and are designed to motivate employees, monitor performance, correct deviations from standards, and reward achievements. In addition to finance & accounting standards, other areas are also covered, such as quality, customer satisfaction, and supplier performance.

Though Mockler (2000)'s framework includes both traditional measures assessing individual companies (the interactive planning and control systems and the diagnostic control and guidance systems), and alliance specific measures (the enterprise strategic frameworks), the alliance specific measures are far from sufficient. Core values for partners and risks to be avoided can be viewed as

alliance objectives; it is not enough to just assess whether alliance objectives are achieved (i.e. output), but leave operational issues (i.e. input & process transforming input into output) not under control, since they form the initial condition of an alliance, and strongly influence its evolution. Although Mockler (2000) mentioned that continued monitoring of each partner's contribution to the alliance is needed, partner contribution is only one of the issues; other issues, such as cross-partner teams, task allocation, and alliance decision making, are also important.

Yan and Luo (2001) indicated that performance should be measured in reference to the specific goals of each party involved. There are three immediate parties involved: the two parent firms and the venture management. The achievement of the goals and objectives of all these parties is critical. With the three sets of objectives identified, the next step is to decide the appropriate measures against which the level of achievement of these objectives can be evaluated. When the performance of all these parties is identified, appropriate changes can be made, as shown in table 2.4.

Table 2.4 Patterns of changes

		Performance to parents		
		Both high	One high and one low	Both low
Performance to joint venture	High	No change necessary	Reconfiguration /redirection	Tuning /adjustment
	Low	Tuning/adjustment	Reconfiguration /redirection	Overhaul /termination

Yan and Luo (2001)'s framework of alliance performance measurement has a similar weakness to Mockler (2000)'s framework: only assessing outputs, without assessing inputs. Although they identified the actions to be taken according to different combinations of joint venture performance and performance to parents, these actions are only made when, based on their framework, poor performance has occurred, which, however, may be too late. In addition, they separate the goals of a joint venture from the goals of parent companies, which is an inherent potential trigger of poor performance, since only when the joint venture works for the parent companies' benefits, the parent companies will continue to support it, and cooperate with each other. Therefore, "whether the joint venture goals integrate the parent companies' goals" should become a measure assessing the effectiveness of the joint venture goals, rather than separating them at the start of the alliance.

Das and Teng (2003) submit that alliance performance is strongly influenced by particular characteristics of the partner firms as mediated by alliance conditions. They use the term 'partner analysis' to denote the integrated approach comprising market analysis (competitor analysis) and resource analysis of partner firms. Partner analysis covers partners' (1) market commonality, (2) resource characteristics (mobility, imitability, & substitutability), and (3) resource alignments (supplementary, complementary, surplus, & wasteful). These three components of partner analysis affect the alliance conditions, which are composed of: (1) collective strengths (positive effects of alliances); (2) inter-partner conflicts (negative effects of alliances); and (3) interdependencies

(necessity for alliances). Das and Teng (2003) propose that alliance condition variables are directly responsible for alliance performance. By introducing partner analysis and integrating its three components with the three aspects of alliance conditions, they seek to achieve a systematic appreciation of the determinants of alliance performance. Table 2.5 shows this integration.

Table 2.5 Integration of partner analysis, alliance conditions, and alliance performance

Inter-partner market commonality	Resource characteristics (mobility, imitability, & substitutability)	Resource alignments			Alliance conditions	Alliance performance
		Supplementary & complementary alignments	Surplus alignments	Wasteful alignments		
Positively related	Not significantly related	Positively related	Not significantly related		Collective strengths	Positively related
Positively related	Positively related	Not significantly related	Negatively related	Positively related	Inter-partner conflicts	Negatively related
Not significantly related	Negatively related	Positively related	Negatively related		Inter-dependencies	Positively related

As indicated by Das and Teng (2003), instead of covering a large number of factors, their proposed model calls attention to the most important determinants of alliance performance. As shown in table 2.5, these determinants are about resource inputs into an alliance (market commonality; resource characteristics; resource alignments; collective strengths), and partner relationship (inter-partner conflicts; interdependencies). However, there are many other crucial determinants of alliance performance, namely the processes transforming inputs into outputs. Their framework does not include any of such operational determinants; thus, cannot serve as a comprehensive framework assessing the alliance performance.

Geringer and Hebert (1991) identified a set of objective and subjective measures of joint venture performance:

- Subjective performance measures: (1) how satisfied partners have been with the joint venture's overall performance; (2) IJV performance versus initial projections
- Objective performance measures: (1) survival; (2) stability; (3) duration

Again, since this set of performance measures assesses alliance outputs only, without considering how to assess alliance inputs and processes of transforming inputs into outputs, it is not comprehensive enough to become a framework of alliance performance measurement.

Luo (1996) evaluated the performance of strategic alliances in China using the measures shown in Table 2.6. The set of measures used by Luo (1996) cannot serve the generic purpose of assessing alliance performance due to the following reasons:

- These measures are used to evaluate alliance performance from only the financial perspective. However, the purposes of partners entering an alliance may well be non-financial, such as learning.
- Most of these measures are traditional financial measures, which are used in single company situation; they are not specific to alliance situation.
- This study is focused on evaluating performance of strategic alliances in China with the consideration of its special foreign investment policies. Thus it has geographic and national limits, which is not suitable for serving as a generic framework for evaluating alliance performance.

Table 2.6 Alliance performance measures used by Luo (1996)

Anderson (1990) argued that joint ventures should be evaluated primarily as stand-alone entities seeking to maximise their own performance, not the parents', and suggested an 'Input-Output Continuum' to evaluate a joint venture, as shown in figure 2.3. It is thus not surprising, based on his 'stand-alone' argument, to see that only 'harmony among partners' is an alliance-specific measure among all.

Although a joint venture needs to be measured as a stand-alone entity, it is not right to say that a joint venture should be evaluated primarily as a stand-along entity, because doing so lures a joint venture to conduct its business without considering partners' benefits and risks. Although Anderson (1990) explained that his 'stand-alone' argument would free a venture "from parent politics and parochial viewpoints", conflicts among partners will still occur if they cannot gain satisfying benefits from the

venture in spite of the great success of the venture itself. Such conflicts may result in the fall-apart of a joint venture. In addition, although the 'Input-Output Continuum' assesses both the inputs and outputs of a joint venture, it does not include measures assessing the processes/ways transforming inputs into outputs.

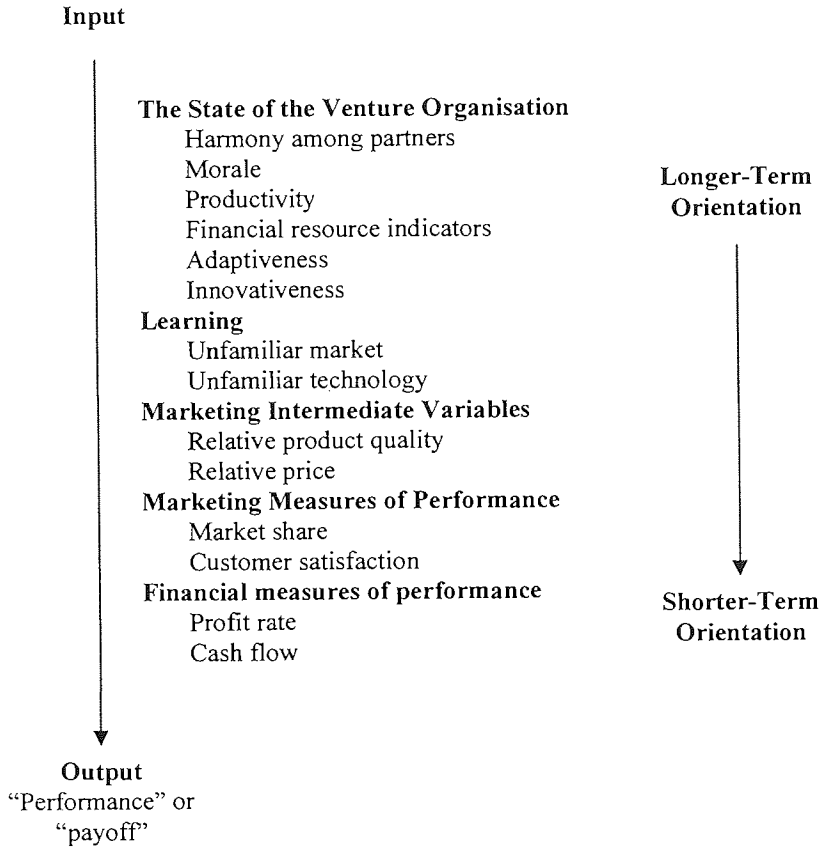


Figure 2.3 The input-output continuum for a joint venture

Harrigan (1986) indicates that "any evaluation of joint-venture performance depends on the joint venture's purpose ... Managers in sponsoring firms hope that the rate of return from cooperation will be the same as if they had invested a larger amount alone. If they are lucky, their returns on investment are higher than going it alone while their ticket to entry is smaller (due to their pooled resources). In addition, their firm is exposed to less risk". However, further exploration wasn't made to include any operational issues that are crucial for achieving expected returns on investment and less risk.

Arino (2003) recognised three levels of alliance performance, but the relevant performance measures cover alliance outputs only.

- Financial performance is relevant when the partners in a strategic alliance have explicit financial goals.

- Operational performance focuses on those key operational success factors that might lead to financial performance. Operational measures are in practice measures of alliance stability: longevity, ownership/contractual changes, and survival are among them. Such measures' validity is questionable, and can be related to performance only in particular instances. It would be misleading to use them as measures of performance without certain prior knowledge.
- Organisational effectiveness refers to the fulfilment of the organisation's goals. Organisational effectiveness measures assess the degree of fulfilment of goals: partners' satisfaction with the overall alliance performance; degree of fulfilment of partners' strategic goals; net spillover effects of the strategic alliance on other activities of a partner.

Yan & Gray (1994) indicated three areas in which the prior literature on Joint Venture (JV) performance has inconsistencies:

- First, whose perspective is used for performance measurement - that of one parent, two parents, or the JV management?
- Second, variations occur in performance measures which may range from financial performance indicators (objective measures) to subjective perceptions of performance.
- Third, the appropriateness of different performance measures changes as a JV matures.

As to the second inconsistency, Anderson (1990) and Geringer and Hebert (1991) argue that, when assessing joint venture performance, financial measures have potential limitations. Empirical results also support that traditional accounting figures are statistically insufficient to distinguish more successful firms from less successful ones (Chowdhury, 1992; Demirbag & Mirza, 2000). Thus, despite poor financial results in the short-term, an international joint venture may have been meeting or exceeding parents' objectives, and thus be considered successful by one or all of the parents (Geringer & Hebert, 1991; Demirbag & Mirza, 2000). In support of this view, Anderson (1990) argued that financial measures assess only one dimension of performance and that a number of other factors, many of them qualitative, must be weighted. By using both objective and perceptual (i.e. qualitative) measures, Geringer and Hebert (1991) found that objective measures were positively correlated with perceptual measures. Therefore, it can be seen that a suitable way of assessing alliance performance is to use a combination of objective and subjective performance measures.

Callahan & MacKenzie (1999) designed a system of performance measures (see Table 2.7) for assessing product development alliances. This system has its limitations for being a generic framework of alliance performance measurement from the following aspects:

- This system is designed for joint product development, which is only one of the many alliance scenarios.

- This system mainly assesses alliance inputs, but neglecting outputs and processes transforming inputs into outputs. In other words, it mainly focuses on alliances' initial healthiness, but neglecting alliances' progress.

Table 2.7 Performance measures for assessing product development alliances

Partner motives
Clarity of partner motives
Partner commitment
Motive congruence
Motive conflict
Partner capabilities
Appropriateness of capabilities
Capability complimentarity
Access to required capabilities – can our partner easily access outside skills
Metrics related to a skill map of partner team
Partner resources
Managerial resources
Managerial turnover
Financial resources
Product development processes
Appropriateness – are the partner's product development processes appropriate for the task
Complimentarity – do our product development processes fit well with those of the partner
Maturity – what level of maturity are the partner's processes
Interaction of development primes – how well do the individuals charged with the development in each organisation interact
Organisational cultures
Not-invented-here
Opposition to the alliance
Core values
Decision speed
Approach to tasks

In addition to the system of performance measures, Callahan & MacKenzie (1999) gave some useful guidelines of how such measures should be designed:

- They should measure and cover critical issues.
- They should be simple and clear.
- They should not depend on complex hard-to-develop data.
- They should be reasonably easy to evaluate.
- They must allow for rapid and frequent alliance review so as to avoid the problems of feedback delays.
- They must be actionable – there must be metric values that lead to changes in alliance control.

Cravens et al. (2000) proposed the use of the balanced scorecard (Kaplan and Norton, 1996) to evaluate alliance performance. The balanced scorecard is a template and can be customised for evaluating alliance performance (Kaplan and Norton, 1996; Cravens et al., 2000). Based on the

balanced scorecard, Cravens et al. (2000) developed the following evaluation criteria for strategic alliances (see Table 2.8). Although explanations are not given why these categories of criteria are comprehensive for assessing alliance performance, Cravens et al. (2000)'s framework did give a good example of how the balanced scorecard can be applied to the evaluation of alliance performance.

Table 2.8 Alliance evaluation criteria based on Kaplan and Norton (1996)'s balanced scorecard

To implement an evaluation of alliance performance, "formalised and regular assessment is essential for those involved in the alliance to attach credibility to the process and to learn from the results" (Cravens et al., 2000). Kaplan and Norton (1996) advocate that the implementation of the balanced scorecard become a critical component of feedback in the strategic learning process. There is an interlinked process of 4 steps facilitated by the balanced scorecard (Kaplan and Norton, 1996):

- Clarifying and translating the vision and strategy;
- Communicating and linking;

- Planning and target setting;
- Strategic feedback and learning.

These 4 steps act as a continuous loop to facilitate learning. These 4 steps are embedded in the following implementation issues (Cravens et al., 2000):

- The frequency of the formalised assessment should be determined to give the participants an awareness of the process and allow for them to plan for information collection.
- Measures must be put in place to assure that the results of the evaluation are communicated and that relevant feedback is generated.
- The evaluation process will also need to be refined throughout the alliance life cycle to assure that timely information is being collected.
- The final link in the evaluation process is to consider how the output of the evaluation will be used to determine individual and team performance and rewards.

As a conclusion, the existing literature on alliance performance measurement has the following deficiencies:

- No framework is found covering the entire 'inputs → processes → outputs': Mockler (2000), Yan and Luo (2001), Geringer and Hebert (1991), Harrigan (1986), and Arino (2003) cover outputs; Das and Teng (2003) and Callahan & MacKenzie (1999) cover inputs; Anderson (1990) covers inputs & outputs.
- Alliance objectives are separated from partners' objectives (Yan and Luo, 2001).
- Alliances are measured as stand-alone entities, less considering partners' benefits and risks (Anderson, 1990).
- Alliance performance is still assessed using traditional measures for individual companies, rather than measures specific for alliances (Mockler, 2000; Luo, 1996; Anderson, 1990).
- No framework is found clearly indicating whose perspective is used for performance measurement – that of one parent, two parents, or the alliance management (Yan & Gray, 1994).
- No framework is found clearly indicating at which alliance stage various alliance performance measures are appropriate (Yan & Gray, 1994).

This research proposes an Alliance Performance Measurement System (APMS) overcoming these deficiencies, and at the same time, inheriting good practices such as assessing performance along the balanced scorecard's four perspectives, and combining objective measures with subjective measures. Further, a VME Performance Measurement System (VMEPMS) is designed with the APMS as one of

its modules. This VMEPMS is used for assessing the VME performance, which is a topic not touched by previous research.

2.9 Summary

Based on the literature review, this chapter started with a clear definition of "Virtual Manufacturing Enterprise" to justify this research. Although no publication was found directly addressing the research problem, five areas in the literature were reviewed: alliance life cycle; decision to alliance; alliance management function; competency protection in alliances; alliance performance measurement. The works done previously in these areas are closely related to the reference model proposed in this research. The gaps observed were explained. In chapters 4, 5 & 6, these works would be improved to fill the gaps, and combined to generate a holistic solution to the research problem.

3 Conceptual Framework and Research Methodology

3.1 Introduction

Chapter 2 described in detail the relevant works in the literature which were perceived as closely related to the answer to the research problem. Based on the literature review, this chapter first explains a conceptual framework constructed for further developing the targeted reference model. Then it goes to explain the research methodology used in this research, the research design, and the data analysis methods adopted. The validity and reliability of this research are also briefly introduced in this chapter, which are further explained in Chapter 7.

3.2 Conceptual Framework

Miles and Huberman (1984) suggested building a conceptual framework prior to undertaking research. A conceptual framework helps explain the research scope, and the relationships within the scope. It helps focus the research on key issues. The conceptual framework underlying this thesis is illustrated in Figure 3.1. Its purpose is to conceptually answer the research problem and the high-level questions stated in Chapter 1, which are repeated here.

The research problem addressed in this research is:

> **How to transform a traditional manufacturing company into a Virtual Manufacturing Enterprise?**

This research problem raises the following high-level questions:

(1) **How to make decisions of operational externalisation?**

(2) **How to transform to a VME from the aspect of functional structure?**

(3) **How to evaluate a VME's performance?**

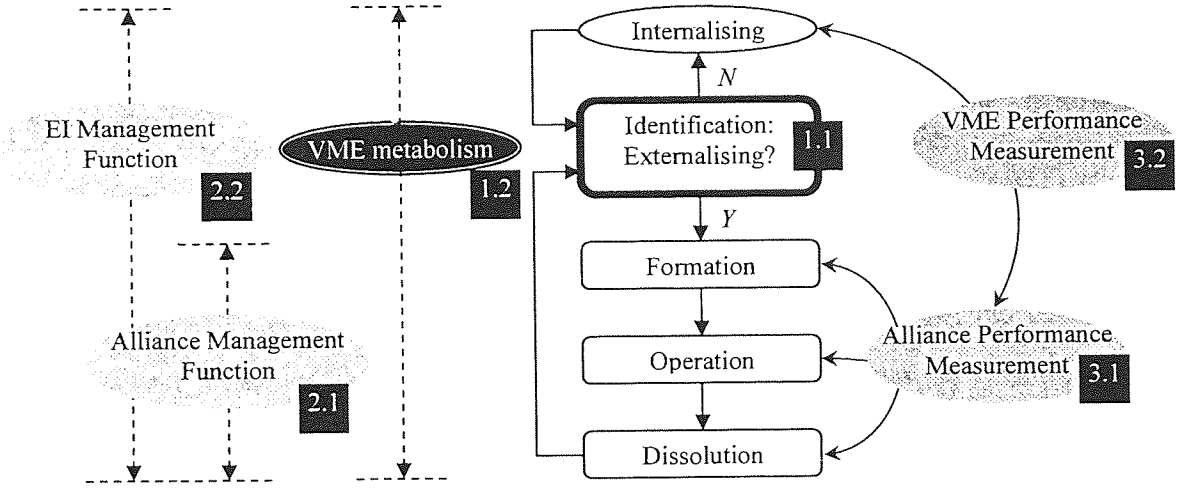


Figure 3.1 Conceptual Framework

This conceptual framework begins with the "identification of whether to externalise" (1.1), which leads to the "VME metabolism" (1.2). This first module answers the 1st high-level question: **How to make decisions of operational externalisation**?

The second module is about a dedicated "alliance management function" (2.1), which can be upgraded to an "externalisation-internalisation (EI) management function" (2.2). This module intends to establish a VME functional structure, which sets a clear structural destination for VME transformation. This module answers the 2nd high-level question: **How to transform to a VME from the aspect of functional structure**?

The last module is about performance measurement. "Alliance performance measurement" (3.1) covers all the alliance life cycle stages subsequent to the identification stage: formation, operation and dissolution. Alliance performance measurement system becomes a part of "VME performance measurement" system (3.2), with the latter covering both external and internal operations. This module answers the 3rd high-level question: **How to evaluate a VME's performance**?

3.3 Research Methodology

The research methodology underlying this research is based on "**a systematic approach for empirical research**" (Flynn et al, 1990), as shown in figure 3.2. The term "empirical" means that this type of research is field-based, and "uses data gathered from naturally occurring situations or experiments, as opposed to laboratory or simulation studies, where researchers have more control over the events being studied" (Williams, 1998). Empirical research methodology helps provide real data in practice.

Figure 3.2 A systematic approach for empirical research (Flynn, et al. 1990)

Empirical research methodology has been successfully applied in both theory building (Burgalman, 1983; Eisenhardt, 1989; Gersick, 1988; Davies, 1998) and theory verification (Cohn and Turyn, 1984; McLachlin, 1997; Meredith, 1987; Roth, 1989; Williams, 1998). To validate the Reference Model established in this research, the empirical research methodology is applied using the theory verification approach.

As depicted in figure 3.2, this research consists of six phases. In the first phase, based on thorough literature reviews, a theoretical foundation is established which takes the form of a Reference Model. In the next three phases, the research is designed, data collection methods selected and implemented. In the fifth phase, data collected are analysed to verify and refine the Reference Model. In the last phase, the research findings are published.

3.4 Research Design

Robson (2002) proposed a framework for research design, which consists of the following components: (**1**) research purpose; (**2**) theory; (**3**) research questions; (**4**) methods (including data collection methods and data analysis methods); and (**5**) sampling strategy. A good research design shows high compatibility among these components.

Based on the "systematic approach for empirical research" discussed above (see Figure 3.2), the meanings of these components in this research are interpreted as follows:

(1) **Research purpose**: to establish a Reference Model of transforming a manufacturing company to a Virtual Manufacturing Enterprise (VME). To achieve this purpose, two stages are used: (**a**) the theory building stage (the 1st phase in Figure 3.2), and (**b**) the theory verification stage (the 3rd, 4th and 5th phases in Figure 3.2).

(2) **Theory**: the Reference Model (see Section 3.2 "Conceptual Framework"). The Reference Model is established in the 1st phase (see Figure 3.2). In the 3rd, 4th, and 5th phases, it is tested and refined.

(3) **Research questions**: the research problem "How to transform a traditional manufacturing company into a Virtual Manufacturing Enterprise?" raises three high-level questions:

How to make decisions of operational externalisation?

How to transform to a VME from the aspect of functional structure?

How to evaluate a VME's performance?

(4) **Methods**: data collection methods (see Section 3.4.1) & data analysis methods (see Section 3.4.2).

(5) **Sampling strategy**: see Section 3.4.3.

3.4.1 Data Collection Methods

In this research, **'multiple case study'** is used as the data collection method. The 'multiple case study' is a well-established technique and has been successfully used to verify and develop theories through empirical field-based research (McCutcheon & Meredith, 1993; Yin, 1989; Brennan et al, 1990; Cohn & Turyn, 1984; Lascelles & Dale, 1990; Titus & Liberatore, 1991; Williams, 1998). A case study is defined as an objective and in-depth examination of a contemporary phenomenon, where the investigator has little or no control over events (Yin, 1989; Williams, 1998). This involves the gathering of a large amount of data from a case study organisation to develop the clearest possible picture of the phenomenon (Williams, 1998). A case study's purpose may be to either describe a situation or to establish how or why certain events occur (McCutcheon & Meredith, 1993; Williams, 1998). In either case, a research case study requires considerable depth to allow comparison with other case studies, and a description of the environment in academic terms (Williams, 1998). The 'multiple case study' is just one of the many empirical approaches that aim to develop an understanding of 'real world' (McCutcheon & Meredith, 1993; Yin, 1989) events, and maintains its strength by focusing research on actual conditions (Williams, 1998).

The 'multiple case study' was selected from three data collection methods: (1) surveys; (2) experiments; and (3) case studies. The choice is made based on two conditions:

- The nature of the research problem;
- Whether or not control is required over studied manufacturing companies.

Since this research has an exploratory research problem, 'surveys' become not suitable due to their limitation in the number & depth of questions; since control is not required over studied manufacturing companies, 'experiments' also become not suitable. 'Case studies' do not control the elements of studied objects, and have advantages over 'surveys' in exploring a situation, thus are suitable for this research.

Figure 3.3 shows that the 'multiple case study' method can be divided into three stages: (1) Define & Design, (2) Prepare & Collect Data, and (3) Analyse & Conclude. This multiple case study process

may well be recycled, and stages repeated, when the theory is updated, or when deficiencies are detected in the designed data collection protocol.

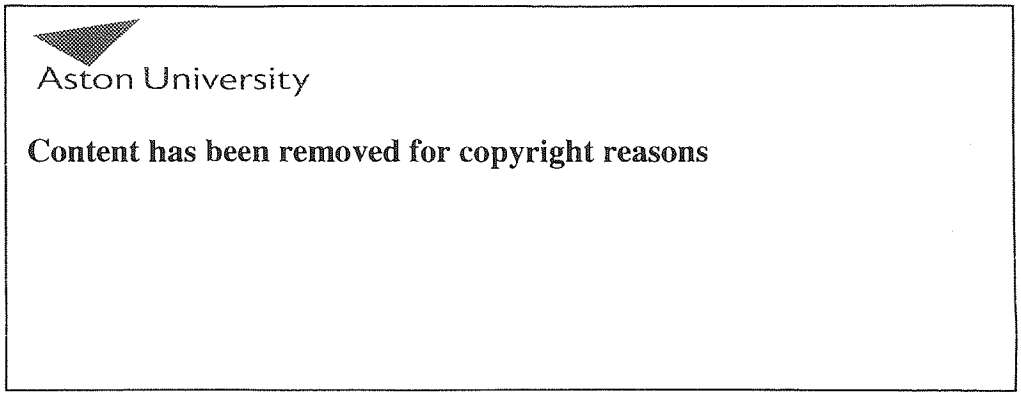


Figure 3.3 The multiple case study process [adapted from Yin (1989) & Williams (1998)]

In this research, the multiple case study process went through the following cycles (see Table 3.1).

Table 3.1 Cycles of the multiple case study process

Cycle	Reference Model	Data Collection Protocol (Questionnaire)	Case Study
1	1st Version	1st Version	Pilot case study (China)
2	2nd Version	2nd Version	Pilot case study (China)
3	3rd Version	3rd Version	Pilot case study (China)
4	4th Version	4th Version (see Appendix 1)	Formal case study (China; UK)

The main difference between the 1st and 2nd versions of questionnaire is as follows:

- The 1st version has questions focusing on alliance partner selection criteria, which was later identified as not particularly relevant to this research.
- The 1st version does not have questions focusing on VME identification stage, which was later identified as particularly relevant to this research.
- There are also changes in the wording of the questionnaire, which were made according to case study companies' feedback.

The main difference between the 2nd and 3rd versions of questionnaire is as follows:

- The 2nd version has questions focusing on alliance partner selection process, which was later identified as not particularly relevant to this research.

- The 2nd version does not have questions eliciting case study companies' externalisation situations, and questions focusing on VME functional structure, which were later identified as particularly relevant to this research.
- There are also changes in the wording of the questionnaire, which were made according to case study companies' feedback.

The main difference between the 3rd and 4th versions of questionnaire is as follows:

- The 3rd version has no question about value streams, which was later identified as necessary.
- The 3rd version emphasises on the balancing aspect of EI analysis; the 4th version emphasises on the aspects of comprehensiveness and regular review.
- Questions on competency protection approaches are removed in the 4th version questionnaire, since they are no longer included as a separate module of the reference model.
- Questions eliciting case study companies' external situations were removed in the 4th version to reduce the interview duration.
- There are also changes in the wording of the questionnaire, which were made according to case study companies' feedback.

Case study can take various forms. This multiple case study uses structured interviews (telephone, or face-to-face). A significant advantage of using structured interviews is the ability to allow additional questions to be asked, whilst ensuring that certain questions are standard and asked at every interview (Flynn et al, 1990). This helps promote informal discussion on important issues (Williams, 1998), and collect unpredictable but useful data.

Approximately 3 hours were spent for each interview. All the data obtained from the interview were combined in a template to build a 'picture' of the company according to the established reference model. Since a common template is used, this further allows cross case comparison. This template is included as Appendix 4 "Case Study Analysis Template".

Phone calls and emails were used as a last resort, after the interviews were completed, to fill in any gaps identified in the data, or to reaffirm a particular response (for examples, see Appendix 2 "Further Questions".

Due to the practical limitations in the time available for field research, it was important that the number of individual visits to a case study company was kept to a minimum. To achieve this, the following preparations prior to the interviews were made:

- A copy of the questionnaire was sent to each of the case study companies prior to the interviews. This allowed the companies to be familiar with the questions to be asked, and the level of detail to be investigated. It also gave the companies the time to arrange appropriate personnel and relevant information for the interviews.
- It was communicated to each of the case study companies that part of the questionnaire was preferably to be completed, and returned to the researcher before the interview. This not only urged each company to familiarise itself with the questionnaire, but also gave the researcher a chance to customise the questions to be asked during the interview, which improved the results, and also significantly reduced the time spent in the subsequent interview.
- Email & telephone communication was frequently used to clarify the problems occurred prior to the interviews, such as the explanation for the wording of the questionnaire.

The persons interviewed are all senior managers of the case study companies. The participants all have a good knowledge of the companies' strategies and operations.

3.4.2 Data Analysis Methods

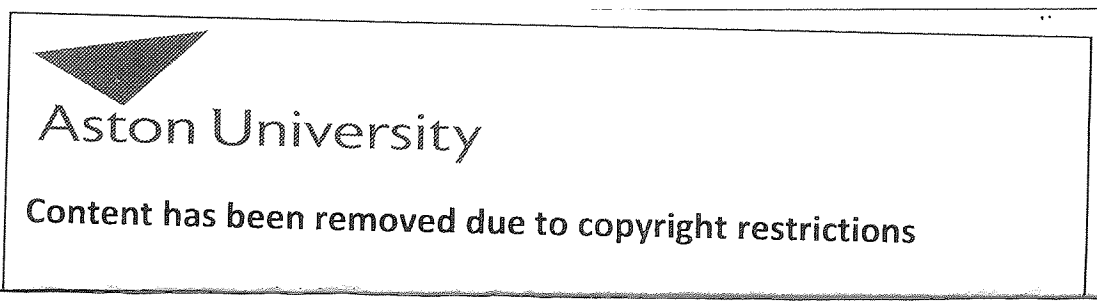
Based on the data collection method selected, and the objectives of testing and refining theories, suitable data analysis methods are chosen, which will be discussed in Section 3.5 "Data Analysis".

3.4.3 Sampling Strategy

A sampling strategy involves two important issues: (1) sampling design; and (2) sample size.

Sampling design concerns how to select a sample from a population frame (a population frame is a listing of all the elements in the population from which the sample is drawn). Sampling design can be the following types (see Table 3.2):

Table 3.2 Types of sampling design (Robson, 2002; Sekaran, 2003)



Theory states that, for case study research, individual cases should be chosen to fill theoretical niches (for the essence of theoretical niches, see Section 3.6 "Validity and Reliability"), and not based on

probability sampling which is normally used in surveys (Eisenhardt, 1989; McLachlin, 1997; Williams, 1998). Due to the level of detail in case study research, generalisation is analytical from each case to a broader theory, and not, as in surveys, a statistical generalisation from selected samples to a population (Yin, 1989). Although in theory it's possible to use analytical generalisation to generalise from only one case, it's difficult in practice (Williams, 1998); this is why multiple case study is used instead of single case study. A multiple case study should therefore not be mis-constructed as a small-sample survey and confined to the same restrictions (Williams, 1998). As described by Schwab (1985), and cited by Bryman (1989) and Robson (2002): "almost all of the empirical studies published in our journals [organizational studies] use convenience, not probability samples ... Thus if one took generalization to a population using statistical inference seriously, one would recommend rejecting nearly all manuscripts submitted."

In this research, before companies were approached and invited to participate the research, some criteria were identified to construct the theoretical niche. These criteria include:

(1) The case study companies must be manufacturing companies.

(2) The case study companies must have alliance experience, thus possessing the data/knowledge sought by this research.

(3) Each case study company should have a unique profile in terms of the following characteristics, to form a suitable theoretical niche:

- Industry
- Size
- Location
- Market scope

According to the above criteria, companies were then approached. As a result, five Chinese companies and two UK companies attended this research. There is no generally accepted ideal number of cases for a multiple case study, but research has shown that between four and ten works well (Brennan et al, 1990; Eisenhardt, 1989; McLachlin, 1997; Williams, 1998).

3.4.4 Role of "Research Design"

In Figure 3.2, the 2nd phase "research design" can be seen, in an empirical research for theory verification, as a summary of the 1st phase "establish theoretical foundation", and as guidance, based on the 1st phase, of the later phases: "select data collection method", "implementation", and "data analysis". This is because:

(1) The first three components of a research design – "research purpose", "theory" and "research questions" – summarise what have been done in the 1st phase;

(2) The later two components of a research design, "methods" (including data collection methods and data analysis methods) and "sampling strategy", give guidance of data collection and analysis.

Thus, the 2nd phase "research design" can be viewed as a junction of the theory building stage and the theory verification stage.

3.5 Data Analysis

3.5.1 Data Analysis Methods

Two categories of data analysis are quantitative data analysis and qualitative data analysis. The data analysis used in this research belongs to qualitative data analysis due to the nature of the research and the data collection method (multiple case study) used. Methods available for qualitative data analysis can be categorised into four groups, which construct a progression from more to less structured and formal (Robson, 2002; Drisko, 2000). In this research, all types of methods are used.

(1) Quasi-statistical methods – Using word or phrase frequencies and inter-correlations as key methods of determining the relative importance of terms and concepts.

(2) Template methods – Key codes are determined either on an a priori basis (e.g. derived from theory or research questions), or from an initial read of the data. These codes then serve as a template for data analysis. The template may be changed as analysis continues. One example is the Case Study Analysis Template (see Appendix 4).

(3) Editing methods – No or few a priori codes. Codes are based on researchers' interpretation of the texts.

(4) Immersion methods – Emphasising researchers' insight, intuition and creativity, such methods are fluid and non-systematised.

3.5.2 Computer Software for Data Analysis

Computer software for data analysis can be divided into general packages and specialist packages. For example, for qualitative analysis, a general package can be Microsoft Word, a specialist package can be NVivo; for quantitative analysis, a general package can be Microsoft Excel, a specialist package can be Statistical Package for the Social Sciences (SPSS).

Stanley and Temple (1996) compared a widely used word software (Word for Windows) with five specialist packages (Ethnograph, askSAM, ETHNO, NUD*IST, and InfoSelect), and concluded that: "Qualitative researchers should consider using a good word-processing package as their basic analytic aid, and that only if they want to do something that this package cannot do should they then consider using a dedicated package. That is, for many researchers, the facilities provided in a good word-processing package will be sufficient to the analysis required". Pelosi et al. (1998) also indicated that for simple statistical tasks, spreadsheet software such as Excel could satisfy the requirements. Thus, the computer software package selected in this research is Microsoft Word.

3.5.3 Uncomfortable Evidence

When analysing data, not only supporting evidence is paid attention, but also uncomfortable evidence. Uncomfortable evidence, especially opposing evidence, usually provides opportunities for improvement. The questions asked include:

- Why the Reference Model does not work in some situations? (Does it have defects?)
- If the Reference Model has defects, how to improve?

3.5.4 Components of Data Analysis

Data analysis consists of three components (Miles and Huberman, 1994):

- Data reduction
- Data display
- Conclusion drawing/verification

Robson (2002) identifies five data reduction techniques. They are all used in this research:

- Data collection session summary sheet: summarising what has been obtained from each interview.
- Document sheet: clarifying and summarising each document obtained.
- Coding: categorising the data to be analysed.
- Memo: capturing anything, particularly ideas, views and intuitions, that occurs to the researcher at all stages of the data analysis.
- Interim summary: summarising what have been found so far and highlighting what still needs to be found out.

Data display techniques used in this research include: (**1**) matrices (i.e. tables with rows and columns), and (**2**) networks (i.e. a set of boxes or 'nodes' with links between them). Miles and Huberman (1994) view them as two main types of data displays. Matrices and networks can clearly show the relationships between data using minimum amount of words, and therefore serve as good data reduction techniques as well.

Robson (2002) indicates that: "Qualitative researchers appear to have little difficulty in making sense of their data and generating conclusions. Indeed, humans in general organize and interpret the complex and messy world around them as a part of everyday life. The issue is more whether or not these conclusions are valid and correct, referred to here as verification". Except to note that the main technique used is 'causal explanation', it does not make sense to explicitly name the techniques used for conclusion drawing, since usages of certain techniques are natural occurrences. Miles and Huberman (1994, pp. 245-246) list the following 13 techniques, which are used in this research for data analysis: (1) noting patterns, themes and trends; (2) seeing plausibility; (3) clustering; (4) making metaphors; (5) counting; (6) making contrasts and comparisons; (7) partitioning variables; (8) subsuming particulars into the general; (9) factoring; (10) noting relations between variables; (11) finding intervening variables; (12) building a logical chain of evidence; (13) making conceptual/theoretical coherence.

Verification techniques used in this research include:

- Causal explanation
- Checking out rival explanations in order to make comparison and select the best
- Seeking negative evidence for theory improvement.
- Using multiple evidence sources: Multiple data sources are used for seeking evidence. These sources can be categorised into: (i) the literature; (ii) the industrial companies. Findings based on multiple data sources are likely to be more accurate (Yin, 1994).
- Pilot case studies: Pilot case studies can detect questions (or other issues) that are unlikely, or less likely, to obtain reliable answers. For example, a question that cannot be understood by respondents is much less likely to elicit reliable answers than a question fully understood. Such questions/issues can be discovered in pilot case studies.
- Giving feedback to, and getting feedback from, case study companies: this provides a double check of data validity.

3.6 Validity and Reliability

LeCompte and Goetz (1982) and Kirk and Miller (1986) wrote about reliability and validity in relation to qualitative research (Bryman and Bell, 2003):

- **External reliability**: The degree to which a study can be replicated.
- **Internal reliability**: When there is more than one observer, whether members of the research team agree about what they see and hear.
- **Internal validity**: Whether there is a good match between researchers' observations and the theoretical ideas they develop.
- **External validity**: The degree to which findings can be generalised across social settings; this represents a problem for qualitative researchers because of their tendency to employ case studies and small samples.

Internal reliability is not an issue in this research, since only one researcher is involved. **Internal validity** is not an issue directly related to sampling, but to the soundness of the theory established. It is ensured through the verification techniques discussed in Section 3.5.4 "Components of data analysis". The internal validity of the answers to the high-level questions is tested by the evidence from both the literature and the field case studies.

Bryman and Bell (2003) indicate: "A case study is not a sample of one drawn from a known population. Similarly, the people who are interviewed in qualitative research are not meant to be representative of a population ... It is 'the cogency of the theoretical reasoning' (J. C. Mitchell 1983: 207), rather than statistical criteria, that is decisive in considering the generalisability of the findings of qualitative research. In other words, it is the quality of the theoretical inferences that are made out of qualitative data that is crucial to the assessment of generalisation". Based on this view, **external validity** also becomes unrelated to case study sampling.

Thus it can be seen that only **external reliability**, among the above four criteria, is relevant to case study sampling. As mentioned before, individual cases should be chosen to fill **theoretical niches** (Eisenhardt, 1989; McLachlin, 1997; Williams, 1998). Here, it can be seen that what this actually means is: case study companies are chosen to demonstrate the scope within which a qualitative research can be replicated.

In this research, the case study samples demonstrate the following scope (see Table 3.3). **Industries** are classified according to the Standard Industrial Classification Codes (D&B, 2002). **Size** has three values, ranging from small, medium, to large according to whether the company had up to 100, up to 250, or over 250 employees respectively (Denton & Hodgson, 1997). **Location** has two values, China

and UK, representing developing countries and developed countries respectively. **Market scope** has three values, ranging from national (e.g. within China), regional (e.g. within Asia), to global (worldwide).

Table 3.3 External reliability of this field research

		A	B	C	D	E	F	G
Industry (Code)	Iron and steel forgings (3462)	✓						
	Steel foundries (3325)		✓					
	Motor vehicles and motor vehicle equipment (3710)			✓				
	Motor vehicle parts and accessories (3714)			✓				✓
	Construction machinery and equipment (3531)				✓			
	Metal heat treating (3398)					✓		
	General industrial machinery and equipment (3569)						✓	
Size	Small ≤100	✓ 50				✓ 65		
	100< Medium ≤250				✓ 148		✓ 200	
	250< Large		✓ 290	✓ 21,000				✓ 18,000
Location	China (developing)	✓	✓	✓	✓	✓		
	UK (developed)						✓	✓
Market Scope	National		✓ China	✓ China		✓ China		
	Regional	✓ China; Japan			✓ South East Asia			
	Global						✓	✓

3.7 Summary

This chapter first explained the conceptual framework established in this research, upon which a detailed reference model would be built. Each of the three modules of the conceptual framework targets one of the three research questions. The research methodology underlying this research is based on "a systematic approach for empirical research" (Flynn et al, 1990), consisting of six phases. This research is designed from six aspects, including research purpose, theory (i.e. the reference model), research questions, data collection methods, data analysis methods, and sampling strategy. "Multiple case studies" is used as the data collection method in this research. The sampling strategy is closely related to the reliability of this research. In the following three chapters (4, 5, 6), each of the

three modules of the conceptual framework will be developed into one of the three modules of the reference model.

4 Module 1 – EI Decisions and VME Metabolism

4.1 Introduction

Based on the conceptual framework described in Chapter 3, this chapter starts to build the first module of the reference model, and answers the first research question: "How to make decisions of operational externalisation".

The concept "VME metabolism" is proposed in this chapter, indicating the importance of the Identification stage for a wise combination of external and internal operations. Before proposing a decision template for the Identification stage, this chapter explains the resources that are generally relevant to a manufacturing company, and the fact that a company's activities can be categorised into either external or internal operations. These explanations intend to clarify some basic understandings regarding resource-based EI decision making.

Based on the three aspects of resource combination (i.e. effectiveness, management complexity, and flexibility), a template of EI decision making is then proposed. Evidence is found that these three aspects are closely related to a company's motives to use external or internal operations. Two ways are also identified to ensure effective EI analyses: regular review of long-term tasks; value stream joint analysis towards lean manufacturing.

4.2 VME Metabolism

The word **metabolism** comes from μεταβολισμος, the Greek word for "change". All living things must have an unceasing supply of energy and matter; the transformation of this energy and matter within the body is called **metabolism**. **Metabolism** is one of the basic features distinguishing green plants, algae, and some bacteria from all other organisms, including human being:

- Green plants, algae, and some bacteria are **autotrophs** ("**self-feeders**"). Most of them use the energy of sunlight to assemble inorganic precursors, chiefly carbon dioxide and water, into the array of organic macromolecules of which they are made.
- All other organisms, including human being, are **heterotrophs**. They secure all energy from organic molecules taken in from **surroundings** ("food").

Source:
http://encyclopedia.laborlawtalk.com/Metabolism
http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/M/Metabolism.html

As social organisms, both traditional manufacturing companies and VMEs have their special kinds of metabolism, which can be defined as the **transformation of external and/or internal resources within a firm**.

Like metabolism can distinguish green plants, algae, and some bacteria from all other organisms, metabolism can also distinguish VMEs from traditional manufacturing companies. Traditional manufacturing companies are basically "**self-feeders**" like autotrophs, only depending on internal (self) resources, without treating externalisation (i.e. utilising external resources to do tasks) as an equal option. By comparison, VMEs **carefully analyse** tasks to decide whether external (surrounding) resources need to be brought in.

> In 1993, Sextant received orders from various airlines to supply them with over 3000 TCAS screens. These were to be delivered in less than 8 months. The initial studies carried out by Sextant's engineering department made it clear that it would be impossible to design and manufacture the whole product in-house owing to the short lead-time, the tight cost constraints and the innovative nature of the technologies required. To meet the specifications, Sextant needed a specific DSP (Digital Signal Processor), i.e., a very powerful graphic processor capable of carrying out a large number of operations in real time. Not only was Sextant unable to produce such a processor but, in addition, no adequate product was available on the market at that time. The only solution was for Sextant to turn to a microprocessor producer. Texas Instruments agreed to collaborate with Sextant on this project, but despite its expertise in microelectronics, it was unable to develop an adequate processor on its own because of lack of in-depth knowledge of the customers' needs. It was only by working closely together that the two companies managed to meet all the technical specifications, as well as the time and cost requirements. (*Source: Dussauge and Garrette, 1999*)

In the above case study, Sextant didn't enter by its own the development of the TCAS screens upon receiving the orders, but carried out feasibility analyses on the task, as well as its own development capabilities. It was such analyses that led to the decision making of bringing external capabilities into the development, which further led to the final success of the mission. Other case studies were also found in the literature, which exhibit similar analyses that not only helped avoid the expected risks, but also led to the final success:

> The feasibility analysis by Boeing identified heavy financial risk, which motivated Boeing to form an alliance with a consortium of 3 Japanese heavy industry companies and the Japanese government to design and build the 767 and future Boeing aircraft. (*Source: Brouthers et al., 1995*)

> Stork's analysis of its mission to develop new engines, and Wärtsilä's analysis of its capabilities to develop international market outside of Scandinavia, brought the two companies together into a joint venture to develop and produce medium speed diesel engines. (*Source: Douma et al., 2000*)

> DSM's and Tosoh's feasibility studies on their abilities to compete alone with the Nutrasweet brand of aspartame brought the two firms together into the HSC joint venture, which gave huge benefits to both firms from the aspects of finance resource, technical expertise and scarce materials. (*Source: Groot and Merchant, 2000*)

All these case studies demonstrated the importance of treating task externalisation as an equal option to task internalisation, and the crucial role played by the relevant analyses to ensure that both options are equally considered before investing extensive resources. The field case studies carried out in this research also found similar supporting evidence:

> SFQMC is a leading domestic company in Shanghai, China, operating in the "Steel Forgings" industry. When formed, SFQMC designed itself to be a "de-materialised" company. Its only job was to identify customer needs and assemble suppliers delivering parts to satisfy the needs. The company delegated almost all of its manufacturing activities to suppliers, and it focused on NPD. SFQMC chose this way of doing business based on its initial analyses briefed as follows: (**pros**) because the company lacked financial resources to support its equipment investment, "*using suppliers' equipment, we saved a large amount of fixed assets investment*"; (**cons**) "*Suppliers usually charge us a price much higher than the costs if we do by ourselves. This means that they took a large share of our profits.*" "*It is also more difficult to control their quality than the situation if we do by ourselves.*" "*Since product quality and delivery are difficult to control, our risks are increased.*" "*We are also facing the risks of the leakage of our core technologies to suppliers.*" Despite the downsides, since SFQMC, at that time, viewed savings in equipment investment as the most important factor, it headed to the "de-materialised" form. (*Source: from the author's field research*)

The above case studies illustrate that VME metabolism starts from the **Identification** stage, analysing whether externalisation (*i.e. utilising external resources to do tasks*) or internalisation (*i.e. only depending on internal resources to do tasks*) should be used. Based on the analysis, the alliance (externalisation) life cycle is then entered, or the internalisation life cycle (see Figure 4.1). The same pattern was also perceived in other field case study companies (SJA, COMEDIL, and SSQHTC).

It is the Identification stage, the alliance life cycle, and the internalisation life cycle that compose the VME metabolism: *the transformation of external and/or internal resources within a VME.* In comparison, the metabolism of a traditional manufacturing company normally starts from the internalisation life cycle, rather than the Identification stage.

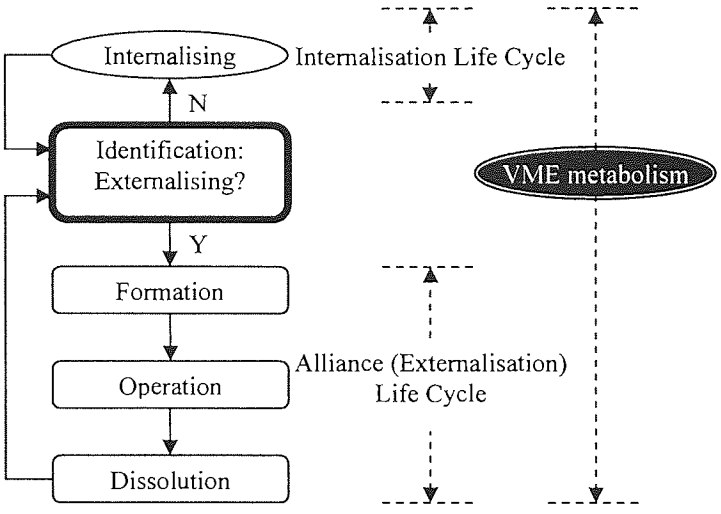


Figure 4.1 VME Metabolism

When operating along the VME metabolism closing loop, firms are more likely to become heavily dependant on alliances. In the SFQMC case study, the company persists in "good combination, grand scale production and nice service for clients", formed a network of strategic alliances with steel works, heavy machine manufacturing factories, and pressure vessel fabrication factories in China, gradually enhanced its core competencies in forgings, and established a reputation in the industry (Source: from the author's field research). Similarly, case studies were also found in the literature, where even large companies also heavily depended on alliances for their business:

> Sony formed alliance groups in promoting the VCR, the 3½ floppy disk, and the Sony memory stick, with Sony at the center surrounded by partners with whom it share technologies. (Source: Goerzen, 2005)

> Despite its policy to maintain full control over its international operations through wholly owned subsidiaries, Sandvik entered into at least 30 collaborations (mostly joint ventures) with other firms (Source: Hyder and Eriksson, 2005).

> BAE is involved in 29 major collaborative partnerships, including Airbus, Matra BAE Dynamics, Eurofighter, etc, and also formed various partnerships with universities, such as Cranfield, Glasgow, Loughborough and Southampton Universities.
>
> Source:
> http://www.eurofighter.com/Organisation/BAESYSTEMS/
> http://defence-data.com/f2000/pagefa1005.htm
> http://www.cranfield.ac.uk/baesystems/
> http://www.scottishresearch.com/WhatsNew/News/Older/tcm-26-39780.asp

> AT & T has maintained and expanded a rich set of European partners, including Italtel, Philips and Telefonica, which helped its establishment in Europe (Source: Medcof, 1997; Dussauge and Garrette, 1999).

A glance of EADS's history demonstrated a heavy reliance of the aerospace leader on forming alliances for its development.

Source:
http://www.eads.net/frame/lang/en/1024/content/OF00000000400004/6/27/549276.html

To provide quality repair and overhaul services in locations near to customers, Rolls-Royce partnered with customers, and established a global network of repair and overhaul facilities

Source:
http://www.rolls-royce.com/media/showPR.jsp?PR_ID=362
http://www.rolls-royce.com/media/showPR.jsp?PR_ID=1322
http://www.rolls-royce.com/media/showPR.jsp?PR_ID=40058

JVC depended on a number of alliances in its successful efforts to make VHS the industry standard for the video industry (Source: Yan & Luo, 2001).

Although large firms are usually rich in financial resource, they also actively seek benefits from alliances due to reasons like financial risk sharing (Brouthers et al. 1995; Cullen et al. 2000; Browning, 1994), lack of other types of resources (see Section 4.3.1), or time pressure (the AT&T example). Some firms (e.g. Porsche, Micro Compact Car, and Volkswagen) deliberately "de-materialise" themselves to seek the benefits of lean operations (Arnold, 2000). Behind the scenes were rounds of operations along the VME metabolism, started by careful EI analyses before making significant investment on external or internal operations.

4.3 Classification of Resources & Explanation of EI operations

At VME metabolism's Identification stage, decisions are made about whether tasks should be externalised or internalised. This research proposes a template analysing EI decision making.

Before deriving this template, it is useful to have a clear classification of the general resources for manufacturing companies, and a clear explanation of external & internal (EI) operations.

4.3.1 A Classification of Resources

In the literature, "**resource**" is defined as "all assets, capabilities, processes, information and knowledge **controlled** by the firm enabling it to select and use strategies that enhance organizational efficiency and effectiveness" (Ireland et al., 2002). Such a definition establishes "**controllable**" as a feature of resources. Barney (1991) defines resources as "**strengths** that firms can **use** to conceive of and implement their strategies". Such a definition establishes "**usable**" rather than "**controllable**" as a feature of resources. Some classifications of resources are also found in the literature:

- Das and Teng (2003) classified resources into physical, financial, technological, managerial, and organisational.

- Tsang (1998) grouped resources into three categories: (1) physical resources, (2) human resources, and (3) organisational resources. Physical resources include tangible assets such as land, plant, equipment, finished and semi-finished goods, as well as intangible assets such as brand name, copyright and patent. Human resources include the education, training, experience, relationships, skills, and intelligence of individual staff in a firm. Organisational resources include corporate culture, organisational structure, rules, procedures, management information systems, as well as a firm's relationships with external institutions.
- Harvey and Lusch (1995) classified resources into tangible and intangible resources.

This research identifies the types of resources for manufacturing companies, each of which might be particularly sought by companies through alliances. Here, a company's "**resources**" are defined as something that are **owned** or **accessible** by the company, and can be **used** to generate **benefits** for the company. According to this definition, resources can be tangible or intangible; can be something that can/cannot be manipulated; can exist within/outside the company; it can be something basic or something combined or generated. For a manufacturing company, resources can be of the following types (see Table 4.1):

Table 4.1 Types of resources for manufacturing companies

Types of resources	Descriptions	Features			
		Tangible/ intangible	Can /cannot be manipulated	Within /outside the company	Basic/ combined/ generated
Products	Usually sought by partners to fill the gaps of their product lines	Tangible	Can	Within	Generated
Services	Usually sought by partners to quickly establish service network for geographic expansion	Intangible	Can	Within	Generated
Customers	Usually sought by partners to achieve economy of scale, or to increase sales	Tangible	Cannot	Outside	Generated
Knowledge (including technologies and management expertise)	Can be, e.g. local market knowledge usually sought by foreign partners; product technologies usually required for NPD alliances; manufacturing expertise usually sought by learning partners	Intangible	Can	Within	Basic/ combined/ generated
Equipment	Usually sought by partners without enough financial resources or interest for equipment investment	Tangible	Can	Within	Basic
Financial resource	Usually sought by partners without enough financial resources, or intending to share financial risks with others	Intangible	Can	Within	Basic /generated

Human resource	Usually needed in NPD alliances for technological expertise, or alliances seeking cheap labour	Intangible	Can	Within	Basic /generated (via training)
Supply chain (including distribution network)	Channels through which raw materials from suppliers are transformed into products by manufacturers, and finally reach customers through distributors; usually sought for improving manufacturing performance, or for expanding foreign market through established distribution network	Intangible	Can	Partly within & partly outside	Combined /generated
Brand	Recognised by customers as a guarantee of certain satisfaction; usually sought for overcoming reputation weakness	Intangible	Can	Within	Generated
Relationships	Connections with certain organisations/individuals; e.g. relationships with governments are particularly important in countries where governments play important roles in business, such as in China	Intangible	Can	Outside	Basic /generated

(1) **Products** – Products are sometimes sought by partners to fill the gaps of their product lines. For example, in the Omega joint venture between Alpha and Beta (Groot and Merchant, 2000), Beta produced the equipment of which Alpha's digitizers were a part; whereas, Alpha produced some digitizer models that enable Beta to produce a full product range.

(2) **Services** – Services are usually sought by partners to quickly establish service network for geographic expansion. In the Stork-Wärtsilä joint venture (Douma et al. 2000), Stork had a strong international service network outside of Scandinavia, which could help Wärtsilä's international expansion.

(3) **Customers** – Customers are sometimes sought by partners to achieve economy of scale, or to increase sales. In the Butachimie joint venture by DuPont de Nemours and Rhône-Poulenc (Dussauge and Garrette, 1999), both DuPont and Rhône-Poulenc were unable to implement the "butadiene" technology alone profitably in Europe due to their limited market shares to meet the minimum efficient scale for butadiene production. This became the major reason why the two firms joined their forces.

(4) **Knowledge** (including technologies) – Knowledge can be, e.g. local market knowledge usually sought by foreign partners; product technologies usually required for NPD alliances;

manufacturing expertise usually sought by learning partners. For example, in the Matra-Renault alliance (Dussauge and Garrette, 1999), Matra's technology contribution was highly attractive to Renault, since Matra's proprietary low-volume manufacturing technology made it possible to serve a small segment profitably. In the NUMMI joint venture between General Motors and Toyota (Dussauge and Garrette, 1999), both partners intended to use NUMMI as a tool for learning: GM would witness the Japanese manufacturing methods first hand and could then try to transfer them to its own production units, while Toyota would learn how to manage a factory in an American environment. In the Stork-Wärtsilä joint venture (Douma et al., 2000), Wärtsilä possessed the technical expertise that Stork needed for developing new engines. In the Butachimie joint venture by DuPont de Nemours and Rhône-Poulenc (Dussauge and Garrette, 1999), Rhône-Poulenc had decided to expand its nylon production capacity and wanted to use this alliance opportunity to acquire the new "butadiene" technology. SJA, a large Chinese Auto manufacturer, actively sought to form alliances (mostly joint ventures) with larger international Auto manufacturers to improve its technical expertise and management skills (from the author's field research). Similar example was also found in COMEDIL who set up a technology transfer partnership with a leading Italian manufacturer (from the author's field research).

(5) **Equipment** – Equipment is sometimes sought by partners without enough financial resources or interest for equipment investment. In the Matra-Renault alliance (Dussauge and Garrette, 1999), Renault had very little incentive to invest in facilities specialised in short production runs, which became one of the major motivations for entering an alliance with Renault. In the NUMMI joint venture between General Motors and Toyota (Dussauge and Garrette, 1999), GM's former plants, located in Fremont, California, provided Toyota an excellent environment for learning without first investing on building plants. In the author's field research, examples were also found where a case study company (SSQHTC) set up a joint venture with a local partner for accessing its factory, and another (SFQMC) almost completely depended on its supplier partners' equipment to develop its business.

(6) **Financial resource** – Financial resource is usually sought by partners without enough financial resources, or intending to share financial risks with others. In the IBM, Siemens and Toshiba's joint development of a semiconductor technology (Brouthers et al. 1995; Cullen et al. 2000; Browning, 1994), the financial risks were shared among the three partners, although each had the financial strength to take on this venture alone. In the Stork-Wärtsilä joint venture (Douma et al., 2000), Stork, which had just escaped bankruptcy, depended on Wärtsilä's financial resources to develop new engines.

(7) **Human resource** – Human resource is usually needed in NPD alliances for technological expertise, or alliances seeking cheap labour. In the IBM, Siemens and Toshiba's joint development of a semiconductor technology (Brouthers et al. 1995; Cullen et al. 2000; Browning,

1994), over 200 scientists came from these culturally different companies and countries, and worked together in the IBM research facility in New York to foster creativity and dramatic advances.

(8) **Supply chain** (including distribution network) – As channels through which raw materials from suppliers are transformed into products by manufacturers, and finally reach customers through distributors, supply chain is sometimes sought for improving manufacturing performance, or for expanding foreign market through established distribution network. In the Omega joint venture between Alpha and Beta (Groot and Merchant, 2000), Beta's strong world-wide distribution network is one of the factors motivating Alpha to enter the alliance. In the Matra-Renault alliance (Dussauge and Garrette, 1999), Renault's distribution network became the major resource sought by Matra.

(9) **Brand** – Recognised by customers as a guarantee of certain satisfaction, brand is sometimes sought by partners for overcoming reputation weakness. In the Omega joint venture between Alpha and Beta (Groot and Merchant, 2000), Beta had a well-established brand name and a reputation for high-quality products, which was one of the major factors motivating Alpha to enter the alliance. A similar example was found in the field research where COMEDIL set up a technology transfer partnership with a leading Italian manufacturer, not only for accessing its expertise but also its reputation which could greatly help the company open the South East Asia market.

(10) **Relationships** – Relationships with certain organisations/individuals, e.g. governments, are particularly important in countries like China where governmental bodies play important roles in business. Multinationals might deliberately choose to expand through joint ventures due to local partners' networks of political and personal connections (Dussauge and Garrette, 1999). In the joint venture between Honeywell and the Chinese National Petroleum Company (Yan & Luo, 2001), the Chinese partner's strong relationship with the central government served as the "proprietary asset" to the venture. Similarly, Wu and Callahan (2005) also identified government's influence in the Chinese market, and indicated that forming strategic alliances with local partners who have strong government relationships was an efficient means to overcome barriers in the local market. Even in local business, relationship might also be sought to smooth operation, as shown in one of the field case studies, where SSQHTC set up a joint venture with a local partner due to the partner's strong relationships with local governmental bodies. However, relationships as resources sought by partners are not restricted in countries like China. In the joint venture between GE and SNECMA (Yan & Luo, 2001), SNECMA's French identity and close links with Airbus and Airbus's French and German partners strongly motivated GE's entering into the alliance.

4.3.2 An Explanation of EI operations

Externalisation and internalisation are considered in this research as the two alternatives for sourcing tasks. They can also be referred to as outsourcing and insourcing respectively. **Externalisation** is defined here as a way of performing tasks using external resources accessed through alliances. Firms do not own the resources accessed via alliances. Alliances can take a number of forms, which can differentiate from one another according to the degree of collaboration. **Internalisation** is defined here as a way of performing tasks using internal resources. Firms do own the resources, although they might be acquired through a number of ways, such as merge/acquisition.

To demonstrate the reasonability of classifying operations into "external" and "internal" two groups, various sourcing approaches identified in the literature are summarised under the "externalisation" and "internalisation" headings (see Table 4.2).

Table 4.2 Classifying operations into externalisation and internalisation

Internalisation
Horizontal **merge/acquisition** can be used to achieve economies of scale (Garette and Dussauge, 2000; de Man and Duysters, 2004)
Merge/acquisition can be used to source technologies; alternatively, technologies can be developed **internally** (Lambe and Spekman, 1997; Amesse et al., 2004)
Bresman et al. (1999) indicate that "firms may be inclined to engage in an **acquisition** in order to solve problems related to the transmission of tacit knowledge".
Securing technologies by **acquiring** the relevant suppliers goes beyond an alliance relationship to **vertical integration** (McCutcheon & Stuart, 2000).
Externalisation
Das and Teng (2000) commented that "when the purchase of the resource's service from the firm that possesses it can be efficiently conducted through the market, market exchanges are preferred". This comment essentially indicates an **outsourcing** approach **without close collaboration** with the service providers.
Yasuda (2004) explained 4 alliance forms: **technology license**; **joint R&D**; **sourcing agreement** (agreement in which firms consign manufacturing to partners); **joint venture**.
Garette and Dussauge (2000) classify alliances into **scale alliances** (i.e. alliances for the purpose of achieving economies of scale) and **complementary alliances** (i.e. alliances for the purpose of accessing partners' complementary resources).
When a firm sees that the technological environment as too uncertain, these leading-edge technology suppliers will be given **fixed-term 'exclusive provider' contracts**, since the firm is not sure whether the suppliers' particular technological skills will not be obsolete within a few years (McCutcheon & Stuart, 2000).
Yan & Luo (2001) indicated that "if an investment project is financially too large or too risky for single firms to handle alone, they may join forces to share the financial risk. This is the case with oil exploration and commercial aircraft manufacturing where large, risky projects call for **inter-firm collaboration**."
Dell Computer's direct business model rests on "virtual integration" with suppliers and customers based on information exchange and learning. It attempts to turn **conventional buyer-seller relationships** into **collaborations**, thus more effectively exchanging information and knowledge with suppliers and customers. (Source: Cravens, et al., 2000)

4.4 A Template for EI Decision

4.4.1 Motives

A group of papers in the literature explained motives for using alliances. These motives can be summarised into three categories (see Table 4.3).

(1) **Improving task outputs**: Alliances pool partners' resources needed to generate desired outputs (Munns et al., 2000), and can create scarce combinations of resources which generate competitive advantages (Harvey and Lusch, 1995), and produce better products at a similar/lower cost (Tsang, 1998). For technology transfer, alliances can produce better effects due to close collaboration between partners (Munns et al., 2000). In the SJA field case study, joint venture was considered as the best approach for acquiring its foreign partners' management and technical expertise. Alliances can also reduce time to market for new products (Yasuda, 2004), as supported by the COMEDIL and SSQHTC field case studies, where both companies saved much time in developing technologies and building factory, which largely helped the companies in early launch of their products.

(2) **Reducing task inputs**: Task inputs are essentially resources of different types (see Table 4.1). Alliances can create scarce combinations of resources which can produce similar products at a lower cost (Tsang, 1998). Pooling of resources through alliances also means less investment of own resources (Munns et al., 2000; Yasuda, 2004), e.g. sharing of R&D costs (Nielsen, 2003). Alliances can be used to achieve economies of scale, thus reducing unit costs (Harvey and Lusch, 1995; Nielsen, 2003). They can also lower costs (time, money, efforts) for international expansion through partnering with local partners who might possess local market knowledge and distribution network (Harvey and Lusch, 1995). Alliances can lower costs for technology improvement through technology transfer partnerships (Munns et al., 2000), as shown in the COMEDIL field case study. Other evidence was also found in the field research: SFQMC formed extensive partnerships with suppliers to save equipment investment; SJA established joint ventures with foreign Auto manufacturers, thus cutting financial costs; SSQHTC built a joint venture with a local governmental authority, whereby its costs of building a local factory was completely avoided.

(3) **Reducing task risks**: Forming alliances is an effective way of reducing risks of expansion, e.g. risks due to unfamiliarity with local market, and of sharing NPD risks with partners (Tsang, 1998; Nielsen, 2003). Since alliances facilitate risk sharing between partners, they can effectively reduce individual partners' exposure to failure (Munns et al., 2000; Nielsen, 2003). Level of task risks varies according to the ways of performing the tasks. For example, when alliance is chosen, relational risks (*i.e. risks resulted from partners' opportunistic behaviour, such as stealing*

technologies) may be high; when internalisation is chosen as the way of performing large NPD projects, performance risks (*i.e. risks of low performance, such as failure of developing new products, or low market requirement for the new products thus a low level of return on investment*) may be high.

Table 4.3 Literature support of the three categories of motives

	Improving task outputs	Reducing task inputs	Reducing task risks
Tsang (1998)	- Producing better products at a similar/lower cost	- Producing similar products at a lower cost	- Reducing risks of expansion - Sharing risks of NPD
Harvey and Lusch (1995)	- Complementary contributions of partners to create competitive advantages	- Achieving economies of scale - Lower costs (time, money, efforts) for international expansion	- Risk reduction
Munns et al. (2000)	- Better effects for technology transfer - Pooling of resources needed to generate desired outputs	- Lower costs for technology improvement through technology transfer partnerships - Pooling of resources needed to generate desired outputs	- Facilitating risk sharing among parties involved, thus reducing individual partners' exposure to failure
Nielsen (2003)		- Sharing R&D costs - Achieving economies of scale	- Sharing R&D costs - Spreading risk of investment
Yasuda (2004)	- Shortening time to market for new products	- Accessing partners' resources - Cost reduction	

A decision of externalisation/internalisation (EI decision) is a **comparison analysis** among these three categories of motives, as demonstrated by the following case studies.

Table 4.4 SFQMC's analyses for its transformation from "de-materialised" to "semi-de-materialised"

	Outputs	Inputs	Risks
Externalisation	✗ (transfer of profits to suppliers; difficult to control suppliers' product quality and delivery performance)	✓ (saving on fixed assets investment)	✗ (increased performance risks; increased relational risks)
Internalisation	✓ (more profits; more control on product quality and delivery performance)	✓ (decreased variable costs)	✓ (reduced performance risks; reduced relational risks)
		✗ (increased fixed assets investment)	✗ (increased reversibility risks; increased core competency risks)

(*Source: from the author's field research*)

SFQMC's transformation from "de-materialised" to "semi-de-materialised"

When formed, SFQMC was a "de-materialised" company. Its only job was to identify customer needs and to find suppliers delivering parts for a product which satisfies these needs. The company delegated almost all of its manufacturing activities to suppliers, and it focused on product development, which

gradually enhanced its core competencies in forgings. The company chose this way of doing business under the following motive:

Decreased task inputs: "*Using suppliers' equipment, we saved a large amount of fixed assets investment.*"

However, the managers of the company also perceived the downsides of this 'de-materialised' form:

Decreased task outputs: "*Suppliers usually charge us a price much higher than the costs if we do by ourselves. This means that they took a large share of our profits.*" "*It is also more difficult to control their product quality and delivery performance than the situation if we do by ourselves.*"

Increased task risks: "*Since product quality and delivery are difficult to control, our risks are increased.*" "*We are also facing the risks of the leakage of our core technologies to suppliers.*"

Despites these downsides, since the company, at that time, viewed task inputs as more important than task outputs and risks, the company headed to this "de-materialised" form.

After several years' successful operation, the company is now gradually shifting itself from the "de-materialised" form to a "semi-de-materialised" form, and investing large amounts of financial resource on purchasing lands and equipment for building factories. This shift reflects a new balancing of motives by the company, as follows:

Pros:

Increased task outputs: "*Traditionally, suppliers would charge a high price for the manufacturing tasks we outsourced to them; now we can do these tasks by ourselves at much lower cost. In this way, our profit is increased.*" "*It is now also easier to control the product quality and order delivery.*"

Decreased performance risks and suppliers' opportunistic risks: "*Since product quality and delivery are now well under control, our risks are reduced.*" "*We are also no longer facing the risks of the leakage of our core technologies to suppliers.*"

Decreased variable task inputs: "*The variable costs for insourcing some manufacturing tasks are much lower than the variable outsourcing costs* (i.e. the price charged by suppliers)."

Cons:

Increased fixed task inputs: Shift from outsourcing to insourcing dramatically increased the company's investment on fixed assets (such as lands and equipment for new factories) and on human resource (new employees need to be recruited and properly trained).

Increased reversibility risks and core competency risks: Fixed assets investment reduces the company's operational reversibility, and somewhat divert its focus from developing core competencies to manufacturing tasks.

It can be seen that the new balancing views task outputs, performance risks and suppliers' opportunistic risks, and variable task inputs as more important than fixed task inputs, and reversibility risks and core competency risks. This is why the company begins to internalise tasks. Table 4.4 summarises the analyses.

Table 4.5 gives motive analyses of some case studies found in the literature.

Table 4.5 Motive analyses of some other case studies

(**E**-Externalisation; **I**-Internalisation)				
Case studies		Outputs	Inputs	Risks
Sextant Avionique's decision of alliance for TCAS screens (Dussauge and Garrette, 1999)	E	✓ (Effective combination of Sextant's knowledge of customer needs and Texas's expertise in microelectronics; no adequate product available on the market)	✓ (Inputs saved for Sextant since no need to develop relevant expertise in microelectronics)	✓ (Performance risks reduced – able to deliver in time within cost constraints)
	I	× (Sextant lacked relevant expertise in microelectronics)	× (Sextant's inputs increased for developing relevant expertise in microelectronics)	× (Performance risks increased – unable to deliver in time within cost constraints)
Boeing's alliance to ease NPD burden (Brouthers et al., 1995)	E	✓ (Effective combination of Boeing's technologies & financial resource and the Japanese consortium's financial resource & market potential)	✓ (Boeing's financial inputs saved)	✓ (Boeing's NPD market risks reduced by adding a large potential customer as an 'insider'; Boeing's NPD financial risks shared with the Japanese consortium)
	I	× (Boeing's return on NPD investment was at risk)	× (Boeing's financial inputs increased)	× (Boeing's NPD market risks increased; Boeing took NPD financial risks alone)
DSM's alliance with Tosoh (Groot and Merchant, 2000)	E	✓ (Effective combination of DSM's key raw material & financial resource, and Tosoh's aspartame production technology & financial resource)	✓ (DSM's financial inputs saved for developing aspartame production technology, and for starting a new plant)	✓ (DSM's financial burden shared with Tosoh)
	I	× (DSM lacked aspartame production technology)	× (DSM's inputs increased for developing aspartame production technology, and for starting a new plant alone)	× (DSM alone took the financial burden of starting a new plant)

Tosoh's alliance with DSM (Groot and Merchant, 2000)	E	✓ (Effective combination of DSM's key raw material & financial resource, and Tosoh's aspartame production technology & financial resource; accessing European product and labor markets; learning how to manage a fine chemical process)	✓ (Tosoh's inputs saved for starting a new plant, for developing the technology to produce phenylalanine, for accessing European product and labor markets, and for learning how to manage a fine chemical process)	✓ (Tosoh's financial burden shared with DSM)
	I	✗ (Tosoh lacked key raw material)	✗ (Tosoh's inputs increased for starting a new plant, for developing the technology to produce phenylalanine, for accessing European product and labor markets, and for learning how to manage a fine chemical process)	✗ (Tosoh alone took the financial burden of starting a new plant)
Stork Werkspoor Diesel's JV with Wärtsilä Diesel (Douma et al., 2000)	E	✓ (Effective combination of Stork's international service network outside of Scandinavia, and Wärtsilä Diesel's financial resources and technical expertise)	✓ (Stork's investment saved for developing new engines)	✓ (Performance risks reduced – able to develop new engines with less investment)
	I	✗ (Stork lacked financial resources and technical expertise)	✗ (Stork's investment increased for developing new engines)	✗ (Performance risks increased – without sufficient financial resource to develop new engines)
Wärtsilä Diesel's JV with Stork Werkspoor Diesel (Douma et al., 2000)	E	✓ (Effective combination of Stork's international service network outside of Scandinavia, and Wärtsilä Diesel's financial resources and technical expertise)	✓ (Wärtsilä Diesel's investment saved for developing international service network outside of Scandinavia)	✓ (Performance risks reduced – able to access established service network outside of Scandinavia)
	I	✗ (Wärtsilä Diesel lacked international service network outside of Scandinavia, the development of which is time-consuming)	✗ (Wärtsilä Diesel's investment increased for developing international service network outside of Scandinavia)	✗ (Performance risks increased – international expansion delayed)

Although **motives** for EI decisions have been discussed in the literature, a clear specification of such motives' **underlying factors** (in other words, factors influencing task outputs, inputs and risks) is not found. However, scrutinising motives' underlying factors can help firms have clear and comprehensive analyses of their motives. The next section explains three underlying factors based on **resource combination**.

4.4.2 Resource Combination Based Underlying Factors

Suppose that an auto manufacturer intends to develop a component for its new model of vehicle: If it develops the component through an alliance with a supplier, resource combination occurs between the company and the supplier, no matter how close the collaboration with the supplier is; if it develops the component totally depending on itself, resource combination occurs among its own resources, even when some technologies are gained through acquiring another firm. Thus, it can be seen that no matter which way (externalisation/internalisation) is chosen, there must be some sort of resource combination; the difference resides in whose resources are combined, and how the resources are combined. Thus, if underlying factors could be based on resource combination, their generality for explaining externalisation and internalisation can be achieved. Based on resource combination, this research identified three underlying factors: (1) resource combination **effectiveness**; (2) resource combination **management complexity**; (3) resource combination **flexibility**. They are explained as follows.

4.4.2.1 Resource Combination Effectiveness

Resource combination effectiveness concerns the choice between externalisation and internalisation according to relevant tasks' and resources' **nature**. Support is found in the literature that resource combination effectiveness can be an underlying factor in all three categories of motives (see Figure 4.2):

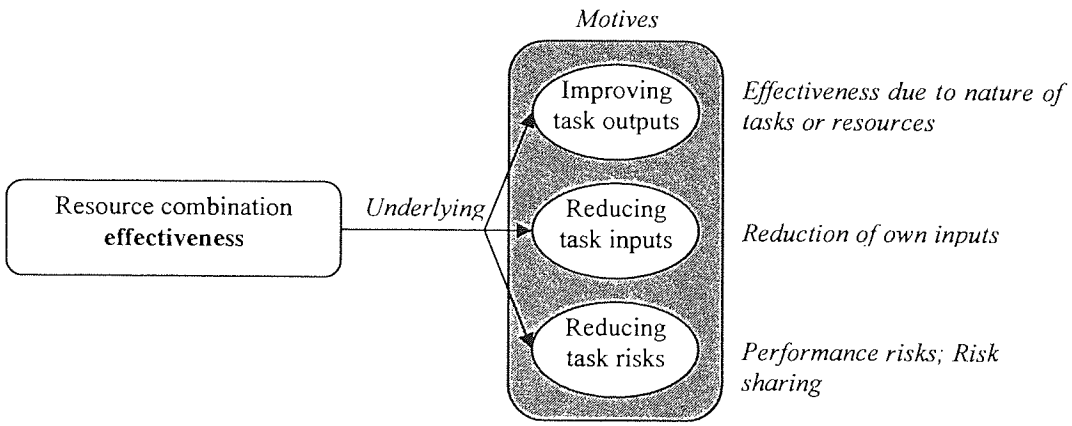


Figure 4.2 Resource combination effectiveness as an underlying factor

- Resource combination effectiveness can be an underlying factor in **task outputs**, because whether the EI choice is compatible with relevant tasks' and resources' **nature** directly influences task outputs.

  For example, de Man & Duysters (2004) indicated that technological know how is often tacit and can therefore not be easily transmitted from one firm to another (Larsson et al., 1998). In order to avoid high transaction costs, firms may be inclined to engage in an acquisition in order to solve

problems related to the transmission of tacit knowledge (Bresman et al., 1999). Tsang (1998) also indicated an important factor influencing the choice of technology transfer mode is the nature of the technology concerned: "the transfer mode needs to be joint ventures, or even wholly owned subsidiaries. Licensing is not good enough for effectively transferring the (tacit) know-how". It has been established empirically that, other things being equal, the higher the proportion of tacit knowledge in a technology, the more likely the transfer will take place in joint ventures or wholly owned operations (Contractor, 1984; Davidson and McFetridge, 1984; Kogut and Zander, 1993). O'Dwyer and O'Flynn (2005)'s research in the alliances by Molex with four partners also reflected the same situations. Similarly, Dell Computer's direct business model closely combined tacit information/knowledge from suppliers and customers (Cravens, et al., 2000); the NUMMI venture between GM and Toyota met both partners' interest in acquiring knowledge deeply embedded in one another's organisations (Rangan and Yoshino, 1996). In the field research, similar cases were also found in SJA's alliance experience. The company considered joint ventures as a favourite medium for acquiring its foreign partners' management and technical expertise.

- Resource combination effectiveness can be an underlying factor in **task inputs**, because a firm's **own inputs** can be reduced through accessing others' (e.g. partners') resources.

  McCutchen and Swamidass (2004) indicated that through alliances, firms can bring to bear significant resources beyond the capabilities of the individual cooperating firms (Byrne, 1993). Often, these partnerships bring together firms with complementary core competencies that enable the firms to enter new markets, deal with trade barriers, and develop new products (Mason, 1993). In the Matra-Renault alliance (Dumont and Garrette, 1996; Dussauge and Garrette, 1999), Matra used Renault's distribution network to market the Espace, while Renault used Matra's proprietary low-volume manufacturing technology to profit from the mini-vans market in Europe. In the Stork-Wärtsilä joint venture (Douma et al., 2000), Stork had just escaped bankruptcy, but was able to develop new engines through Wärtsilä's financial support. In the field case studies carried out in this research, it was found that equipment, building and lands were also usually sought by firms through partnerships for saving investment: e.g. SSQHTC (Shanghai, China) set up a joint venture with a local authority, with the purpose of accessing its buildings and lands; SFQMC (Shanghai, China) established extensive alliances with its suppliers to access their equipment, thus dramatically saved investment to start its business (Source: from the author's field research). Similar case studies were also found in the literature: Tambrands set up a joint venture with Ukrainian GAPU partly because that GAPU had a half-completed building in Borispol which was available and could be adapted to Tambrands' specifications (Mockler, 2000).

- Resource combination effectiveness can be an underlying factor in **task risks**, because it directly influences tasks' **performance risks**, and also because such risks can be **shared** with others.

  For example, if an investment project is financially too large or too risky for single firms to handle alone, they may join forces to share the financial risk; if the business environment in a host country is highly uncertain or unfriendly to foreign firms, a joint venture with a local firm may also allow a multinational company to share political risks and to defuse xenophobic local reactions (Yan & Luo, 2001). McCutchen and Swamidass (2004) also found since the stock market crash in 1987, it became much more difficult for biotech firms to obtain money through public offerings, and these firms turned more and more to large pharmaceutical firms seeking cooperative arrangements or strategic alliances for financial support (McCutchen & Swamidass, 1994; McCutchen & Swamidass, 1996). In the HSC JV between DSM and Tosoh (Groot and Merchant, 2000), both partners reduced their competition risks through combining their forces, and investment burdens and risks were also reduced to start the business. In the IBM, Siemens and Toshiba's joint development of a semiconductor technology (Brouthers et al. 1995; Cullen et al. 2000; Browning, 1994), the huge financial risks were shared among the three partners, although each had the financial strength to take on this venture alone.

4.4.2.2 Resource Combination Management Complexity

Resource combination management complexity concerns the EI choice according to **management complexity**. Support is found in the literature that resource combination management complexity can be an underlying factor in all three categories of motives (see Figure 4.3):

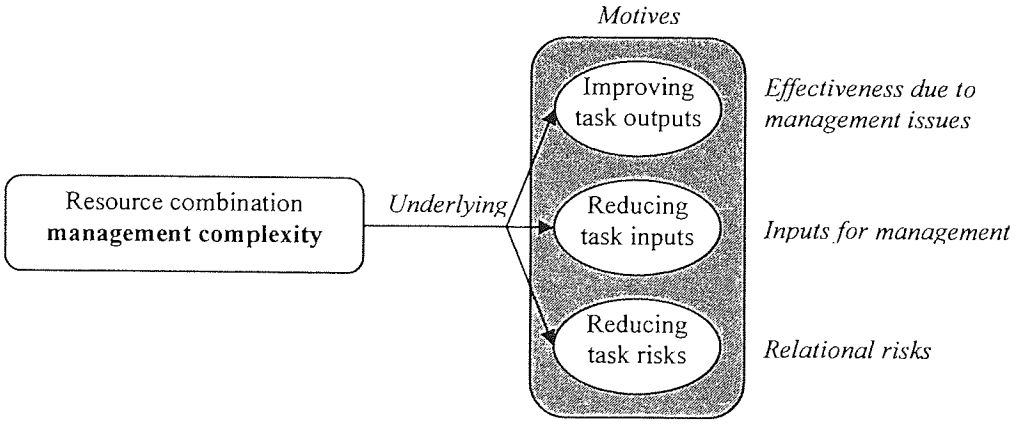


Figure 4.3 Resource combination management complexity as an underlying factor

- Resource combination management complexity can be an underlying factor in **task outputs**, because **management issues** directly influence task outputs.

For example, if firms are seeking to achieve economies of scale, a full-fledged acquisition will allow for a greater rationalisation than alliances because of the two limitations that distinguish alliances from mergers/acquisitions: (1) all decisions must be made by consensus among the partner firms; (2) alliances are transient and reversible in nature (Garette & Dussauge, 2000). Comparing mergers with alliances for R&D, de Man & Duysters (2004) indicated that even when the merger was successful in terms of the integration of R&D departments, in other business areas the merger might not be a success, prompting a disintegration of the company. Post-merger integration management apparently is not an easy task (Chakrabarti et al., 1994). In the IBM, Siemens and Toshiba's R&D joint venture (Cullen et al. 2000; Browning, 1994), the management of the human resources coming from these culturally different companies and countries turned out to be a failure: the results were a lack of trust, a withdrawal of the Japanese, Germans, and Americans into their own teams, and the belief that the other companies' scientists and engineers held back information and didn't share ideas. Evidence has also been found from the field case studies in this research.

> In SFQMC's alliances with suppliers, the company's managers felt difficulties in tackling its suppliers' delivery problems. Although through close collaboration, product quality could be ensured, the suppliers still have problems in timely delivery due to their chaotic order management systems, and traditional manufacturing processes. SFQMC felt difficulties in persuading its suppliers to upgrade the systems and processes, since it could not exert sufficient influence on those suppliers' decision making. Delivery issues directly undermined the overall perceived alliance performance, and formed part of the reasons why SFQMC began to internalise some of the tasks outsourced before. (Source: the author's field research)

- Resource combination management complexity can be an underlying factor in **task inputs**, because more/less management complexity can increase/ease **management costs**.

For example, the consensual decision-making process in alliances increases the cost of rationalising (Garette & Dussauge, 2000). Tsang (1998) indicated that "When several companies cooperate in an R&D project, difficulties may arise due to differences of culture and work procedures, as well as more complicated decision-making processes. More often than not, administrative cost of the project would be higher than the case when it is a single-company endeavour". While strategic alliances have the potential to enhance a firm's performance, doing so is challenging because of the difficulties in managing them (Ireland et al., 2002). Rangan & Yoshino (1996) indicated that "(Alliance operational efficiency) involves holding down costs associated with managing the relationship, among them the cost of negotiating, monitoring and enforcing contracts that must cover a multitude of contingencies and accommodate disagreements between partners regarding relative value of contributions, costs incurred by the need to

coordinate a firm's internal activities with those of its partner and the cost of assuring adequate communication between the partners. Often neglected are the costs of making organizational adjustments as an alliance progresses."

Small firms particularly felt insufficiencies in people, time, energy and skills in managing their alliances. The more complex the issues, the more insufficient they felt. For example, SFQMC felt difficulties in persuading its suppliers to upgrade their order management systems and manufacturing processes to solve delivery problems, partly because it has no more people who can be dispatched to help suppliers with the upgrade, also because it has no relevant expertise. (Source: the author's field research)

- Resource combination management complexity can be an underlying factor in **task risks**, because **relational risks** can be particularly higher in close collaboration than in internalisation.

  Relational risk is unique to strategic alliances (Das & Teng, 1999). Firms might enter alliances with "secret agendas": not for mutual benefit, but for absorbing partners' valuable resources (e.g. knowledge, skills) (Duysters, 1996; de Man & Duysters, 2004). Secret agendas might exist not only in alliances with competitors, but also in alliances with seemingly unharmful parties such as suppliers (McCutcheon and Stuart, 2000). Rangan & Yoshino (1996) identified two offensive goals of alliances, one of which is "to guard against appropriation by a partner of core competencies or strategic advantages" (the other is to "to ensure continued strategic flexibility"). Tsang (1998) indicated that the frequent day-to-day interaction among staff within an alliance makes it difficult to seal off all the unforeseen gateways for a partner to learn other partners' technologies. Brouthers et al. (1995) warned that unless there is a real lack of resources, strategic alliances should be avoided due to management complexity of the inherent risks. In the SmitWijs joint venture by Smit and Wijsmuller (Douma et al., 2000), both managing directors concluded that, considering their competitive history, a successful cooperation would require a careful approach. As a result, the joint venture was formed to coordinate their joint towage business. Salvage jobs were not handled by the joint venture, but divided between the partners using a transparent set of rules to avoid potential conflicts.

Since "resource combination management complexity" is an underlying factor in all three categories of motives, managers' management skills have great influence on EI decision making.

4.4.2.3 Resource Combination Flexibility

Resource combination flexibility concerns the EI choice which causes least **reversibility risks**. Support is found in the literature that resource combination flexibility can be an underlying factor in the motive of "reducing task risks" (see Figure 4.4):

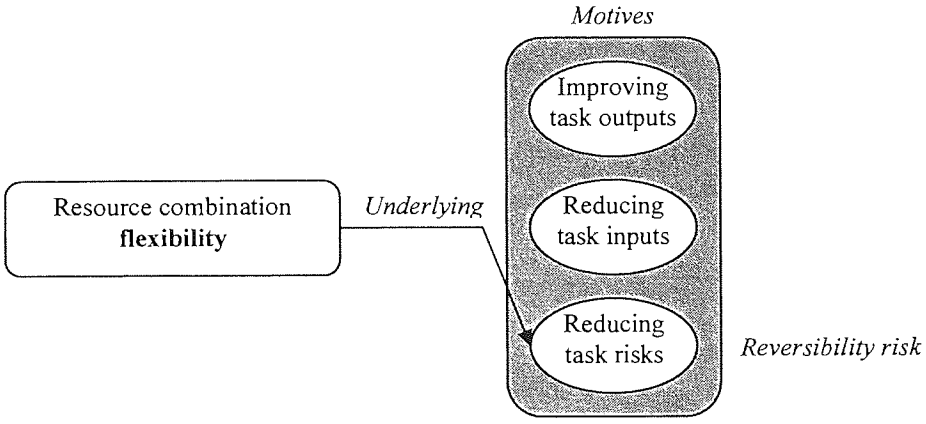


Figure 4.4 Resource combination flexibility as an underlying factor

- Resource combination flexibility can be an underlying factor in **task risks**, because **reversibility risk** can be particularly high in internalisation, but low in alliance.

  "To ensure continued strategic flexibility" is one of the two offensive goals of alliances identified by Rangan & Yoshino (1996) (the other is to guard against appropriation by a partner of core competencies or strategic advantages). The alliances need "to be managed in an integrated manner to enhance the firm's strategic flexibility", and to optimise the "arrangement that arrayed partners as spokes, with the company as hub" (Rangan & Yoshino, 1996). Due to the uncertainty in relation to technology and demand, "companies look for the advantages of flexibility and reversibility ... (Alliances) appear to be a type of arrangement more likely to bring about this advantage than internal development or acquisitions" (Amesse et al., 2004). Complementary alliances create favourable conditions for learning and capability appropriation, which, if properly used, can provide a window on the partner's proprietary know-how and skills (Garette & Dussauge, 2000). In the face of DTC (discontinuous technological change), alliances are far more attractive because they typically require a much lower overall investment, pose considerably less risk than potentially failed mergers/acquisitions, and provide added flexibility to shift to new technologies as necessary (Lambe & Spekman, 1997). Tsang (1998) also indicated that strategic alliances are preferred to other inter-organisational forms such as merger due to greater flexibility (Mody, 1993). Two basic modes of alliances – equity joint venture (EJV) and non-equity alliance (NEA) – are also different in flexibility, since EJV involves equity investment and sharing with partners, thus less reversibility, whereas NEA is more reversible (Glaister and Buckley, 1998).

The managers of a telecommunications service firm "reported that, a decade or more ago, the firm would have secured the technologies by acquiring the suppliers ... These leading-edge technology suppliers are now developed and given fixed-term 'exclusive provider' contracts, since the company is not sure whether the suppliers' particular technological skills will not be obsolete within a few years" (McCutcheon & Stuart, 2000).

4.4.3 Application of the Template

Figure 4.5 and Table 4.6 summarise the template discussed above: Underlying factors influence managers' perception of motives for their EI decisions.

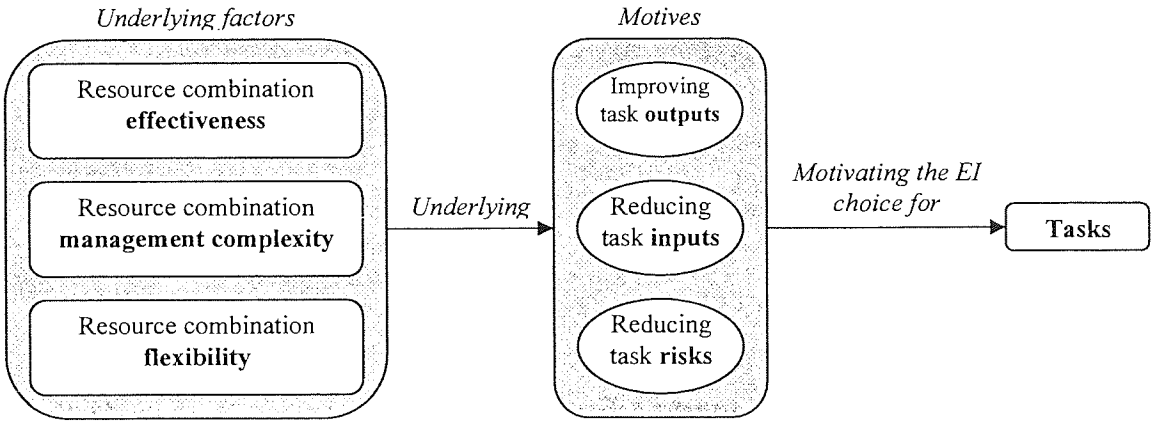


Figure 4.5 The template for EI analysis

Table 4.6 A scrutiny into all potential factors encouraging or discouraging the EI choice

Motives / Underlying factors	Externalisation: Task Outputs	Internalisation: Task Inputs	Internalisation: Task Risks
Resource combination effectiveness	Effectiveness due to nature of tasks or resources	Reduction of own inputs	Performance risks; Risk sharing
Resource combination management complexity	Effectiveness due to management issues	Inputs for management	Relational risks
Resource combination flexibility			Reversibility risk

Table 4.12 can serve as a tool for ensuring a comprehensive scrutiny of all potential considerations that might influence EI decisions. As an illustration, consider the Toyota case study (Ahmadjian and Lincoln, 2001):

Table 4.7 Toyota's balancing process for its capability in electronic components

Internalisation: In-house building			
Motives / Underlying factors	Task Outputs	Task Inputs	Task Risks
Resource combination effectiveness	✓ More effective procurement management ✓ More effective capability integration (thus product development)	× More inputs in building an in-house capability in electronic components	✓ Less performance risks – procurement management; ✓ Less performance risks – capability integration (thus product development)
Resource combination management complexity	–	–	✓ Less relational risks due to information symmetries
Resource combination flexibility			✓ Less dependency on Denso
Internalisation: Buy Denso outright			
Motives / Underlying factors	Task Outputs	Task Inputs	Task Risks
Resource combination effectiveness	✓ More effective procurement management × Less effective capability integration (thus product development)	× More inputs in buying Denso outright	✓ Less performance risks – procurement management; × More performance risks – capability integration (thus product development)
Resource combination management complexity	–	–	✓ Less relational risks due to information symmetries
Resource combination flexibility			✓ Less dependency on Denso
Externalisation			
Motives / Underlying factors	Task Outputs	Task Inputs	Task Risks
Resource combination effectiveness	× Less effective procurement management × Less effective capability integration (thus product development)	✓ Less inputs in accessing external capability in electronic components	× More performance risks – procurement management; × More performance risks – capability integration (thus product development)
Resource combination management complexity	–	–	× More relational risks due to information asymmetries
Resource combination flexibility			× More dependency on Denso

Toyota's building of an in-house capability in electronic components, thus scaling down its dependence on Denso, was due to the following considerations:

- Automotive-electronics technology is now a very hot topic in Japanese auto circles. Currently, electronic parts make up about 10% of an average vehicle's total production cost (more in upscale models); Toyota engineers estimate that this will soon rise to 30%.

- Toyota faced difficulties in evaluating Denso's pricing and delivery of electronic components due to the information asymmetries increased between the two companies: Denso understood electronics far better than Toyota, and Toyota found it increasingly difficult to evaluate what its key supplier was doing.
- The acquisition of expertise in electronics could not be had simply by purchasing electronics know-how on the outside. To learn, apply its knowledge, and keep up with the rapid pace of change in automotive electronics, Toyota had to build absorptive capacity: a base of electronics knowledge from which rapid learning of leading-edge developments could proceed.
- Investment in electronics learning should also be understood as a strategy for preserving the Toyota-Denso partnership. The quality of Toyota's discussions with Denso about parts design and manufacturing had risen since Toyota's investment in electronics learning began.
- With its electronics division in place, Toyota had become its own second source for electronics, which was in line with Toyota's own long-standing rule of having two suppliers of every part sourced (Richardson 1993).

The EI analyses of this case study can be presented in Table 4.7.

4.4.4 The Core Competency Perspective

In the literature, core-competency theory suggests that "only goods and services which are considered to be core competencies should be produced internally (insourcing)" (Arnold, 2000). An examination of the proposed template discloses that the core competency perspective is essentially an **objective**, rather than a **criterion**. In other words, a firm needs to balance among the three motives to decide its ways of performing tasks, while working towards the objective that **all** of the three motives show strongest positive support for outsourcing non-core tasks. There are at least two things a firm can do to achieve this objective:

- **Enhancing its core competencies** – this can increase the firm's flexibility in combining its core competencies with other firms' resources, thus reducing reversibility risks.
- **Increasing its alliance management ability** – this can ease outsourcing management complexity, thus enhancing effectiveness due to management issues, reducing (or stabilising) inputs for management, and preventing relational risks.

4.5 Ways to Ensure an Effective EI Analysis

4.5.1 Regular Reviews of Long Term Tasks

Long term tasks are more vulnerable to situational changes than short term tasks. **Regular reviews** become useful in identifying the effects of such changes on current EI configuration.

In the Matra-Renault alliance (Dussauge and Garrette, 1999), Renault opted to collaborate with Matra in the early 1980s due to the virtually non-existent market for mini-vans in Europe. By 1998, the mini-van market had increased, and all major European automobile manufacturers had introduced direct competitors for the Espace. At that point, Matra's SMC technology shifted from being an advantage to becoming a drawback. Because of this, Renault decided that it would no longer collaborate with Matra on this kind of vehicle in the future but would produce the fourth-generation Espace on its own.

The Toyota case study (Ahmadjian and Lincoln, 2001) just described also demonstrated a similar situation where the industrial changes triggered Toyota to re-analyse its relationship with Denso, and to make significant investment in plant, equipment and recruiting and training electrical engineers to build its in-house electrical capability.

Thus, it can be seen that for the same task, EI analysis might need to be carried out regularly, especially for a long term task. Such an analysis might result in the change of the type of the life cycle the company is operating along for the task, i.e. alliance life cycle might change to internalisation life cycle, and vice versa. This further demonstrates how important the Identification stage is in the VME metabolism.

4.5.2 Value Stream Joint Analysis towards Lean Manufacturing

As one of the most important concepts of lean manufacturing, "**value stream**" can be defined as "the set of all the specific actions required to bring a specific product (whether a good, a service, or, increasingly, a combination of the two) through the three critical management tasks of any business" (Womack and Jones, 2003):

- The problem-solving task running from concept through detailed design and engineering to production launch;
- The information management task running from order-taking through detailed scheduling to delivery;
- The physical transformation task proceeding from raw materials to a finished product in the hands of the customer.

Lean manufacturing aims to banish any waste along the value streams, and make each of the tasks, sub-tasks, and actions value creating. **Externalisation through close partnership can facilitate the achievement of this objective.** Hines et al. (1998) indicated that "the logic behind lean thinking is that companies **jointly** identify the value stream for each product from concept to consumption and optimise this value stream **regardless of** traditional **functional** or **corporate** boundaries". Other support is also found in the literature.

For example, Cagliano et al. (2004) indicate that lean supply utilises network sourcing, and puts high emphasis on supplier coordination, supplier development, and creation of a tiered network. Bowersox et al. (1999) indicate that "lean launch" requires close coordination among supply chain participants. Close supplier partnership is an essential characteristic of modern lean value systems, adopted by many of those companies characterised as "world-class", such as Wal-Mart, Sainsbury, Tesco and Marks & Spencer (Rafuse, 1996).

As important as delivering physical products, developing lean customer services also requires a fundamental shift in the way retailers, service providers, manufacturers and suppliers think about their relationships, and requires consumers to change the nature of their relationships with service providers (Womack and Jones, 2005). The Fujitsu-BMI "help desk" case study gave an excellent example of such relationship changes (Womack and Jones, 2005).

Other case studies were also found in the literature illustrating the importance of close partnership among value stream parties for achieving lean manufacturing. For example, the Lean Aerospace Initiative (LAI) in the U.S. aerospace defence community (Nightingale, 1998) was formed in 1993 to drive LAI member companies toward sharply lowered costs, shorter cycle times, and improved quality by re-engineering organisations and key processes, and building integrated supplier networks through strategic alliances and partnerships. Dell's lean operation model also requires close collaboration with suppliers (Kirkpatrick, 1997). IBM, Hewlett-Packard (HP), Compaq, Gateway, and other competitors in the PC industry were moving to emulate (Moore, 1997; DiCarlo, 1997; Bowersox et al., 1999). Similarly, Tesco has also realised that to shrink costs and improve the reliability of the 85 percent of the value stream it does not directly control, it's obvious that the upstream firms must collectively rethink their operating methods (Womack and Jones, 2003).

All these cases demonstrate that joint analysis across value stream parties, and subsequent joint design and implementation of the value streams are among the correct approaches towards lean operation. Thus, lean operation can be seen as the objective of virtual manufacturing, and virtual manufacturing can be seen as one of the forms to achieve lean operation.

4.6 Summary

This chapter explained the concept "VME metabolism", and proposed a mechanism to ensure a wise combination of external and internal operations: operating along the VME metabolism. Based on the conceptual framework described in Chapter 3, this chapter then started to build the first module of the reference model, and answers the first research question: "How to make decisions of operational externalisation". Before proposing a decision template for the Identification stage, the general resources relevant to a manufacturing company were categorised, and the fact was clarified that a company's activities were a combination of external and internal operations. These preparations intend to clarify some basic understandings regarding resource-based EI decision making. The template designed was based on the three aspects of resource combination: effectiveness, management complexity and flexibility. These three aspects are closely related to a company's motives to use external or internal operations: improving task outputs, reducing inputs and risks. Two approaches were also identified to ensure effective EI analysis: regular review of long-term tasks; value stream joint analysis towards lean manufacturing. The next chapter designs a special functional structure to ensure a smooth operation along the VME metabolism.

5 Module 2 – EI Management Function

5.1 Introduction

Chapter 2 described the "Alliance Management Function" researched in the literature. Chapter 4 introduced "VME metabolism" and a template of EI decision analysis. Now the question is how to ensure that a manufacturing company operates along the VME metabolism, thus achieving a wise combination of external and internal operations.

To answer this question, a functional structure is proposed in this chapter. This structure is built around a manufacturing company's value streams which are supervised by "EI Management Functions". An "EI Management Function" is an upgraded "Alliance Management Function" with responsibilities extended to cover both alliances and internal operations. This chapter answers the 2nd research question "How to transform to a VME from the aspect of functional structure?"

5.2 Alliance Management Function as a Central Function of a VME's Externalisation Structure

Research indicates that firms with a dedicated alliance management function created more value from alliances than those without such a function (Dyer et al., 2001; Kale et al., 2001). The following responsibilities of the alliance management function are identified in the literature (see Section 2.6 for detailed explanation of these responsibilities):

(1) Coordinating alliances to improve their compatibility (Duysters et al., 1999; Kale et al., 2001)

(2) Internal resource allocation for alliances (Kale et al., 2001)

(3) Gaining stakeholders' support for alliances (Kale et al., 2001)

(4) Evaluating alliance performance (Draulans et al., 2003; Kale et al., 2001)

(5) Alliance knowledge management (Kale et al., 2001; Draulans et al., 2003; Bonner et al., 2004)

In Kale et al. (2001)'s field research, they found that global leaders such as Hewlett-Packard, Parke-Davis, Eli Lilly and Oracle have created a totally separate "**alliance management team**" to perform such responsibilities, and the team is usually headed by a middle or senior level executive with the title

of "Vice President" or "Director Strategic Alliances". Companies that create such a team adopt a variety of approaches to organise or locate the team within their organisations (Kale et al., 2001).

- A large computer company, as described by Kale et al. (2001), has 4-5 key strategic partners with whom it has several alliances each. It has set up separate alliance teams (each comprising an alliance manager supported by a technology and marketing manager) to coordinate its multiple alliances with **each strategic partner**. These alliance teams in turn report to a corporate-level alliance function.
- On the other hand, a large global financial services company, as described by Kale et al. (2001), has organised its alliance teams by geography. A separate alliance team coordinates and supports all alliance activities in its four **geographical regions** of North America, Europe, Latin America and Asia including Japan. A senior Vice President coordinates the effort of all these individual teams.
- Kale et al. (2001) also found that some multi-business sample companies organise their alliance teams on a **divisional** or **sector** basis. Each relevant division/sector has its own alliance team, if necessary, and teams from different divisions are occasionally coordinated further at the corporate level.

Thus, Kale et al. (2001)'s field research indicates that alliance management teams can be organised as **central functions** for either focal **partners**, **geographies** or **businesses** as the case may be.

As discussed in Chapter 4 Section 4.3.2, tasks along a firm's value streams can be either externalised or internalised. Thus, the alliance management teams can be viewed as the **central functions** of the **externalised** part of the value streams, and this part can be called **externalisation structure** (or alliance structure). The alliance management teams and their surrounding functions form a firm's externalisation structure. For example, the externalisation structure of the above mentioned firms (organising alliance management teams around focal partners, geographies or businesses) can be depicted in Figures 5.1, 5.2, and 5.3 respectively.

Although the alliance management teams act as the central functions of a firm's externalisation structure, they have difficulties in becoming the central functions of a firm's entire structure due to their **insufficiencies** in managing the other part of the value streams – the **internal** part (also called as the **internalisation structure**).

However, if the alliance management teams' responsibilities can be extended to overcome such insufficiencies, they have the potential to become the central functions of a VME's entire structure, thus giving clear guidance as to how to construct a VME's functional structure, which answers the 2nd research question.

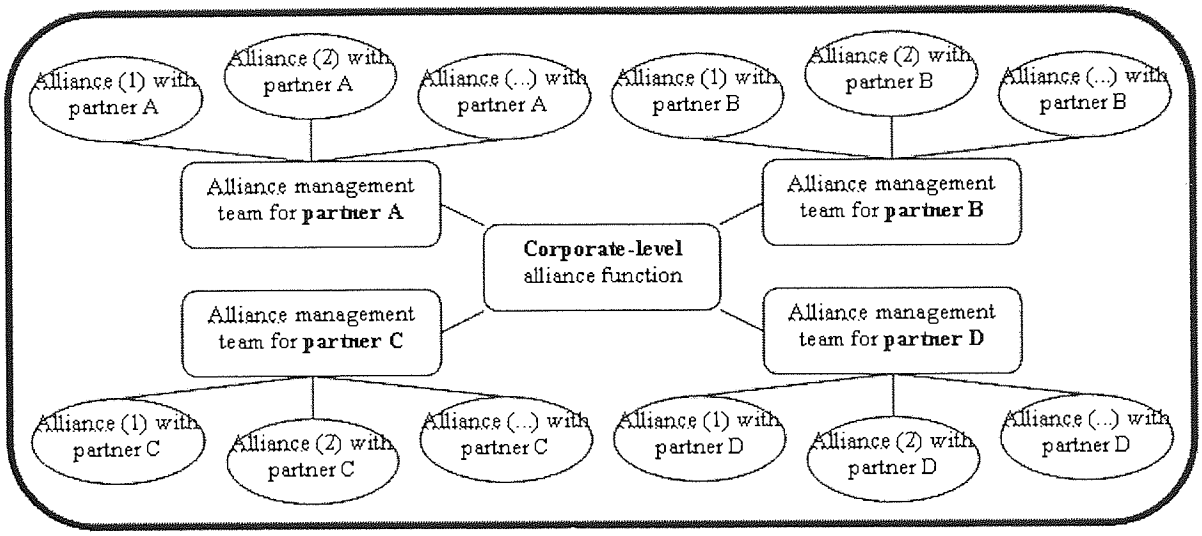


Figure 5.1 Externalisation structure around focal partners

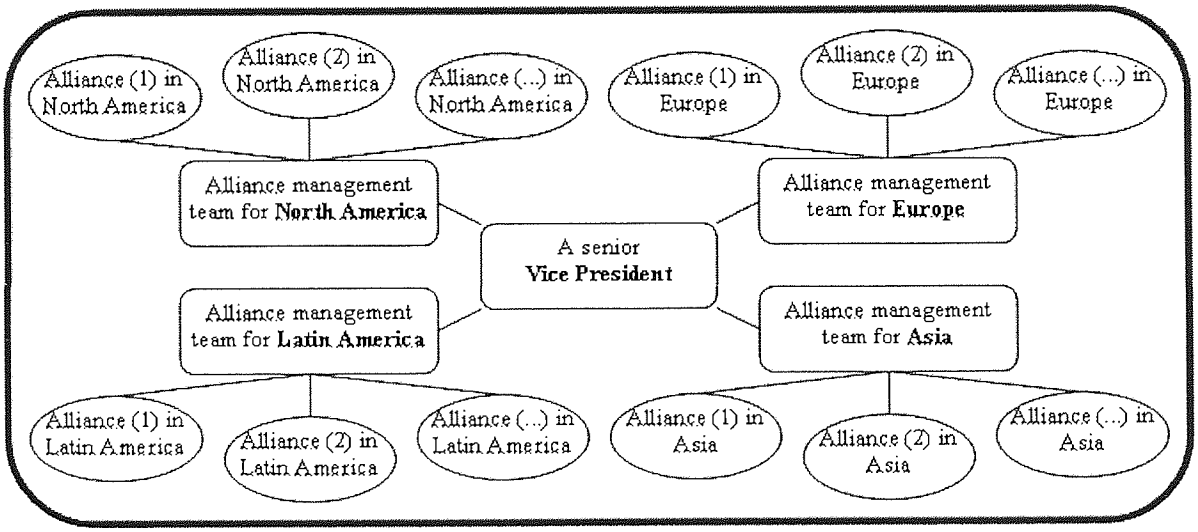


Figure 5.2 Externalisation structure around geographies

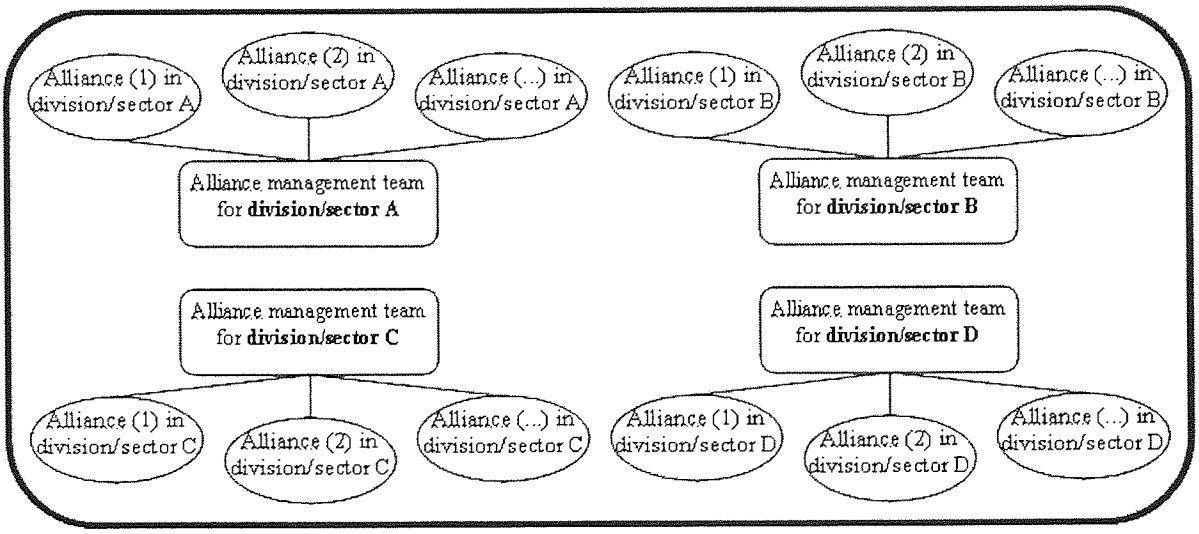


Figure 5.3 Externalisation structure on a divisional or sector basis

To reflect such an extension of the **alliance management function**, this research renames it as the **externalisation-internalisation (EI) management function**.

5.3 Responsibilities of EI Management Function

5.3.1 Responsibilities Enhancement

The responsibilities of the alliance management function form the basis on which the responsibilities of the EI management function are designed. First, those responsibilities identified in the literature are all upgraded to cover both externalisation and internalisation (see Table 5.1).

Table 5.1 Upgrading alliance management function to cover both externalisation & internalisation

Covering externalisation		Covering both externalisation & internalisation (EI)
(1) Coordinating alliances to improve their compatibility	→	**(1) Improving EI compatibility**
(2) Internal resource allocation for alliances	→	**(2) Internal resource allocation for EI**
(3) Gaining stakeholders' support for alliances	→	**(3) Gaining stakeholders' support for EI**
(4) Evaluating alliance performance	→	**(4) Evaluating EI performance**
(5) Alliance knowledge management	→	**(5) EI knowledge management**

The reasons for the upgrading are specified as follows.

(1) **Improving EI compatibility**

A firm can have alliances that are often in direct conflict (Duysters et al., 1999; Kale et al., 2001). Incompatibility may also exist when **internal operations** are taken into consideration. In the JVCO joint venture between Hexagon and NAMCO (Ariño and Doz, 2000), the alliance operations resulted in the cannibalisation of NAMCO's products, since the alliance products used the same channels and distribution space as those for NAMCO's products.

Alliance operations might also be not compatible with a company's strategies, thereby requiring adjustment. This situation was found in the field case studies of this research.

> When started, SFQMC delegated almost all of its manufacturing activities to suppliers, and itself focused on product development. After several years' successful operation, considering cost reduction and performance improvement, the company is now gradually investing on lands and manufacturing equipment for building new factories. This reflects its shift of strategy from externalisation to internalisation. The company carefully checked the compatibility between its alliances and operations to be internalised, and began to eliminate its collaborations with suppliers step by step. Such elimination cannot be too quick, since the company still needs time to learn the relevant operations; in fact, new collaborations with suppliers were set up for the company to learn from its suppliers. The

> ultimate objective of the company's internalisation, e.g. heat processing, is that "We are able to do the procedure by ourselves completely; external suppliers are only called upon when orders exceed our capacity". This also means that collaborations with relevant suppliers won't be removed completely. (Source: from the author's field research)

Sometimes, even when no conspicuous incompatibility exists, a firm's EI situation may still need to be adjusted to improve overall business performance, as demonstrated by EADS' acquisition of BAE Systems' Astrium shares.

> The acquisition is a key element in EADS' effort to restructure and integrate all its Space interests in the UK, France, Germany and Spain. EADS will gain the strategic and restructuring flexibility required by the current space market conditions.
>
> Source: http://www.defense-aerospace.com/cgi-bin/client/modele.pl?prod=13822&session=dae.4563273.1091970180.QRYkhMOa9dUAAEIGILM&modele=jdc_1

The Toyota case study (Ahmadjian and Lincoln, 2001) described in Chapter 4 Section 4.4.3 exhibited a similar situation. The study carried out by Hoffmann (2005) also demonstrated the importance of aligning a company's alliance portfolio with the company's strategic goals. Thus, it can be concluded that not only the compatibility among a firm's alliance operations needs to be improved, but also their compatibility with the firm's internal operations and overall strategies.

(2) **Internal resource allocation for EI**

Similar to external operations, internal operations may also trigger significant internal resource allocation. What's more, internal operations often require much more internal resource allocation; this is one of the main reasons why alliances are often sought as alternatives. The Concorde project involving collaboration between Sud-Aviation and British Aircraft Corporation (Dussauge and Garrette, 1999) was triggered since both firms realised that they did not possess the financial and human resources needed to launch alone an aircraft of this kind. Other similar case studies were also found in the literature, e.g. the Stork-Wärtsilä joint venture (Douma et al. 2000), and the IBM, Siemens and Toshiba's R&D venture (Brouthers et al. 1995),

(3) **Gaining stakeholders' support for EI**

A company can have a variety of stakeholders, such as shareholders, employees, local government, etc. Gillespie and Teegen (1995) indicated that "Stakeholders may be able to exercise influence over an alliance at its inception as well as during its life span. Formal and informal programs must be in place to ensure the support of all relevant stakeholders, such as customers, suppliers, other alliance partners, financiers and unions".

Similarly, stakeholders may also be able to exert (great) influence on internalisation decisions. For example, in the Renault-Volvo alliance (Bruner and Spekman, 1998), the Volvo's Executive Chairman underestimated the resistance from a number of key stakeholders, which directly resulted in the failure of his proposal to merge Renault and Volvo. As another example (Zhang and Li, 2001), the proposal by the Japanese partner of buying 60% of the IJV equity shares held by the Chinese partners was strongly opposed by the local Chinese IJV general manager, since he believed that the proposal would damage the interests of the IJV and the employees. The proposal could not be passed without the general manager's approval in the board, and the manager also had called for all employees not to cooperate with the consultant team sent by the Japanese headquarters for restructuring.

As a conclusion, both external and internal operations need stakeholders' support. The situations could become even more complicated when external parties have been involved in alliances, whose relevant tasks need now to be internalised.

(4) **Evaluating EI performance**

Since the early 20th century, financial performance measures such as return on investment began to be used by companies such as Dupont and General Motors to control and improve their financial performance. These performance measures became important management information for decision-making, and were not questioned by academics and practitioners until the 1980s (Johnson and Kaplan, 1987). One reason for the questioning is that such measures are difficult to use to measure the day-to-day operation of a company (Dixon, Nanni, and Vollmann, 1990; Kald and Nilsson, 2000).

During the 1990s, performance measurement models combining both financial performance measures and non-financial performance measures were presented. Kaplan and Norton (1992) presented the Balanced Scorecard model that can be used to evaluate business performance from four perspectives: (1) customer perspective, (2) internal perspective, (3) innovation and learning perspective, and (4) financial perspective. Maisel (1992) further demonstrated the causal links among these four perspectives, and Kaplan and Norton (1996) included these causal links into their Balanced Scorecard model. The balanced scorecard model has been adopted in companies like Sears (McLemore, 1999), Boeing (McLemore, 1999), General Electric (http://healthcare.isixsigma.com/library/content/c031028a.asp), Michigan Consolidated Gas (McLemore, 1999), Petrobras (http://www.bscol.com/bsc_portal/success/petrobras/), Australian Healthcare System (http://www.bscol.com/bsc_portal/success/queensland/), and Madison Paper Company (http://www.bscol.com/bsc_portal/success/madison/).

Neely (1998) suggested a "what-how" performance measurement model based on Kaplan and Norton's Balanced Scorecard, indicating that top-level performance measures should be mapped on the four perspectives of the Balanced Scorecard model, and low-level performance measures should have explainable causal links with these top-level performance measures. Neely (1998) called these causal links as assumptions and indicated that companies should challenge these assumptions to establish a perfect performance measurement system, and the challenge process is the learning process of the company.

Another important model is the Performance Pyramid System (PPS) originally developed by Judson (1990) and improved by Lynch and Cross (1991; 1995). PPS divides a company's performance measures into two sides (i.e. a company's internal and external sides) and four levels (i.e. a company's overall level performance measures; individual business unit level performance measures grouped under the market and financial headings; key measurement level of customer satisfaction, flexibility and productivity; the bottom level measures such as product quality and delivery reliability). The contribution of PPS lies in its mapping of performance measures to a company's organisational structure, and mapping these measures on the day-to-day operations of business units.

The recent trend of increasing vertical disintegration and outsourcing in many industries has shifted the focus from a pure intra-organisational towards a more holistic inter-organisational view of the overall value system. The result has been an increasing awareness of the importance of inter-organisational management control.

Source:
http://www.ifm.eng.cam.ac.uk/csp/projects/johannes.html

The above historical review of performance measurement evolution illustrates the importance of performance measurement for internal operations. These approaches' influence is so great that they became the outset of many of the subsequently designed alliance evaluation approaches. Thus, it is reasonable to say that performance measurement for internal operations has at least the same level of importance as that of performance measurement for external operations. This is why the responsibility of "evaluating alliance performance" is upgraded into "evaluating EI performance".

(5) **EI knowledge management**

Knowledge management practices were used by companies to capture, share, and create useful knowledge for improving their alliance operations (Kale et al., 2001; Draulans et al., 2003; Bonner et al., 2004; Tsang, 1999; see Section 2.6 for details). Hoang and Rothaermel (2005) suggested that firms should assess whether they are providing sufficient resources and organisational support to leverage alliance experience, e.g. increasing efforts to codify knowledge and creating systems to

coordinate and disseminate information between alliance managers across projects and across time. Firms must be able to account for the results of their alliances and deliberately engage in organisational routines to methodologically capture, process, and disseminate knowledge (Emden et al. 2005).

In addition, knowledge management practices are also deliberately used for learning & capturing alliance partners' knowledge (Goerzen, 2005; Revilla et al. 2005; Kandemir and Hult, 2005; Revilla, Sarkis and Acosta 2005, Almeida et al., 2002; Chen, 2004; Hermens, 2001; Inkpen, 1998, 2000; Parise and Henderson, 2001; Simonin, 1999; Tsang, 1999), and at the same time, protecting own knowledge competencies (Norman, 2001, 2002; Das & Teng, 1999; Baughn et al., 1997; Jordan, 2004).

However, knowledge management has very diverse roots (Drew, 1999), **none** of which supports that knowledge management is **only** for external operations:

- Academically, the field of **organisational learning** popularised by Senge (1990) dates back to the late 1970s.
- **Innovation** is another contributing thread. Firms' core competencies are essentially knowledge-based sources of competitive advantage.
- Other academic roots of knowledge management can be located in the **business process re-engineering** (BPR), **IT management**, and **strategic control** literatures.
- Practically, the **BPR** trend of the early 1990s has led to widespread adoption of new systems, notably **ERP** systems. The growth of the **Internet** and Corporate **Intranets** serves as platforms for information and knowledge dissemination.
- Governments are concerned with promoting **economic growth**, for which knowledge is an important **driver**, especially in the high-tech and service sectors. Encouragement of innovation in knowledge-intensive firms, dissemination of best practices and investments in education have become hot political issues.
- Knowledge management can also **generate new competencies** for firms, which attracts relevant stakeholders (e.g. shareholders).

Companies like Siemens (Davenport & Probst, 2002), Arup (author's field research), Unipart (author's field research), IBM (Mertins et al 2001), ABB (Hoegl and Schulze, 2005), Ricardo (Ward, 2005), Unilever (Drew, 1999), and Volkswagen (http://www.vw-personal.de/www/en/wissen/wissensmanagement.html) have successfully established their knowledge management systems, which mainly focus on improving the efficiency of their internal operations.

For merger/acquisition, knowledge management also plays an important role.

For example, in the acquisition of MediaOne by AT&T (Armistead and Meakins, 2002), merger-specific knowledge was collected and stored in a repository, with the objective being to help teams track their progress against each other and share lessons learned in real-time. In the merger of BP and Amoco (Armistead and Meakins, 2002), knowledge management also played an important role to make sure that lessons leaned before were taken into consideration, a broad range of views from employees as to how the merger had gone could be collected, and merger-specific knowledge could be shared and captured throughout the merger process.

Thus, knowledge management is not restricted to a firm's external operations, but has a much wider scope of application. It is a crucial factor in the improvement of both external and internal operations. This is why it is upgraded to further cover a firm's internal operations.

5.3.2 Additional Responsibilities

The above discussed responsibilities are **updates** of those of the alliance management function. This section discusses some new responsibilities included into the EI management function to further strengthen its central functioning role within a VME. These new responsibilities are listed in Table 5.2 as (6) and (7).

Table 5.2 New responsibilities included into the EI management function

Covering externalisation		Covering both externalisation & internalisation (EI)
(1) Coordinating alliances to improve their compatibility	→	(1) Improving EI compatibility
(2) Internal resource allocation for alliances	→	(2) Internal resource allocation for EI
(3) Gaining stakeholders' support for alliances	→	(3) Gaining stakeholders' support for EI
(4) Evaluating alliance performance	→	(4) Evaluating EI performance
(5) Alliance knowledge management	→	(5) EI knowledge management
	New	**(6) Ensuring value stream optimisation**
	New	**(7) Designing competency protection**

(6) Ensuring value stream optimisation

As indicated in Chapter 4 Section 4.5.2 "Value Stream Joint Analysis for Lean Manufacturing", value stream optimisation is the objective of configuring external and internal operations. If separated, EI configuration loses its significance in helping firms improve overall performance. Thus, the behaviour of continuous value stream optimisation signals wise usage of alliances, and also provides guidance to EI configuration.

Adding the responsibility of "ensuring value stream optimisation" into the EI management function essentially guide proper EI configuration along value streams, without losing its close

connection with value stream optimisation. Since "value stream" can be defined as "the set of all the specific actions required to bring a specific product" through the following three critical management tasks (Womack and Jones, 2003), this responsibility strengthens the EI management function's central position in a VME.

- The problem-solving task running from concept through detailed design and engineering to production launch;
- The information management task running from order-taking through detailed scheduling to delivery;
- The physical transformation task proceeding from raw materials to a finished product in the hands of the customer.

(7) **Designing competency protection**

Competency risks due to alliances have been well documented in the literature (Das & Teng, 1999; Duysters, 1996; de Man & Duysters, 2004; McCutcheon and Stuart, 2000; Brouthers et al, 1995; Norman, 2001; Norman, 2002; Quintas, Lefrere, & Jones, 1997; Dickson et al. 2005). The reasons why alliances might particularly trigger competency risks can also be justified (see Section 2.7 for literature support). Since VMEs have a much higher possibility to become heavily dependent on alliances than traditional manufacturing companies (for case studies, see Section 4.2), it is important to set up a defence system against competency leakage. This is why the responsibility of "designing competency protection" is included in the EI management function. A variety of competency protection approaches can be followed to help the EI management function design a proper defence system for its firm. These approaches are summarised as follows:

① **Identifying competencies** (Norman, 2001; Baughn et al., 1997)

② **Assessing risk** of competency leakage prior to initiating alliances: (**i**) estimating the consequences of competency leakage (Baughn et al., 1997); (**ii**) anticipating partners' intents of competency acquisition (Norman, 2002; Baughn et al., 1997); (**iii**) assessing partners' absorption capability (Norman, 2002; Baughn et al., 1997). "Firms should make it clear prior to alliance formation that they are aware of the possibility of unauthorized learning" (Das & Teng, 1999). Jordan (2004) indicated the importance of "recognising potential dangers".

③ Creating a **moving target** by continuously improving competencies (Nair and Stafford, 1998; Shultz and Saporito, 1995)

④ **Controlled information disclosure**: To prevent opportunistic learning, "a firm may withhold information from a partner ... Management of knowledge flows and communication has been identified as a critical method for protecting knowledge (Baughn et al., 1997) ... Because the

structure of information flows influences how much a partner can learn (Levinson & Asahi, 1995), limitations on the amount of information sharing and the frequency of communication can protect against the loss of competitively important knowledge (Kumar & Seth, 1998)" (Norman, 2002). Das & Teng (1999) also suggested limiting the exposure of tacit knowledge and know-how to their partner firms. Norman (2001) indicated that to protect knowledge, information flows could be limited to one person (gatekeeper), limited to a few people (communication stars), or completely excluded from alliances. "Participating firms should be aware of what the appropriate access points are, and what information is channelled through them. When consistency and coordination regarding information access is not established within a firm, multiple requests for information may be undertaken by a partner firm at different levels, departments or divisions. The firm may unwittingly provide information through one access point that would have been restricted by another." (Baughn et al., 1997)

⑤ Using **patents** (Norman, 2001)

⑥ Using **high-tech labelling** for direct protection to limit access, such as special inks and dyes, holograms, and electronic passwords and signatures (Nair and Stafford, 1998)

⑦ Establishing **reward** practices for competency protection (Norman, 2001; Baughn et al., 1997)

⑧ Staff **training & education** (Norman, 2001; Baughn et al., 1997; Das & Teng, 1999; Jordan, 2004): Norman (2001) indicated that both top management and alliance management should stress protection of core competencies; human resource management should take the responsibility of educating & training personnel about competencies protection; an information manager can be designated to an alliance, and act as a consultant in cases where employees feel that the circumstances surrounding knowledge protection are vague or unclear. Jordan (2004) indicated "the important role that the individual played in the control of knowledge flows ... attempts to protect the knowledge leaks were often directed at individuals, who were sometimes instructed to withhold certain types of information in formal meetings".

⑨ **Choosing proper alliance structure** among **equity & non equity** forms (Norman, 2002; Baughn et al., 1997; Das & Teng, 1999; Das & Teng, 1996; Mitchell et al., 2002)

⑩ **Task design**: (**i**) to limit partners' access to competencies (Norman, 2001; Baughn et al., 1997); (**ii**) to perform certain tasks to maintain relevant expertise (Dussauge & Garrette, 1999). Greater emphasis should be placed on task partitioning and modular working (Jordan, 2004). Langlois (2002) explains that by "breaking up a complex system into discrete pieces which can then communicate with one another only through standardised interfaces within a standardised architecture – one can eliminate what would otherwise be an unmanageable spaghetti tangle of systemic interconnections". "While the modular design approach still

required extensive exchanges of information, these exchanges between partners could occur despite physical separation of personnel, in particular engineers, which allowed core technology to be 'walled off' and thereby protected" (Jordan, 2004).

⑪ **Restriction on alliance location**: Baughn et al. (1997) comment: "Conducting joint activities within one's own firm allows the partner access to one's facilities, providing a window to ongoing processes and access to knowledgeable personnel. This greatly increases the permeability of the interface, with a strong potential for outflow of knowledge to the partner ... By placing the joint activities in a third location, the parents can more effectively decide what technology to include in the venture and what to exclude." Thus, to protect competencies, partners' access to facilities and non-alliance personnel can be limited (Norman, 2001; Das & Teng, 1999).

⑫ **Alliance staffing design**: e.g. Norman (2001) suggested the use of information managers in alliances to monitor and act as consultants for competency protection. Baughn et al. (1997) indicated that "The **personnel** comprising the alliance **interface** serve both as **gatekeepers** of information and as potential **receptors** of partner skills. The knowledge, skills, and abilities of the individuals selected for partnership roles is a critical determinant of information access ... Interface personnel should be well briefed in what skills can and cannot be shared, and should be aware of the strategic costs and benefits of collaboration (Hamel, 1990; Pucik, 1988)". To have one's own **staff** in key posts in an alliance is also a significant mechanism for effective managerial control (Das & Teng, 1999). Jordan (2004) indicated that "rapid turnover of staff in a number of the alliance projects did ... produce a rather unexpected benefit, namely it reduced the risk that tacit knowledge would leak to partners".

⑬ **Alliance timing design**: "Many firms ... limited their involvement with alliance partners, initially transferring older technologies, and gradually introducing newer technologies over time. Temporal limitations may also be stipulated in the alliance contract, limiting the planned duration of the alliance, and thereby the window of learning opportunity for each partner" (Baughn et al., 1997).

⑭ **Counterbalance** activities (Norman, 2001; Lui & Ngo, 2004; Dussauge & Garrette, 1999): activities that could produce a force counterbalancing the effects of possible resource leakage: e.g. an agreement forbidding a partner to compete with the company within 10 years after the alliance dissolves.

⑮ **Monitoring**: Norman (2001) suggested the use of an information manager to: **(i) scrutinise** critical knowledge used in alliances, and **ensure** that it has been **classified** accurately and that alliance employees are properly **informed** and **educated**; **(ii)** continuously **ensure** that employees are actually **following** the guidelines and procedures established by the knowledge

protection system. Norman (2001) also suggested the **monitoring** of contacts with partner employees. Baughn et al. (1997) indicated that "Monitoring information flow is likely to prove more difficult. However, information regarding information requests by the partner can be tracked, as well as compliance with expectations to control information flow (hiring practices, personnel rotation, technical contribution), and geographic or product expansion by the partner firms". Das & Teng (1999) suggested tight **monitoring** of alliance operations as a useful way of controlling relational risks.

5.4 EI Structure

As depicted in Figures 5.1-5.3, firms' externalisation structure can be organised around focal partners, geographies or businesses, with alliance management functions as central links. However, after the alliance management function is upgraded to EI management function, especially for the responsibility of "**Ensuring value stream optimisation**", it becomes difficult to draw a firm's EI structure around focal partners, geographies or businesses, since the EI management functions now supervise a firm's value streams, which are organised around the firm's customers/products/services!

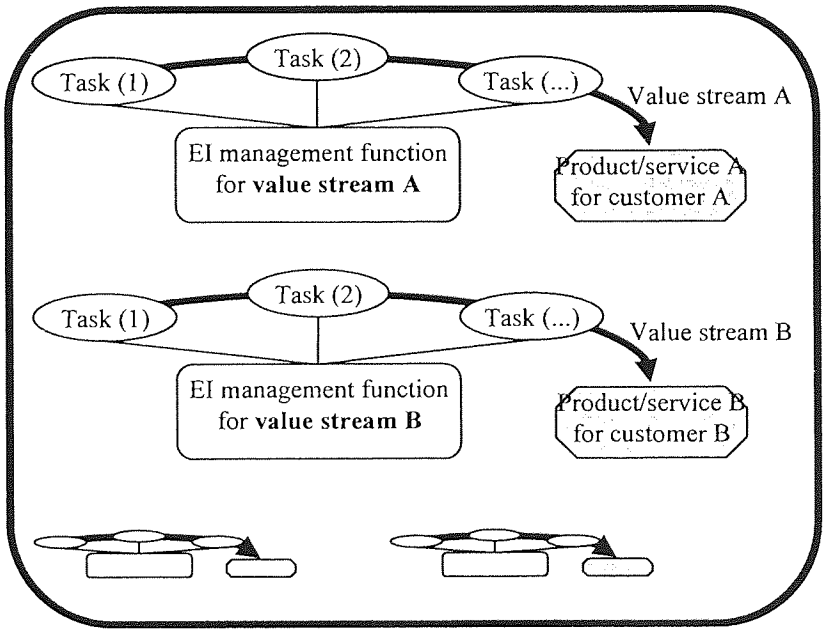


Figure 5.4 EI structure around a VME's value streams

Constructing EI structure around a firm's value streams (see Figure 5.4) is perceived as more beneficial than the original externalisation structure around partners/geographies/businesses, because it complies with both of the academic and practical trends which are in favour of **customer-oriented operations**. For example, one innovative costing method designed to deal with the deficiencies of traditional costing systems is **Activity-Based Costing** (ABC) (Roztocki et al., 2004). ABC, pioneered

by Robin Cooper, Robert Kaplan, and H. Thomas Johnson (Cooper, 1988a; 1988b; 1990; Cooper and Kaplan, 1988; Johnson, 1990), is a costing methodology used to trace overhead costs directly to cost objects (i.e. products, processes, services, or customers). ABC can radically change how managers determine the mix of their product line, price their products, identify the location for sourcing components, and assess new technology (Turney, 1989). Another example is the **lean** approach. Originated in the auto industry in Japan, the lean approach has been adopted by many of those companies which could be characterised as "world-class" (Rafuse, 1996). Lamming (1994) argued persuasively that all significant product value systems will ultimately adopt the lean approach. The basic idea of lean operations is to identify entire value stream for each product, to eliminate any waste along value streams, to precisely synchronise the production rate with the sales rate through continuous flow in small-lot production, and to offer customers exactly what they want (Womack and Jones, 2003).

Based on the responsibilities just discussed, the **boundaries** between the EI management function and other functions along the value streams can be clearly perceived (see Table 5.3).

Table 5.3 Boundaries between the EI management function and the value streams (other functions)

EI management function		
(1) Ensuring value stream optimisation Improving EI compatibility	Guiding →	Other functions along value streams
(2) Internal resource allocation for EI	Fuelling →	
(3) Gaining stakeholders' support for EI	Smoothing →	
(4) Designing competency protection	Defending →	
(5) Evaluating EI performance	Evaluating →	
(6) EI knowledge management	Refining practices →	

5.5 Summary

Based on the "Alliance Management Function" identified in the literature, this chapter proposed a VME functional structure built around a manufacturing company's value streams. These value streams are supervised by "EI Management Functions". An "EI Management Function" upgraded the responsibilities of an "Alliance Management Function" to cover both external and internal operations. With new responsibilities added, an "EI Management Function" is responsible for: ensuring value stream optimisation; improving EI compatibility; internal resource allocation for EI; gaining

stakeholders' support; designing competency protection; evaluating EI performance; and EI knowledge management. These responsibilities help "guide", "fuel", "smooth", "defend", and "refine" the practices of other functions to ensure a proper operation along the VME metabolism. Based on the gaps identified in Chapter 2, the next chapter goes on to detail "EI performance evaluation".

6 Module 3 – VME Performance Measurement

6.1 Introduction

Chapter 5 explained the responsibilities of an "EI Management Function". This chapter details one of these responsibilities: evaluating EI performance. A VME Performance Measurement System (VMEPMS) assesses both external and internal operations for an evaluation of these operations' holistic performance on a value stream.

Based on the literature review in Chapter 2, this chapter identifies fourteen categories of performance measures for evaluating alliance performance. The collective of these performance measures demonstrates important features overcoming the gaps perceived in the literature. This chapter answers the 3rd research question: "How to evaluate a VME's performance".

6.2 VME Performance Measurement System (VMEPMS)

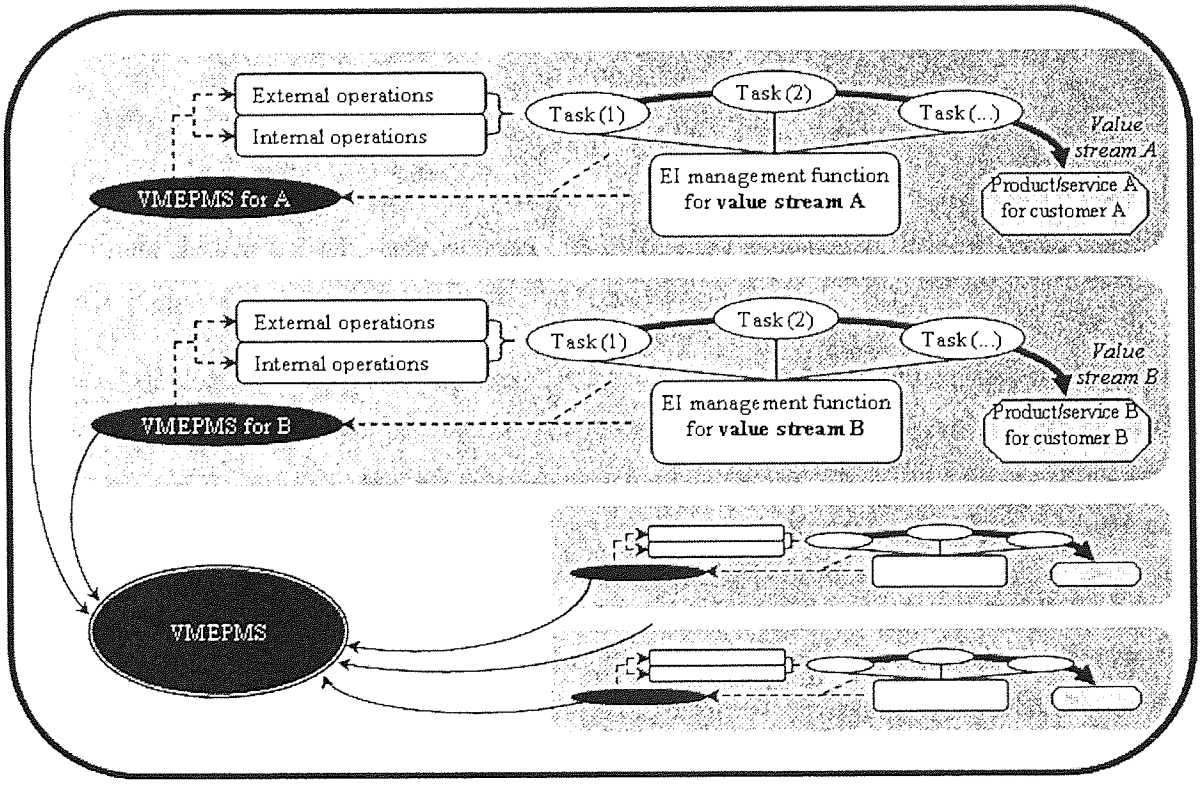


Figure 6.1 VMEPMS assessing both external and internal operations along value streams

It has been explained that a value stream is a combination of external and internal operations required to bring a specific product to market (Womack and Jones, 2003). Thus, to evaluate a VME's performance, both **external** operations and **internal** operations need to be assessed (see Figure 6.1).

Like designing EI structure around value streams (see Section 5.4), designing VMEPMS around value streams is perceived as more beneficial, because it complies with the academic and practical trends which are in favour of customer-oriented operations: e.g. Activity-Based Costing (ABC) (Roztocki et al., 2004; Cooper, 1988a; 1988b; 1990; Cooper and Kaplan, 1988; Johnson, 1990; Turney, 1989), and lean production (Rafuse, 1996; Lamming, 1994; Womack and Jones, 2003). Another benefit of establishing VMEPMS around value streams is that it facilitates the evaluation of the **holistic** performance of the external and internal operations along a value stream.

6.2.1 Performance Measurement for Internal Operations

Performance measurement for internal operations has been well documented in the literature. Chapter 5 Section 5.3.1 has described the evolution history of performance measurement. This research does not delve into the performance evaluation of internal operations. The subsequent sections of this chapter discuss **how to evaluate alliance (externalisation) performance**.

6.3 Performance Measurement of External Operations

6.3.1 Alliance Performance Measures

This section explains the performance measures included in the proposed Alliance Performance Measurement System (APMS) (see Appendix 3). Before the explanation, it is useful to clarify the meanings of **objective** and **subjective** performance measures.

In the Oxford English Dictionary, "**objective**" is explained as "not influenced by personal feelings or opinions", whereas "**subjective**" is explained as "based on or influenced by personal feelings, tastes, or opinions". Thus, **objective performance measures** could be understood as those measures whose values are not influenced by personal feelings or opinions, whereas **subjective performance measures** are those whose values are based on or influenced by personal feelings, tastes, or opinions.

For example, if used as performance measures, the **lead time** of a supply chain is an objective performance measure because the time duration (from customers' order placing to product receiving) is not influenced by personal feelings or opinions, whereas **customers' satisfaction** at the lead time is a subjective performance measure based on customers' personal feelings, tastes or opinions.

According to the definitions, it should be noted that **quantified** performance measures are not necessarily **objective** measures, such as the quantified representation of customers' satisfaction on a scale of 1-5, where 1 means "not satisfied at all" and 5 means "totally satisfied". This is because the choice of such a number is still based on customers' personal feelings, tastes or opinions. However, turning a **subjective** performance measure into **quantified** representation offers some important benefits:

- It helps avoid the language confusion. For example, "very satisfied" and "totally satisfied" may have different meanings to different persons. Using 5 to represent this top-level satisfaction helps avoid such confusion.
- Figures like 1, 2, 3 have their visual advantage in performance comparison. For example, it is quicker and easier to compare 2 and 3 than to compare "a little bit satisfied" and "satisfied".
- Quantified form also offers significant advantages in mathematical operations of the performance scores. For example, it is much easier to calculate the average performance of 10 assessment objects if the performance is represented in figures.

6.3.1.1 Measures Assessing Alliance Parties' Resource Contributions

Defined as the degree to which partners' resources can be used in conjunction with each other (Dacin et al., 1997), **resource complementarity** has been identified as one of the important factors in increasing the effectiveness and performance of an alliance (Harvey & Lusch, 1995; Brouthers et al., 1995; Killing, 1983; Harrigan, 1985; Dymsza, 1988; Chowdhury, 1989; Geringer, 1988; Geringer, 1991; Parkhe, 1993; Nielsen, 2003). A lack of complementary strengths is the most important factor underlying ineffectiveness of strategic alliances (Harvey & Lusch, 1995; Chowdhury, 1989; Geringer, 1991). Resource complementarity can be further divided into supplementary alignment and complementary alignment, both of which have positive effect on the collective strengths of an alliance (Das and Teng, 2000). Complementary capabilities represent one of the most important criteria used to select strategic alliance partners (Hitt et al., 2000; Ireland et al., 2002).

In addition to resource complementarity, **collective strengths of an alliance** are also positively related to alliance performance (Das and Teng, 2003; Beamish, 1987). Collective strengths are the amounts of relevant valuable resources possessed by the alliance (Das and Teng, 2000). From a resource-based view, the very objective of forming alliances is to join forces with partners to pursue market opportunities that are otherwise beyond reach (Das and Teng, 2000); therefore, it should be assessed whether partners together can realise the alliance objectives (Supphellen et al., 2002).

Case studies were identified in the literature supporting the importance of co-existence of complementarity and collective sufficiency of alliance parties' resource contributions. For example, in

the Sextant-Texas alliance (Dussauge and Garrette, 1999), Sextant's market knowledge well complemented Texas's technical expertise, and collectively they were able to meet the technical specifications as well as the time and cost requirements for the supply of over 3000 Traffic Alert and Collision Avoidance Systems (TCAS) screens. In the Matra-Renault partnership for the mini-vans market in Europe (Dussauge and Garrette, 1999), Matra's low-volume manufacturing technology was exactly what Renault needed for perusing the early 1980s virtually non-existent mini-vans market in Europe. Vice versa, Matra also needed Renault's distribution network, which if developed on its own, was out of the question due to an annual output of a few thousand cars. With a combination of their technology and distribution network, they were able to profitably serve the mini-vans market in Europe. Similar examples were also found in the Butachimie joint venture, and the Nestlé-General Mills joint venture (Dussauge and Garrette, 1999).

Whipple and Frankel (1998) suggest an assessment of whether each partner performs as promised, which, from the perspective of resource contributions, is to assess **whether partners have contributed resources as promised**. In order to accurately identify resource complementarity, collective strengths, and whether partners input resources as promised, **detailed measures assessing resource contributions** (*e.g. the technical measures assessing the product technology contributed*) are needed.

As a summary, the main performance measures assessing alliance parties' resource contributions are:

(1) Measures assessing alliance parties' resource contributions

In Chapter 4 Section 4.3.1 "A Classification of Resources", resources that might be sought by manufacturing companies through alliances were classified into 10 categories. Table 6.1 lists examples of objective and subjective measures for these categories.

Table 6.1 Examples of objective and subjective measures for resource categories

Categories of resources	Examples of performance measures	
	Objective assessment	**Subjective** assessment
Products	- 12.5% reduction of electricity consumption relative to the last generation product	- Product colour 5 (on a scale of 1-5: 1 least appealing; 5 most appealing)
Services	- 10 minutes lead time (from customer order to service delivery)	- Customer satisfaction 5 (on a scale of 1-5: 1 not satisfied at all; 5 totally satisfied)
Customers	- 30% market share	-
Knowledge (e.g. technologies, market knowledge)	- Capable of achieving 30% more energy saving compared with the industry standard	-
Equipment	- Maximum spindle speed 2500rpm	-
Financial resource	- £3,000,000	-
Human resource	- 10 chartered engineers, each with minimum 5 years of product design experience	-

Supply chain (including distribution network)	- Localised supply chain in China - Distribution network covering all major cities in China with a minimum population of 5,000,000 each	-
Brand	-	- Quality reputation 5 (on a scale of 1-5: 1 poor; 5 excellent)
Relationships	- Minimum 5 years business relationships with key local customers - Minimum 10 years personal friendship with key decision maker(s) in local government	-

(2) Whether alliance parties' resource contributions complement each other

"**Weighted percentage of resource contributions**" is a way to quantitatively assess the complementarity.

For example:

Assuming a two-partner alliance scenario, where partner 1 contributes 90% of resource A and 10% of resource B, and partner 2 contributes 10% of resource A and 90% of resource B, then the weighted % can be calculated as follows (see Table 6.2):

Table 6.2 Weighted percentage of resource contributions

Resources	Importance (*A scale of 1-5: 1 least important; 5 most important*)	% of Partners' Resource Contributions	
		Partner 1	Partner 2
Resource A	1	90%	10%
Resource B	5	10%	90%
Weighted %		**23.33%** =(1*90%+5*10%)/(1+5)	**76.67%** =(1*10%+5*90%)/(1+5)

The closer the weighted percentages, the higher the degree of complementarity is. The above alliance scenario shows a low degree of complementarity.

■ **Objective** measurement

If the "importance" and the "% of partners' resource contributions" are obtained objectively, the "weighted %" becomes an objective measure.

For example:

In an alliance, the total contribution of machines is worth of £1,000, and the total financial contribution is £5,000. The "importance" of each resource and the "% of partners' resource contributions" are both based on share of financial value. Thus, the weighted % can be objectively calculated as in Table 6.3.

Table 6.3 Objective weighted percentage of resource contributions

Resources	Importance	% of Partners' Resource Contributions	
		Partner 1	Partner 2
Machines	1/6 =£1,000/(£1,000+£5,000)	90%	10%
Financial resource	5/6 =£5,000/(£1,000+£5,000)	10%	90%
Weighted %		**23.33%** =(1/6*90%+5/6*10%)/(1/6+5/6)	**76.67%** =(1/6*10%+5/6*90%)/(1/6+5/6)

■ **Subjective** measurement

If the "importance" and/or the "% of partners' resource contributions" are obtained subjectively, the "weighted %" becomes a subjective measure.

For example:

In an alliance, partner 1 contributes brand, and partner 2 contributes distribution network. The importance of brand and distribution network is 2 and 5 on a scale of 1-5, based on managers' opinions according to the alliance scenario. Thus, the weighted % can be subjectively calculated as in Table 6.4.

Table 6.4 Subjective weighted percentage of resource contributions

Resources	Importance (*A scale of 1-5: 1 least important; 5 most important*)	% of Partners' Resource Contributions	
		Partner 1	Partner 2
Brand	2	100%	0%
Distribution network	5	0%	100%
Weighted %		**28.57%** =(2*100%+5*0%)/(2+5)	**71.43%** =(2*0%+5*100%)/(2+5)

(3) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

"**Deficit/surplus of alliance parties' total resource contributions**" is used here.

■ **Objective** measurement

Objective assessment takes place when the resource requirements are identified objectively.

For example (see Table 6.5):

Table 6.5 Objective deficit/surplus

Resources	Resources Requirements	Partners' Resource Contributions		Total	Deficit	Surplus
		Partner A	Partner B			
Customers	Market share 30%	-	20%	20%	10%	-
Technology	Capable of achieving 5% more energy saving compared with the industry standard	10% more energy saving	-	10%	-	5%

■ **Subjective** measurement

Subjective assessment takes place when the resource requirements are identified subjectively.

For example (see Table 6.6):

Table 6.6 Subjective deficit/surplus

Resources	Resources Requirements	Partners' Resource Contributions		Total	Deficit	Surplus
		Partner A	Partner B			
Service	Customer satisfaction 5 *(on a scale of 1-5: 1 not satisfied at all; 5 totally satisfied)*	-	5	5	-	-
Brand	Quality reputation 5 *(on a scale of 1-5: 1 poor; 5 excellent)*	3	-	3	2	-

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

This performance measure should be used from two perspectives:

- the resources contributed (assessed by **deficit/surplus**)
- the time of contributing the resources (assessed by **delay/ahead**)

The following table (see Table 6.7) has been designed for the assessment from these two perspectives.

Table 6.7 Assessment of actual contributions by alliance parties

Agreed Contributions	Actual Contributions	Deficit	Surplus	Agreed Time	Actual Time	Delay	Ahead

■ **Objective** measurement

Objective assessment is used when the "agreed contributions" are identified objectively. The "time" perspective should be assessed objectively.

For example (see Table 6.8):

Table 6.8 Objective assessment of actual contributions by alliance parties

Partner A							
Agreed Contributions	Actual Contributions	**Deficit**	**Surplus**	Agreed Time	Actual Time	**Delay**	**Ahead**
10 engineers	8 engineers	2 engineers	-	1 month after the alliance agreement	3 months after the alliance agreement	2 months	-

- **Subjective** measurement

  Subjective assessment is used when the "agreed contributions" are identified subjectively.

  For example (see Table 6.9):

Table 6.9 Subjective assessment of actual contributions by alliance parties

Partner B							
Agreed Contributions	Actual Contributions	**Deficit**	**Surplus**	Agreed Time	Actual Time	**Delay**	**Ahead**
Service with level 5 customer satisfaction *(on a scale of 1-5: 1 not satisfied at all; 5 totally satisfied)*	Service with level 3 customer satisfaction	2	-	Throughout the alliance	Throughout the alliance	-	-

6.3.1.2 Measures Assessing Alliance Parties' Dependency

Alliance partners' inter-dependency is found positively related to alliance performance (Das and Teng, 2003). Co-dependence creates both parties' commitment towards their cooperation (Whipple and Frankel, 1998; Hendrick and Ellram, 1993). Those considering forming an alliance should ask themselves how important the alliance is to their potential partner (Brouthers et al., 1995). Changes in partners' inter-dependency significantly influence the alliance's stability (Seabright et al., 1992; Das and Teng, 2000; Dussauge and Garrette, 1999; Garette and Dussauge, 2000), as illustrated in the Toyota-Denso case study (Ahmadjian and Lincoln, 2001).

The "Matra-Renault" case (Dussauge and Garrette, 1999) demonstrates that resource dependency is the main factor determining partners' inter-dependency. However, **objective compatibility** and **perception of risk** may also influence partners' inter-dependency. Compatible objectives will significantly influence alliance success (Nielsen, 2003; Dacin et al., 1997; Das and Teng, 2003; Hatfield and Pearce, 1994; Ireland et al., 2002; Park and Russo, 1996; Lyles, 1987; Baykasoğlu, 2003; Wong et al. 2005). Objective assessment is particularly important when a firm is searching for a partner (Brouthers et al., 1995). The seeds of alliance tension and instabilities have been sown from

the start when the alliance partners fail to recognise a mismatch in their strategic intents (Koza and Lewin, 2000). Since the achievability of a partner's objectives directly influences the partner's willingness to contribute its resources into the alliance, objective compatibility influences resource dependency, thus partners' inter-dependency. The joint venture between GM and Daewoo (Dacin et al., 1997) was unsuccessful, largely because the two firms had different strategic orientations and goals and as a result were largely incompatible. Daewoo was seeking growth and access to new markets while GM's overriding goal was to achieve reasonable financial returns. Because the financial returns were negative, GM management was unwilling to make further investments to achieve the growth desired by Daewoo. As a result, they ended their partnership, both losing substantial investments in the joint venture.

Perception of risks deters partners from inputting resources into the alliance, and counterbalances their perceived benefits, thus influencing the partners' inter-dependency. In alliances, two types of risk are possible (Das and Teng, 1996; Cravens et al., 2000):

(1) **Relational risk**: relational risk exists only with collaborative relationships. Relational risk is the risk of opportunistic behaviour of one of the partners having a negative impact on the other partner(s). The existence of relational risk in alliances is well documented in the literature (Lambe and Spekman, 1997; McCutcheon and Stuart, 2000; Supphellen et al., 2002).

(2) **Performance risk**: the risk of alliance's poor performance due to factors other than partners' opportunistic behaviour. Performance risk in alliances is also well documented in the literature, such as partners' financial health (Luo, 1998; Dacin et al., 1997) and operational performance (Rangan and Yoshino, 1996).

As a summary, the main performance measures assessing alliance parties' dependency are:

(1) Our dependency on our partners

(2) Our partners' dependency on us

The following discussion applies to both (1) & (2):

- **Objective** measurement

  "**The number of alternatives to the alliance**" is an indication of the dependency. The higher the number, the lower the dependency is.

  For example (see Table 6.10):

Table 6.10 Objective assessment of dependency

	Alternative partner(s)	Alternative way(s) other than alliance	Total
Alternatives to an NPD alliance	3	1 (internal development)	4

(3) Compatibility among alliance parties' objectives

"**The longevity of the alliance's win-win situation**" is an indication of the partners' objective compatibility. Depending on the clarity of the alliance scenario, it could be a figure based on factual data or subjective judgement.

- **Objective** measurement

  For example:

  3-year longevity can be clearly identified for a foreign joint venture in China where technology transfer is the chief purpose of the Chinese partner, and it has been specified in the joint venture agreement that the technology transfer should be completed within three years.

- **Subjective** measurement

  For example:

  In the NUMMI joint venture between GM and Toyota (Inkpen, 2005) where there was no clear indication when any of the two partners would first achieve its learning objective, subjective judgment would have to be made based on managers' observations and feelings.

(4) Our risks due to the alliance

(5) Our partners' risks due to the alliance

The following discussion applies to both (4) & (5):

Different types of risks have their special indicators, such as accounting ratios for financial risks, and technical indicators for product competency risks. Whether objective or subjective assessment takes place depends on the availability of factual data.

- **Objective** measurement

  For example:

  Product competency risk: **technical indicators** assessing whether a partner's products has achieved same/higher performance as/than ours

- **Subjective** measurement

  For example:

  Product competency risk: **level of risk on a scale of 1-5** from least to most risky

6.3.1.3 Measures Assessing Alliance Objectives

Alliance performance can be defined as the degree to which partners achieve their objectives (Arino, 2003; Das and Teng, 2003; Brinkerhoff, 2002). Managers must develop win-win deals for alliances to be successful (Dacin et al., 1997). Once a partner feels its benefits are less than its contributions, its incentives to cheat are easily energised, leading to opportunistic behaviors to pursue self-interests, which cause damage to the other partner (Park & Zhou, 2005; Parhke, 1993). "A firm must be willing to give as much as it gets ... Alliances in which one party is out to take as much as can be obtained without giving anything in return are bound to fail" (Brouthers et al. 1995). As an example, the serious problems facing the joint venture by a Chinese firm and a Japanese firm (Zhang and Li, 2001) were mainly caused by the imbalance of benefits between the two partners. Thus, for an alliance to be perceived as a success by both partners, or even for an alliance to be workable, the **alliance objectives must create a win-win situation.**

For each partner to accurately assess its achieved benefits (*in other words, the degree to which it achieves its objectives*), **detailed measures assessing the benefits** (*e.g. the technical measures assessing the product technology enhanced*) should be used. The win-win situation created by the alliance objectives does not mean anything real for the partners, unless the **objectives are achievable.** To identify objective achievability, **detailed measures assessing the objective achievement** (*e.g. a joint venture's projected net profit/sales*) are needed.

Thus, the main performance measures assessing alliance objectives can be:

(1) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

Benefits are essentially enhancement of resources. As shown in Table 6.1, resources can be assessed objectively and/or subjectively, thus benefits can also be assessed objectively and/or subjectively. The following table (see Table 6.11) lists some examples.

Table 6.11 Examples of objective and subjective assessment of alliance parties' benefits

Examples of benefits	Examples of performance measures	
	Objective assessment	**Subjective** assessment
Improvement of customer services	-	- Customer satisfaction 5 (on a scale of 1-5: 1 not satisfied at all; 5 totally satisfied)
Customers	-	- Market share 4 (on a scale of 1-5: 1 decrease rapidly, 2 decrease, 3 remain same, 4 increase, 5 increase rapidly)
Improvement of quality assurance system	- Reducing scrap rate by 10 times	-
Net profit from alliance operation	- A minimum of £1,000,000	-
Improvement of supply chain efficiency	- Reducing lead time to 24 hours	-
Improvement of brand reputation	-	- Quality reputation 5 (on a scale of 1-5: 1 very poor; 2 poor; 3 average; 4 good; 5 very good)

(2) The alliance objectives create a mutually acceptable win-win situation

■ **Subjective** measurement

"**Significance difference**" can be used as an indication of the degree of an alliance's win-win situation. It shows the difference between levels of significance of different partners' benefits. The larger the difference, the weaker the win-win situation is. The difference can be the one between the highest significance of each partner, or between the total significance of each partner, as the following example shows (see Table 6.12).

Table 6.12 Examples of assessment of alliance win-win situation

	Benefits	Significance (on a scale of 1-5 from least to most important)
Partner A	Increase of customer satisfaction	1
	Increase of market share	3
	Improvement of quality assurance system	2
Partner B	Establishment of good relationships with local government and key market players	5
	Financial gains	5
	Highest significance	Total significance
Partner A	3	6
Partner B	5	10
Significance difference	**2**	**4**

Because how significant a benefit is for a partner is normally influenced by the assessor's opinions, this performance measure is considered as subjective.

(3) Whether the alliance objectives are achievable

This performance measure essentially assesses "whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives" (please see Chapter 6 Section 6.3.1.1 for details).

(4) Measures assessing alliance objective achievement (e.g. ROI)

Similar to "partners' benefits through alliance", alliance objectives can also be viewed as enhancement of resources. Since resources can be evaluated objectively and/or subjectively (see Table 6.1), alliance objective achievement can also be assessed objectively and/or subjectively. Table 6.13 lists some examples.

Table 6.13 Examples of objective and subjective assessment of alliance objective achievement

Examples of alliance objectives	Examples of performance measures	
	Objective assessment	**Subjective** assessment
Blocking the monopoly of a common competitor	- Reduce its market share from 40% to 20%	-
Enhancing the joint venture brand	-	- Quality reputation 5 (on a scale of 1-5: 1 very poor; 2 poor; 3 average; 4 good; 5 very good)

6.3.1.4 Measures Assessing Resource Protection

More and more companies began to be aware of the benefits that forming wise alliances can bring to them. However, alliances are not risk-free. Dangers due to alliance partners' opportunistic behaviours are also well known. Companies are often said to enter alliances with secret agendas (de Man and Duysters, 2004). Such companies do not participate in cooperation for mutual benefit but for absorbing partners' knowledge, skills and other assets (Duysters, 1996). A company's cooperative cultures are beneficial to alliance success; however, such cultures also pose danger that the company may inadvertently leak its competencies to its partners (Brouthers et al., 1995). For example, when engaged in alliances, knowledge sharing is usually a key to success (Crossan and Inkpen, 1995; Hutt et al., 2000). By sharing knowledge, however, a company may expose its critical knowledge to partners, which can lead to appropriation or imitation (Norman, 2002). Thus, alliances create situations where a firm needs to be open in communication, while simultaneously preventing leakage of its competitive knowledge (Quintas, Lefrere, & Jones, 1997). Firms must balance between knowledge sharing and knowledge protection when engaged in alliances (Norman, 2002), as illustrated by the Molex case study (O'Dwyer and O'Flynn, 2005), where the company employs a policy of minimising reliance on a partner by limiting the quantity of orders placed and supplying only the required knowledge which is strategically insignificant from the perspective of misappropriation.

Risks due to partners' opportunistic behaviour are called as relational risks (Das and Teng, 1996). Because of the existence of relational risks in alliances, a partner needs to ensure that **its competencies have been put under effective protection**, which necessitates actions designed to protect competencies.

To see the effectiveness of such actions, two outcomes can be monitored: (a) **whether the company's competencies are undermined due to the alliance**; (b) **whether its partners have similar competencies improved/generated through the alliance**. The Airbus case study (Dussauge and Garrette, 1999) illustrated that monitoring own competencies helped partners identify their knowledge deterioration due to the task allocation within the Airbus alliance.

Studies indicated that the protection offered by patent and copyright could be less effective in some industries (electronics was specifically mentioned), when patents disclose enough information that competitors may be able to "invent around" them (Norman, 2001). In such situations, it becomes important to monitor whether partners have improved/generated similar competencies (e.g. monitoring their new products). For example, Apple brought a lawsuit against Microsoft due to its perception that Microsoft Windows used Apple's GUI technologies which Microsoft had somehow acquired through its collaboration with Apple in developing spreadsheet (Norman, 2001).

"Many resources, such as tacit knowledge, lose much of their value if moved from their current organisational context and other resources used in conjunction" (Das and Teng, 2000). Putting such resources into similar context helps the resource assimilation. Facilities, such as teams, laboratories and factories, can help competency acquisition, because they provide a "space" where the target competencies (particularly knowledge) can be used/generated/transferred (Dussauge and Garrette, 1999; Baughn et al., 1997). This can be seen clearly in the NUMMI joint venture between GM and Toyota (Inkpen, 2005), where GM put a variety of learning mechanisms in place: managerial assignments to NUMMI, a technical liaison office for managing learning activities, and a learning network to articulate and spread the knowledge. Thus, in an alliance, monitoring **whether a partner set up such facilities** helps identify the partner's intention of competency acquisition.

As a summary, the main performance measures assessing resource protection are:

(1) Whether our company's resources have been put under effective protection

This performance measure essentially assesses

- whether resource protection approaches are in place
- the anticipated effectiveness of these approaches

The former should be assessed objectively, and the latter would be assessed subjectively.

For example (see Table 6.14):

Table 6.14 Examples of objective and subjective assessment of resource protection

Resource risks	**Objective** assessment **Existence of protection approaches**		**Subjective** assessment **Anticipated effectiveness** (*on a scale of 1-5 from 1 not effective to 5 extremely effective*)
Technology leakage	Grouping technical information according to confidential levels	✓	5
	Staff training of awareness of confidential levels of different technical information	✓	3
	Restriction on partner's access to R&D labs	✓	1

(2) Whether our company's resources under protection have been damaged

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

The following discussion applies to both (2) & (3):

The use of these two performance measures is a process of **comparison** between the original status of the resources and their current status. As shown in Table 6.1, resources can be assessed objectively and/or subjectively, thus the comparison might take place **objectively** and/or **subjectively**.

For example (see Table 6.15):

Table 6.15 Examples of comparison between the original and current status of the resources in protection

	Resource in protection	Performance indicators	Ours			Partner's		
			Original status	Current status	**Status change**	Original status	Current status	**Status change**
Objective	Technology	Energy saving capability	30% more than industry standard	30% more than industry standard	**0**	5% less than industry standard	30% more than industry standard	**+35%**
Subjective	Relationship with key customers	Closeness (*on a scale of 1-5 from unknown to very close*)	5	5	**0**	1	5	**+4**

The above example shows that our competencies under protection (i.e. the technology and the relationship with key customers) have been undermined, since the partner has created similar competencies.

(4) Whether our partners set up facilities (e.g. a factory, a team) through which our competencies under protection would be undermined more effectively

This performance measure is used to identify

- the existence of such facilities
- their anticipated effectiveness

The former should be accessed **objectively**; the latter would normally take place **subjectively**.

For example (see Table 6.16):

Table 6.16 Examples of assessing partners' competency acquisition facilities

Competencies under protection	**Objective** assessment **Existence** of partners' facilities undermining the competencies		**Subjective** assessment **Anticipated effectiveness** of the facilities (*on a scale of 1-5 from 1 not effective to 5 extremely effective*)
Local supply chain management expertise	The partner's operation manager was assigned to be in charge of the joint venture supply chain operation.	✓	5
	The partner set up a local factory where the supply chain management expertise learned from us can be applied and practiced	✓	5
Product technologies	Three senior engineers were sent from the partner to directly join the product development activities with our engineers.	✓	5

6.3.1.5 Measures Assessing Alliance Geographic Location

Alliance location is sometimes important for **alliance objective achievement**. This is particularly true when 'delivery' is an important issue. Thus in some alliances, it is important to identify whether alliance locations facilitate alliance objective achievement. For example, the operational site of the joint venture between Lufthansa Technik AG and Rolls-Royce was decided on the basis of which European location could offer the most competitive advantage (http://www.rolls-royce.com/media/showPR.jsp?PR_ID=1325).

Alliance location may cause competency leakage. Jordan (2004) indicated that if "alliance staff are co-located ... it is easy for our partner to get a good sense of the way we do things." Baughn et al. (1997) commented: "Conducting joint activities within one's own firm allows the partner access to one's facilities, providing a window to ongoing processes and access to knowledgeable personnel. This greatly increases the permeability of the interface, with a strong potential for outflow of knowledge to the partner ... By placing the joint activities in a third location, the parents can more effectively decide what technology to include in the venture and what to exclude." "When the partners work shoulder to shoulder in the same entity for an extended period, it becomes difficult to keep others from accessing one's tacit know-how" (Hamel, 1991; Das and Teng, 2000). Thus, to protect competencies, partners' access to facilities and non-alliance personnel can be limited (Norman, 2001; Das & Teng, 1999).

As a summary, the main performance measures assessing alliance geographic location are:

(1) Whether the alliance geographic location helps achieve alliance objectives

- **Objective** measurement

  For example, assuming that the alliance task is concerned with supply chain operation, the choice of the alliance location might be assessed by:

  Supply chain lead time: 48 hours

  Cost saving: 30% saving compared to current costs

- **Subjective** measurement

  For example, assuming that the alliance task is to co-design a new product, the choice of the alliance location might be assessed by:

  Convenience of information sharing with partners: 5 (On a scale of 1-5 from least to most convenient)

(2) Whether the alliance geographic location helps protect our company's resources

- **Objective** measurement

  For example, assuming that the alliance is to co-design a new product:

  Whether physical access to our product development lab has been avoided: the alliance should not be co-located with our product development lab

- **Subjective** measurement

  For example, assuming that the alliance is to co-design a new product:

  Possibility of information leakage due to the alliance location: 2 (on a scale of "1 no → 2 low → 3 some → 4 high → 5 certain")

6.3.1.6 Measures Assessing Alliance Managers

Alliance managers' capabilities have huge influence on alliance success (Ireland et al., 2002; Lambe and Spekman, 1997):

- Effective alliance management requires integration of partners' cultures and resources. Superior negotiating skills are important for alliance managers in achieving effective integration.

- Alliance managers at all levels must work together to (1) balance their interests with those of their counterparts in partner firms, and (2) effectively manage the tension between cooperation and competition (Douma et al., 2000).
- Alliance managers capable to facilitate effective communication and coordination shape alliances in ways that foster trust.

In joint ventures, for example, board members must manage what may be the divergent strategic and economic interests of the parent companies; likewise, they must secure and oversee the flow of operational resources (e.g. technologies, raw materials, staff) between them and their parent companies; they must also navigate through other operational problems, such as the creation of incentives for employees of the parent companies who interact with but aren't employed by the joint venture (Bamford and Ernst, 2005).

Many of the qualities required of alliance managers are quite different from those expected in their parent company (Jagersma, 2005). Companies like Hewlett-Packard spend a considerable amount of money and effort on training its managers in the art of alliance management (Lambe and Spekman, 1997). Alliance management usually requires managers to have characteristics different from those for managing internal operations (Bruner and Spekman, 1998; Spekman et al., 1996), because "an essential characteristic of alliance management is that a manager's formal authority, generally speaking, has little meaning other than as agreed to by all the parties to the alliance" (Ring, 2000). In addition to personal characteristics, **whether alliance managers have effectively conducted their responsibilities** should also be assessed. The failure of the Renault-Volvo alliance and the proposed merger (Bruner and Spekman, 1998) was largely due to both CEOs' lack of communication and buy-in with key stakeholders.

Thus, the main performance measures assessing alliance managers are:

(1) Alliance managers' characteristics, such as their negotiating and coordination skills

- **Objective** measurement

  For example:

  Years of experience as an alliance manager: at least 3 years

- **Subjective** measurement

  For example:

Suitability of being a manager of this alliance: 4 (on a scale of 1-5 from 1 not suitable at all to 5 totally suitable)

(2) Whether alliance managers have effectively conducted their responsibilities

- **Objective** measurement

  For example, to assess the managers of a product distribution network

  Sales increase: increase by 20% each year

  Out-of-stock rate: decrease by 10% each year

- **Subjective** measurement

  For example, to assess alliance managers' communication with stakeholders:

  Stakeholders' support: 5 (on a scale of "1 no support → 2 a little support → 3 some support → 4 much support → 5 total support")

6.3.1.7 Measures Assessing Task Allocation among Alliance Parties

Alliance tasks, such as manufacturing and distribution, **should be allocated to the most suitable partners**. The main criterion for task allocation is to see whether the partner allocated a task has sufficient resources at its disposal to do the task. Normally, tasks are allocated to partners according to the resources the partners have contributed into the alliance, as in the case of the APA joint venture among FiatAvio, ITP, MTU Aero Engines, Rolls-Royce, Snecma Moteurs and Techspace Aero (http://www.rolls-royce.com/media/).

Alliance task allocation among partners can be damaging or beneficial to partners, depending on how the tasks are allocated: (1) if task allocation makes a partner not performing a task for a long time, the partner's relevant expertise can be lost; (2) on the other side, task allocation can also increase a partner's expertise relevant to the tasks performed by it.

For example, according to Dussauge and Garrette (1999), task allocation in Airbus has left the French partner, Aerospatiale, very dependent on the consortium and virtually incapable of developing, manufacturing and selling a commercial aircraft alone. At the same time, DASA, the German partner, which lagged far behind in technology at the beginning of the partnership, has caught up and become Aerospatiale's virtual equal. In addition, the fact that all marketing activities are entrusted to Airbus Industrie has deprived the partner companies of all contact with customer airlines. Aerospatiale and British Aerospace, which both used to market their own civil aircraft, no longer have the sales teams

necessary to do so, simply because these departments have been incorporated into Airbus Industrie. If one of these companies wanted to start manufacturing an aircraft alone once again, it would be extremely difficult.

Similarly, in the alliance between Atlas Copco and Sandvik (Hyder and Eriksson, 2005), all market contacts had been the responsibility of Atlas Copco. As a consequence, customer feedback therefore had to be channelled via Atlas Copco engineers to Sandvik factories. Sandvik gradually came to realise that this was a shortfall from its side and therefore began to take an active part in sales and direct communication with the customers.

Task duplication normally results in duplication of facilities, workforce; worse, it usually eliminates economies of scale. Thus, **task duplication should be avoided.** Sometimes, to avoid a partner's risk of losing its relevant skills, tasks might be duplicated; however, such risk avoidance is at the sacrifice of increasing costs. In the Concorde venture by Sud-Aviation and British Aircraft Corporation (Dussauge and Garrette, 1999), the final bill ($4 billion) far more exceeded the initial estimation ($450 million) partly due to the extreme extent of work duplication between the two partners.

As a summary, the main performance measures assessing task allocation among alliance parties are listed as follows:

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

- **Objective** measurement

  This performance measure is to identify whether a task has been allocated to the alliance party/parties possessing the most appropriate resources for achieving the task. This performance measure should be used **objectively**.

  For example, analyse the Matra-Renault alliance (Dumont and Garrette, 1996; Dussauge and Garrette, 1999) (see Table 6.17):

Table 6.17 Example of assessing whether tasks have been allocated to the most suitable alliance parties

Tasks	Resource requirements	Resources possessed		Partner(s) possessing appropriate resources	Partner(s) allocated	**Identical?**
		Partner A	Partner B			
Manufacturing	Low-volume manufacturing technology	✓	-	A	A	Yes
Distribution	Distribution network	-	✓	B	B	Yes

This analysis shows appropriate task allocation between the alliance parties.

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

For example, assume that a joint venture would take over partners' sales activities. To assess the risk of losing sales capability:

- **Objective** measurement

  Percentage of sales activities taken over by the joint venture: 50%

- **Subjective** measurement

  Level of risk of losing sales capability: 1 (on a scale of "1 no → 2 low → 3 some → 4 high → 5 certain")

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

- **Objective** measurement

  For example, assuming in an international joint venture, the local partner is responsible for manufacturing, and the manufacturing skills are to be transferred from the foreign partner:

  Scrap rate: reduced by half through applying the manufacturing skills learned from the foreign partner

- **Subjective** measurement

  For example, assuming in an international joint venture, the foreign partner and the local partner are jointly responsible for marketing. The benefits for the foreign partner through doing marketing can be assessed by:

  Increase of knowledge about local market: 5 (on a scale of 1-5: 1 no increase; 2 a little increase; 3 some increase; 4 much increase; 5 very much increase)

(4) Whether task allocation avoids task duplication

- **Objective** measurement

  This performance measure should take the forms of:

  - the **number** of **duplicated task**(s)

- the **cost increase** due to task duplication

The higher the number or the cost increase, the more negative influence the task duplication will exert on the alliance performance.

6.3.1.8 Measures Assessing Cross-Partner Teams

The "**people-purpose-links-time**" model (Lipnack and Stamps, 2000) provides four inter-related dimensions for seeing a team: "people linking with purpose over time". The following (categories of) measures can be derived from this model: (1) **whether each cross-partner team has its clear purpose**; (2) **measures assessing team purpose achievement**; (3) **team members' characteristics**; (4) **whether team members can effectively communicate with each other**.

Personal characteristics are particularly relevant to cross-partner teams. The alliance management team composed of managers from different partners is an example of cross partner teams, which can demonstrate the importance of alliance managers' characteristics (see Section 6.3.1.6 "Measures assessing alliance managers"). Effective communication is usually difficult to achieve in cross-country alliances due to culture differences and language barriers (Munns et al., 2000; Nair and Stafford, 1998).

Cross-partner teams provide good environment for team members to interact with & learn from each other; on the other hand, cross-partner teams may also cause competency (particularly knowledge) leakage. Thus, through controlling team purpose, location, staffing, etc., a balance needs to be found: **cross-partner teams facilitate communication**, while **won't cause competency leakage**. The alliance between DSM and Gist Brocades (Douma et al. 2000) is a good example of how partners can learn from each other through cross-partner teams, without undermining the competencies of the other.

As a summary, the main performance measures assessing cross-partner teams are:

(1) Whether each cross-partner team has its clear purpose

- **Objective** measurement

  For example:

  Existence of formal team purpose specification: Yes

  Agreement of team purpose among team members: Yes

- **Subjective** measurement

  For example:

Clarity of team purpose: 5 (*on a scale of 1-5: 1 not understandable at all → 2 very ambiguous → 3 ambiguous → 4 clear → 5 very clear*)

Understanding of team purpose by team members: 5 (*on a scale of 1-5: 1 no understanding → 2 a little understanding → 3 some understanding → 4 much understanding → 5 total understanding*)

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

Since alliances essentially take form of cross-partner teams, the assessment of team purpose achievement is similar to the assessment of alliance objective achievement (see Chapter 6 Section 6.3.1.3 for details).

(3) Cross-partner team members' characteristics

For example, assuming that English language ability and product engineering skills have been identified as the two desired characteristics:

- **Objective** measurement

  English language ability: **at least 2 years** working experience in **English speaking** environment

  Product engineering skills: **senior** engineers with **at least 5 years** product design experience

- **Subjective** measurement

  For example, assuming that the alliance partner speaks English:

  English language ability: 5 (**on a scale of 1-5**: 1 not know English at all; 2 know a little bit English; 3 know English but not good; 4 good at English; 5 excellent at English)

  Product engineering skills: 5 (**on a scale of 1-5**: 1 very low, 2 low, 3 average, 4 high, 5 top)

(4) Whether team members can effectively communicate with each other

- **Objective** measurement

  For example:

  Existence of formal project plan: Yes

  Project plan agreed among team members: Yes

  Communication facilities allowing team members:

- to speak to each other at any time: Yes
- to transfer any type of electronic files over the Internet: Yes
- to receive and send emails while on the road and in hotels: Yes

■ **Subjective** measurement

For example:

Communication skills: 4 (**on a scale of 1-5**: 1 very poor; 2 poor; 3 average; 4 good; 5 excellent)

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

■ **Objective** measurement

For example:

Each team member from our company should

- receive information confidentiality training
- pass the test

■ **Subjective** measurement

For example:

Each team member from our company should

- achieve level 5 understanding of information confidentiality (on a scale of 1-5: 1 no knowledge at all; 3 basic understanding; 5 clear understanding)

6.3.1.9 Measures Assessing Alliance Decision Making

In an alliance, one of the parties cannot force the other to accept any particular solution, and even if one of the partners dominates the alliance, it would be unwise for it to impose too many of its own decisions against the wishes of the other ally (Garette and Dussauge, 2000): "Such a behaviour would very likely lead to the collapse of the alliance ... In certain cases, the lack of agreement between the partners can even paralyze the alliance for considerable lengths of time and delay the implementation of badly-needed rationalization measures". **Shared decision-making** positively contributes to partners' perceptions of alliance success and satisfaction with alliance outcomes (Ring, 2000; Saxon, 1997).

Gillespie and Teegen (1995) indicated that "Stakeholders may be able to exercise influence over an alliance at its inception as well as during its life span. Formal and informal programs must be in place to ensure the support of all relevant stakeholders, such as customers, suppliers, other alliance partners, financiers and unions". Kale et al. (2001) also commented that "Alliances are often complex deals involving significant sharing of tangible and intangible resources between partners. Alliances, especially those in high technology industries, are confronted with dynamic and discontinuous business environments that increase the uncertainty and risk associated with them. External stakeholders and investors often find it difficult to appreciate the logic underlying alliances in such environments. In such cases, a system to educate and communicate with external stakeholders and gain their support and appreciation is critical."

The failure of Renault-Volvo joint venture (Bruner and Spekman, 1998) demonstrates the negative effects resulted from poor communication with key stakeholders. Similarly, the failure of the JVCO joint venture between Hexagon and NAMCO (Ariño and Doz, 2000) also demonstrates the **negative effects of poor communication with stakeholders**, in this case, the parent firms.

As a summary, the main performance measures assessing alliance decision making are:

(1) Whether key alliance decisions are made with alliance parties' consensus

- **Objective** measurement

  In a two-party alliance, consensus means reaching an agreement between these two alliance parties.

  In an alliance among more than two parties, consensus can also refer to reaching a majority agreement among relevant partners.

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies)

- **Objective** measurement

  "**The number of supporting stakeholders**" can be used as an indicator. However, a weakness of this indicator is that it ignores the fact that different stakeholders have different levels of influence on a decision.

- **Subjective** measurement

  "**Weighted total support**" is a useful indicator taking into consideration stakeholders' importance and their levels of support.

For example (see Table 6.18):

Table 6.18 Example of assessing communication of key alliance decisions to stakeholders

Decisions	Stakeholders	Influence (*scale 1-5 from least to most influential*)	Support (*-2 strong opposing; -1 opposing; 0 neutral; 1 support; 2 strong support*)	Weighted total support
Decision 1	Shareholders	5	2	
	Senior managers	4	-2	
	Other employees	3	-1	-1 =5*2+4*(-2)+3*(-1)
Decision 2	Shareholders	5	2	
	Senior managers	4	1	
	Other employees	3	1	17 =5*2+4*1+3*1

It can be seen that support has been well obtained for Decision 2, but poorly obtained for Decision 1.

6.3.1.10 Measures Assessing Alliance Assets Sharing

First of all, it is a common sense of partner firms to **distinguish their own assets involved in the alliance from the alliance assets that might be shared among partners**. This not only protects partners' own assets, but also reduces future disputes on assets ownership. However, as spoken by the Vice President of SJA, a local auto manufacturer in China: "although it is a common sense, we sometimes neglected it, which did cause disputes on assets ownership".

Partners' perceptions of unfairness can have great negative effects on alliance success, such as partners' under-commitment and distrust. How to share alliance assets is a major source for such perceptions. Thus, **whether the alliance assets can be fairly shared among partners** needs to be assessed. Such assessment is needed not just during alliance negotiation, but also when situations change during alliance operation stage. In the ICI Pharma joint venture by ICI and Sumitomo (Child & Faulkner, 1998), ICI believed that Sumitomo got the best of the bargain, and had been insufficiently flexible to renegotiate the deal as this had become apparent. This belief directly resulted in ICI's setup of a production plant in Japan, with the intent to remove the responsibility for producing ICI Pharma's products from Sumitomo.

Improper decisions on alliance assets ownership may result in competition risk. This is because **a partner's ownership of the alliance assets may undermine the other partner's competencies**. A classic example is the IBM-Microsoft collaboration for IBM PC operating system (Bellis [1] [2]; http://www.pjprimer.com/preloads.html): Because IBM allowed Microsoft to retain the rights to market MS DOS separate from the IBM PC project, other PC manufacturers got the opportunities to compete with IBM based on the operating system.

It can then be seen that damaging results may well happen after the alliance dissolves, thus need to be predicted and prevented. In the CPW alliance between Nestlé and General Mills (Dussauge and Garrette, 1999), General Mills requested that the partnership agreement with Nestlé include a number of safeguards, one of which was that most products introduced by CPW would carry trade marks owned by General Mills which Nestlé could not continue using if the alliance was broken. This safeguard counterbalanced the disadvantages of General Mills's position in the alliance, and reduced future competition risk.

As a summary, the main performance measures assessing alliance assets sharing are listed as follows:

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

- **Objective** measurement

  For example:

  The **existence of a formal asset specification**: Yes

  The **difference** between the number of own assets contributed, and the number of own assets specified: 0

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

- **Objective** measurement

  In Chapter 6 Section 6.3.1.1, "**the weighted percentage of resource contributions**" is introduced. This percentage should be used here as the standard according to which alliance assets are shared among alliance parties.

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

- **Subjective** measurement

  This performance measure essentially assesses whether partners' shares of the alliance assets would help partners/other companies create competencies against us.

  For example (see Table 6.19):

Table 6.19 Example of assessing competition risks resulted from alliance assets sharing

Share of alliance assets	Competencies that might be enhanced/created		Level of risks (*on a scale of 1-5: 1 very low, 2 low, 3 average, 4 high, 5 very high*)
PC operating system	The partner	The operating system (vs. our operating system)	4
	Other companies	The capability of accessing the operating system freely through market transaction for their own PC (rather than having to use our operating system)	5
	Total risks		**9**

This performance measure is subjective since the level of risks is strongly influenced by assessors' opinions.

6.3.1.11 Measures Assessing Partners' Post-Dissolution Activities

Partners' potential post-dissolution activities are assessed mainly to ensure that **the partners/other relevant parties won't use the partners' resources enhanced/created through the alliance to compete with us**. Section 6.3.1.10 "Measures assessing alliance assets sharing" discussed examples of decision making on alliance assets ownership to avoid competition risk. Other mechanisms are also available for reducing competition risk. For example, the safeguards adopted by General Mills also include (Dussauge and Garrette, 1999):

- Nestlé had to commit not to acquire General Mills, through a hostile takeover bid or otherwise, for at least 10 years after the joint venture was formed.
- In the event of the alliance being terminated prematurely, Nestlé agreed to not enter the market for cereal in North America for at least 10 years, where General Mills was already No. 2 only after Kellogg's.

Thus, the main performance measure assessing partners' post-dissolution activities is:

(1) Whether our competition risks caused by partners' post-dissolution activities have been minimised

- **Subjective** measurement

For example (see Table 6.20):

Table 6.20 Example of assessing competition risks caused by partners' post-dissolution activities

Partners' possible post dissolution activities	Potential risks	Protection approaches	Level of risks (*on a scale of 1-5: 1 very low, 2 low, 3 average, 4 high, 5 very high*)
Entering our market	Decrease of market share	A safeguard agreement that the partner won't enter the market for at least 10 years after alliance dissolution	1
	Total risks		**1**

Subjective assessment takes place here, since the level of risks is influenced by assessors' opinions.

6.3.1.12 Measures Assessing Alliance Parties' Operational Conflicts

In the literature, alliance parties' operational conflicts normally refer to **partners' conflicts with one another**. Operational conflicts can result from different and incompatible organisational cultures and operational practices of partners (Nordin, 2006, Das and Teng, 2000; Olk, 1997; Munns et al., 2000; Dacin et al., 1997).

For example, in the alliance between SysCo and TeachIT (Nordin, 2006), the training functions within SysCo resisted the alliance, and caused difficulties to TeachIT due to the fear of losing their jobs if the alliance proceeded to complete outsourcing of IT training services.

Such conflicts are negatively related to alliance performance (Das and Teng, 2000; Olk, 1997; Whipple and Frankel, 1998; Das and Teng, 2003; Demirbag and Mirza, 2000), thus are obvious targets for assessment and control (Brinkerhoff, 2002). In the Texas Instruments and Hitachi alliance (Dacin et al., 1997), managers perceived significant differences in the two firms' decision-making processes, and accordingly made efforts to learn to work together over time prior to the development of their memory chip joint venture. Similarly, in a successful joint venture between GE and Snecma (Dacin et al., 1997), they perceived culturally based differences in problem solving, and found out ways to avoid potential conflicts.

Although rarely mentioned in the literature, **operational conflicts also exist between the alliance parties and the alliance**. The above mentioned JVCO joint venture by Hexagon and NAMCO (Ariño and Doz, 2000) clearly demonstrates the negative effects of such conflicts. In another joint venture by two Chinese companies and a Japanese trade company (Zhang and Li, 2001), the proposal by the Japanese partner to buy 60% of the equity shares held by the Chinese partners was strongly opposed by the local JV managers since they believed that the proposal would damage the interests of the JV and its employees.

As a summary, the main performance measures assessing alliance parties' operational conflicts are:

(1) Alliance parties' operational conflicts with the alliance

For example, assuming that a joint venture offers products competing with the products of one of the alliance parties:

- **Objective** measurement

The partner's sales undermined: **£10 sales loss per joint venture product sold**

- **Subjective** measurement

  Influence on the partner's sales: 5 (**on a scale of 1-5** from 1 least to 5 most influential)

(2) Alliance parties' operational conflicts with each other

For example, assuming a supplier-manufacturer partnership, the supplier begins to develop competing products:

- **Objective** measurement

  Competition risk: the supplier's products are capable of **achieving 10% more energy saving than our products**

- **Subjective** measurement

  Partner's intention of learning our core technology: 5 (**on a scale of 1-5**: 1 no intention; 2 lowest priority intention; 3 low priorty intention; 4 high priority intention; 5 highest priority intention)

6.3.1.13 Measures Assessing Trust among Alliance Parties

Inter-partner trust has been found to be a critical factor in alliance success (Styles and Hersch, 2005; Nielsen, 2005, Das and Teng, 2003; Ireland et al., 2002; Kanter, 1994; Sherman, 1994). Trust in a partner can be built when the partner's performance is perceived as satisfactory (McCutcheon and Stuart, 2000). One aspect of trust concerns with specific operating behaviours, called as competence-based trust (Styles and Hersch, 2005; Whipple and Frankel, 1998; Gabarro, 1987). Competence-based trust directly relates to whether a partner can have satisfactory operational performance. Brinkerhoff (2002) indicated that in assessing relationships, the most important indicator of a partner's performance is **the other partners' satisfaction with that performance**.

The importance of **partner commitment** has been well documented in the literature (Styles and Hersch, 2005; Whipple and Frankel, 1998; Mohr and Spekman, 1994; Demirbag and Mirza, 2000). Commitment concerns trust mainly through two ways: it is directly related to a partner's operational performance, thus other partners' satisfaction; it also directly concerns trust sometimes, even when performance is less satisfactory. Demirbag and Mirza (2000) indicated that "Committed partners will consider long-term gains rather than short-term advantages. In such cases the frequency and intensity of conflicts can be expected to be relatively lower; and, therefore, higher levels of commitment should positively affect JV performance and partners' satisfaction with joint venture activities". A high level

of commitment provides the context in which both parties can achieve individual and joint goals without raising opportunistic behaviour (Mohr and Spekman, 1994; Demirbag and Mirza, 2000).

Opportunistic behaviour can have great negative effects on trust (Styles and Hersch, 2005; McCutcheon and Stuart, 2000). For example: McCutcheon and Stuart (2000) indicated that "*A firm's history of exploiting a powerful position can make it difficult to gain suppliers' trust*"; behaviour designed to injure, thwart or gain scarce resources at the expense of the other dramatically reduces the other's trust (Goldman, 1966; Whipple and Frankel, 1998); integrity as a perception of a partner's level of honesty is a major source of character-based trust (Gabarro, 1978; Gabarro, 1987; Whipple and Frankel, 1998); trust suggests that a partner's actions will meet expectations, including the absence of opportunistic behaviour (Ireland et al., 2002).

Ariño and Doz (2000) indicated that one major reason for alliance failure is **how partners interpret the cause of the gaps between their expectations and the results**: whether partners believe that the gaps are caused by other partners' not committing to the alliance, or some other reasons beyond their control. The JVCO example (Ariño and Doz, 2000) mentioned before demonstrates this argument.

Culture compatibility can also have great effects on trust among partners (Mehta et al. 2006). Mutual trust is more likely to occur when complementary management styles simplify working contacts between alliance staffs (Brouthers et al., 1995). Cultural differences exist and may distort communication across cultures, even at the sub-conscious level (Mehta et al. 2006). This effect was referred to by cultural anthropologist, James A. Lee, as the self-reference criterion (Lee, 1966). The R&D joint venture by Toshiba, IBM, and Siemens (Cullen et al. 2000; Browning, 1994) demonstrates how incompatible cultures among partners cause distrust:

> The Japanese found it difficult to work in small isolated offices. The Germans were horrified that Japanese slept in meetings when a topic did not concern them. The Americans complained that the Germans planned too much and were slowing things down. Difficulties with communication in English, lack of sufficient cross-cultural training, and differences in management styles also plagued the venture. The result was a lack of trust, a withdrawal of the Japanese, Germans, and Americans into their own teams and, the belief that the other companies' scientists and engineers held back information and didn't share ideas.

Alliance parties' cumulative interactions, providing data needed for confident prediction of each other's behaviour, is one way to develop trust (McCutcheon and Stuart, 2000). Ireland et al. (2002) indicated that "*the open and regular communications between partners that are a defining characteristic of trust-based relationships (Hutt et al., 2000) contribute to the evolution of cooperative behavior (Volery & Mensik, 1998)*". When information is not shared between the parties, the level of trust will break down and there is a risk that the relationship might fail (Munns et al., 2000). Trust also

has positive effects on open communication: where there is a breakdown in trust, open and honest communication becomes more difficult (Munns et al., 2000; Duysters et al., 1999); trust is essential in order for alliance partners to be willing to share key information on a strategic and operational level (Whipple and Frankel, 1998). Gabarro (1978; 1987) identified "perception of a partner's true intentions", "reliability and predictability of the partner's actions under different situations" and "openness" as sources of character-based trust. **Open and honest communication** of relevant information leads to the prevention of disagreements on solutions concerned with how partners manage day-to-day problems, such as late delivery and poor quality (Deutsch, 1973).

To build trust, a partner can take specific steps to foster the other's trust; but these steps may have no results or even lead to exploitation unless the other is also interested in developing the trust (McCutcheon and Stuart, 2000). Thus, a partner who needs to demonstrate its trustworthiness might be **willingly exposing itself to risks on the other's behalf**. McCutcheon and Stuart (2000) described some examples of actions taken that definitely helped build mutual trust. One was a step taken by a supplier. It seconded a senior manager to a valued customer to help the customer develop its purchasing management systems. Although there was no contractual arrangement, it was agreed that the manager would remain at the customer's site until the new systems were ready to be launched. The supplier firm saw the benefits of having a more competitive customer as greatly outweighing the cost of replacing the manager during his 6-month secondment. In another scenario, a firm arranged for a supplier to have complete responsibility for stocking a range of materials. The supplier representatives were allowed to write the firm's purchase orders for these materials. This type of trust is sometimes referred to as "identification-based trust", characterised by mutual understanding amongst all parties to the point that each can effectively act for the other (Panteli and Sockalingam, 2005; Lewicki and Bunker, 1996). In the field case studies of this research, it was also found that SFQMC's active helps (beyond alliance scope) to its customers and suppliers in designing product strategies and avoiding potential market risk greatly improved customers' and suppliers' trust in the company.

As a summary, the main (areas of) performance measures assessing trust among alliance parties are listed as follows:

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

The following discussion applies to both (1) & (2):

- **Subjective** measurement

  Alliance parties' **degree of satisfaction** should be used here as subjective indication of their perception of their partners' performance and commitment.

  An example of the **satisfaction scale**:

  1 not satisfied at all → 2 not satisfied → 3 → 4 satisfied → 5 totally satisfied

(3) Alliance parties' dishonest behaviour

- **Objective** measurement

  Times of dishonest behaviour

- **Subjective** measurement

  Frequency of dishonest behaviour:

  1 never → 2 rarely → 3 sometimes → 4 often → 5 always

  Satisfaction with partners' business morality:

  1 not satisfied at all → 2 not satisfied → 3 → 4 satisfied → 5 totally satisfied

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results

- **Subjective** measurement

  Influence (on trust) of partner's interpretation of the cause of the gaps:

  -2: **large negative** influence – an alliance party interprets the gaps as caused by its partner's under commitment

  -1: **small negative** influence – the alliance party is unclear whether the gaps were caused by its partner's under commitment, or some other reasons

  0: **no** influence – the alliance party believes that the gaps were caused by some reasons beyond its partner's control, such as wars

(5) Whether open communication exists among alliance parties

- **Subjective** measurement

  Alliance parties' perception of the **degree of open communication** (e.g. 1 very closed → 2 closed → 3 average → 4 open → 5 very open) should be used as the indication of the value of this performance measure.

(6) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

- **Subjective** measurement

  Alliance parties' perception of the **frequency** (e.g. 1 never → 2 rarely → 3 sometimes → 4 often → 5 always) of such behaviours, and their **degree of appreciation** (e.g. little-some-very) of such behaviours should be used as the indication of the value of this performance measure.

(7) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

The above performance measures assess trust from:

- satisfaction with performance
- perception of commitment
- perception of business morality
- perception of open communication
- perception of partner's willingness to act on others' behalf

This performance measure assesses whether partners' cultural behaviours have influence on these aspects, thus affecting the trust among alliance parties. This measure should be used subjectively.

- **Subjective** measurement

  For example (see Table 6.21):

Table 6.21 Example of assessing the influence of cultural behaviour on trust

Influence of a partner's cultural behaviours on ... (*Judge the influence on a scale from -2 to 2: -2 very negative, -1 negative, 0 neutral, 1 positive, 2 very positive*)	
satisfaction with the partner's performance	2
perception of the partner's commitment	1
perception of the partner's business morality	0
perception of open communication with the partner	2
perception of the partner's willingness to act on others' behalf	-1
Total	4

The above example shows that the partner's cultural behaviours exerted positive influence on others' trust in it.

This set of performance measures assesses the **soft** part of an alliance. "Trust, communication, culture, personal relationship, respect, etc. are crucial issues to alliance success. Alliances will fail without these soft issues ready, even when physical assets are all in place." said the Product Strategy and Marketing Director of one of the field case study companies.

6.3.1.14 Measures Assessing Alliance Supporters

Alliance success requires commitment from top management (McCutcheon and Stuart, 2000). Sometimes, **top management as supporters** is not sufficient; **external supporters** also need to be found. This is particularly true in countries where governmental bodies can exert strong influence on firms' activities. Nair and Stafford (1998)'s research of strategic alliances in China provided supporting evidence.

In such situations, **finding strong external alliance supporters** becomes a crucial factor in alliance success. In Tambrands's Russian joint venture with GAPU (Mockler, 2000), the company enlisted the help of British Prime Minister Margaret Thatcher. Through her efforts, Evgeni Chasov, Director of the Ministry of Health for the USSR, was delighted with the proposal and urged that it be pursued.

Thus, it can be concluded that the main performance measures assessing alliance supporters are:

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

- **Subjective** measurement

  The sufficiency of alliance supporters is affected not only by the number of alliance objectors, but also by the total number of the persons who can influence the alliance party's decisions, and also by the degree of influence each of these individuals can exert on the decision making.

  The "**weighted total support**" introduced Section 6.3.1.9 "Measures Assessing Alliance Decision Making" can be adapted here to assess the sufficiency.

  For example (see Table 6.22):

  The example shows that there are sufficient supporters on the side of partner 2, but insufficient supporters on the side of partner 1.

Table 6.22 Example of assessing the sufficiency of alliance supporters

Partners	Supporters /objectors	Influence level (*scale 1-5 from least to most influential*)	Support level (*-2 strong opposing; -1 opposing; 0 neutral; 1 supporting; 2 strong supporting*)	**Weighted total support**
Partner 1	A	5	2	
	B	4	-2	
	C	3	-1	**-1** =5*2+4*(-2)+3*(-1)
Partner 2	D	1	-1	
	E	2	2	
	F	5	2	**13** =1*(-1)+2*2+5*2

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

- **Subjective** measurement

  Subjective sense making, based on good understanding of individual supporters' background, would normally be applied here to clarify their degree of influence on the alliance party's decision making.

  The influence level can be differentiated on a scale of:

  1 no influence → 2 a little influence → 3 some influence → 4 great influence → 5 decisive influence

6.3.2 Features of the APMS

A literature review (see Section 2.8 for details) indicates that the existing literature on alliance performance measurement has the following deficiencies:

- No framework is found covering the entire 'inputs → processes → outputs': *Mockler (2000), Yan and Luo (2001), Geringer and Hebert (1991), Harrigan (1986), and Arino (2003) cover **outputs**; Das and Teng (2003) and Callahan & MacKenzie (1999) cover **inputs**; Anderson (1990) covers **inputs** & **outputs**.*
- Alliance objectives are separated from partners' objectives (Yan and Luo, 2001).
- Alliances are measured as stand-alone entities, less considering partners' benefits and risks (Anderson, 1990).
- Alliance performance is still assessed using traditional measures for individual companies, rather than measures specific for alliances (Mockler, 2000; Luo, 1996; Anderson, 1990).

- No framework is found clearly indicating whose perspective is used for performance measurement – that of one parent, two parents, or the alliance management (Yan & Gray, 1994).
- No framework is found clearly indicating at which alliance stage various alliance performance measures are appropriate (Yan & Gray, 1994).

The APMS explained in this chapter overcomes these deficiencies due to the following features.

- It covers the entire 'inputs → processes → outputs'.
- It balances among the balanced scorecard's four perspectives.
- Alliances are assessed not just as stand-alone entities, but considering parents' benefits & risks.
- It clearly indicates from whose perspective performance measures can be used: (1) own perspective, or (2) that of the alliance.
- It clearly indicates at which alliance stage various alliance performance measures are appropriate: alliance formation stage, alliance operation stage, alliance dissolution stage, or post-alliance stage.
- It combines objective performance measures with subjective performance measures.
- Traditional performance measures are combined with alliance-specific measures.

6.3.2.1 Assessing Inputs, Processes, and Outputs

The issues assessed by the APMS are designed to cover the entire **'inputs → processes → outputs'** (see Table 6.23). To interpret Table 6.23, it needs to be analysed vertically and horizontally.

Table 6.23 APMS covering the entire 'inputs → processes → outputs'

(See Appendix 3 'In/pro/out' column for detailed explanation)

Measures	Mainly focusing on		
	Input	Process	Output
Measures assessing "alliance parties' resource contributions"	✓	✓	
Measures assessing "alliance parties' dependency"	✓		✓
Measures assessing "alliance objectives"	✓	✓	✓
Measures assessing "resource protection"	✓	✓	✓
Measures assessing "alliance geographic location"	✓		
Measures assessing "alliance managers"	✓	✓	✓
Measures assessing "task allocation among alliance parties"		✓	✓
Measures assessing "cross-partner teams"	✓	✓	✓
Measures assessing "alliance decision making"		✓	
Measures assessing "alliance assets sharing"		✓	✓
Measures assessing "partners' post-dissolution activities"			✓
Measures assessing "alliance parties' operational conflicts"	✓		✓
Measures assessing "trust among alliance parties"		✓	✓
Measures assessing "alliance supporters"	✓	✓	✓

Vertically, for example, the issues assessed from the aspect of **'input'** include (see the 'Input' column): (1) alliance parties' resource contributions; (2) alliance parties' dependency; (3) alliance objectives; (4) resource protection; (5) alliance geographic location; (6) alliance managers; (7) cross-partner teams; (8) alliance parties' operational conflicts; (9) alliance supporters.

Horizontally, for example, the issue of **"alliance parties' resource contributions"** is assessed from the aspects of **'input'** and **'process'**. When analysing whether and how an issue should be assessed from the aspects of **'input'**, **'process'**, and **'output'**, this issue is actually being scrutinised.

6.3.2.2 Balancing among Balanced Scorecard's Four Perspectives

Kaplan and Norton's (1992; 1996; 2001) balanced scorecard consists of four perspectives:

(1) **Financial**: growth, profitability, and risk viewed from the perspective of the shareholder.

(2) **Customer**: creating value and differentiation from the perspective of the customer.

(3) **Learning & Growth**: organisational change, innovation, and growth.

(4) **Internal Business Processes**: various business processes that create customer and shareholder satisfaction.

These four perspectives are well balanced in the APMS (see Table 6.24). The **general rule** is that when an issue is assessed from the aspects of **'input'** or/and **'process'**, this issue involves the **'internal business processes'** perspective, because **internal business processes** consist of **inputs** and **processes** in order to generate outputs; when an issue is assessed from the aspect of **'output'**, it involves all of the **'financial'**, **'customer'**, and **'learning & growth'** perspectives, because **outputs** can be any of these three types: (1) financial outcomes; (2) product/service value generated for customers; (3) organisational growth as a result of learning and innovation.

For example:

> Since **"partners' post-dissolution activities"** is the **only** issue **not** assessed from the aspects of both **'input'** and **'process'**, only this issue does **not** involve the **'internal'** perspective.

Say it **'general rule'** because there are some exceptions:

- **"Alliance decision making":** since key alliance decisions need to be effectively communicated to shareholders and customers, the **'financial'** and **'customer'** perspectives are involved.
- **"Trust among alliance parties":** although inter-partner satisfaction, one of the factors influencing trust, is the **'output'** from partners' behaviour, it isn't directly related to financial outcomes, product/service value generated for customers, or organisational growth as a result of

learning and innovation; therefore, it doesn't involve the **'financial'**, **'customer'**, and **'learning & growth'** perspectives.

- **"Alliance supporters":** although **'output'** from alliance supporters' supporting actions is an issue assessed, it isn't directly related to financial outcomes, product/service value generated for customers, or organisational growth as a result of learning and innovation; therefore, it doesn't involve the **'financial'**, **'customer'**, and **'learning & growth'** perspectives.

Table 6.24 Balancing the APMS among balanced scorecard's 4 perspectives

(See Appendix 3 'Balanced Scorecard Dimension' column for details)

Measures	Internal	Financial	Customer	Learning & Growth
Measures assessing "alliance parties' resource contributions"	✓			
Measures assessing "alliance parties' dependency"	✓	✓	✓	✓
Measures assessing "alliance objectives"	✓	✓	✓	✓
Measures assessing "resource protection"	✓	✓	✓	✓
Measures assessing "alliance geographic location"	✓			
Measures assessing "alliance managers"	✓	✓	✓	✓
Measures assessing "task allocation among alliance parties"	✓	✓	✓	✓
Measures assessing "cross-partner teams"	✓	✓	✓	✓
Measures assessing "alliance decision making"	✓	✓ *exception*	✓ *exception*	
Measures assessing "alliance assets sharing"	✓	✓	✓	✓
Measures assessing "partners' post-dissolution activities"		✓	✓	✓
Measures assessing "alliance parties' operational conflicts"	✓	✓	✓	✓
Measures assessing "trust among alliance parties"	✓	*exception*	*exception*	*exception*
Measures assessing "alliance supporters"	✓	*exception*	*exception*	*exception*

6.3.2.3 Win-Win Configuration among Alliance Parents

Table 6.25 Measures ensuring win-win situation (extracted from Appendix 3)

Measures assessing "alliance parties' dependency"
(1) Our dependency on our partners
(2) Our partners' dependency on us
(3) Compatibility among alliance parties' objectives
(4) Our risks due to the alliance
(5) Our partners' risks due to the alliance
Measures assessing "alliance objectives"
(1) The alliance objectives create a mutually acceptable win-win situation
(2) Measures assessing our company's benefits through the alliance
(3) Whether the alliance objectives are achievable (such as feasibility report)
(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

Table 6.25 summarises the performance measures assessing the win-win situation among alliance partners.

The measures assessing **"alliance parties' dependency"** ensure a healthy relationship among partners: (1) acceptable inter-partner **dependency**, (2) acceptable inter-partner **risks**, and (3) compatible **objectives**. These three aspects identify whether the relevant parties should form the alliance based on the win-win principle.

The measures assessing **"alliance objectives"** ensure that the win-win situation is taken into consideration when designing alliance objectives. This category of measures not only assesses alliance objectives & their achievability, but also assesses parents' benefits upon achieving the alliance objectives.

6.3.2.4 Perspectives of Alliance Performance Measurement

Clarity of whose perspective used for performance measurement enhances the **usability** of an APMS. The APMS proposed in this chapter clarifies this issue using two perspectives (see Appendix 3 **'Perspective'** column): (1) own perspective, or (2) that of the alliance.

Measures assessing the issues of (1) inter-partner dependency, (2) inter-partner risk, (3) own benefits from the alliance, and (4) resource protection, can be used from **own perspective**. This is because a firm might not want its partners to know its true situations: e.g. its dependency on the partners, its real risks due to the alliance, its real benefits from the alliance, or what competencies it needs to protect. Other measures can be used from the **alliance perspective**.

Which perspective is used depends on how firms perceive the issues in questions. For example, if alliance parties all value the importance of open communication about their risks due to the alliance, this issue may well be jointly assessed by the alliance parties, thus from the perspective of the alliance, rather than own perspective.

6.3.2.5 Performance Measures' Appropriate Alliance Stages

To ensure a comprehensive assessment, most issues evaluated are covered across multiple stages: from formation → operation → dissolution (see Table 6.26). This coverage reflects the real situations because:

- An assessment issue might have different aspects to be assessed at different alliance stages:

  e.g. for the issue of "alliance parties' resource contributions", the assessment of the aspect "whether alliance parties have actually contributed the resources they have agreed to contribute" begins from

the operation stage, rather than from the formation stage; the assessment of other aspects begins from the formation stage.

- Some aspect(s) of an assessment issue are relevant to multiple stages, thus should be assessed across the relevant stages:

  e.g. the aspect "whether alliance parties' resource contributions complement each other" is relevant to both formation and operation stages, thus should be covered across these two stages.

Table 6.26 Performance measures' appropriate alliance stages

(See Appendix 3 'Stage' column for detailed explanation)

Measures	Formation	Operation	Dissolution	Post-Dissolution
Measures assessing "alliance parties' resource contributions"	✓	✓		
Measures assessing "alliance parties' dependency"	✓	✓		
Measures assessing "alliance objectives"	✓	✓	✓	
Measures assessing "resource protection"	✓	✓	✓	
Measures assessing "alliance geographic location"	✓	✓		
Measures assessing "alliance managers"	✓	✓	✓	
Measures assessing "task allocation among alliance parties"	✓	✓	✓	
Measures assessing "cross-partner teams"	✓	✓	✓	
Measures assessing "alliance decision making"	✓	✓	✓	
Measures assessing "alliance assets sharing"	✓	✓	✓	✓
Measures assessing "partners' post-dissolution activities"	✓	✓	✓	✓
Measures assessing "alliance parties' operational conflicts"	✓	✓		
Measures assessing "trust among alliance parties"	✓	✓	✓	
Measures assessing "alliance supporters"	✓	✓		

6.3.2.6 Combination of Objective and Subjective Performance Measures

Table 6.27 Combination of objective and subjective performance measures

(See Appendix 3 'Objective /Subjective' column for details)

Measures	Objective	Subjective
Measures assessing "alliance parties' resource contributions"	✓	✓
Measures assessing "alliance parties' dependency"	✓	✓
Measures assessing "alliance objectives"	✓	✓
Measures assessing "resource protection"	✓	✓
Measures assessing "alliance geographic location"	✓	✓
Measures assessing "alliance managers"	✓	✓
Measures assessing "task allocation among alliance parties"	✓	✓
Measures assessing "cross-partner teams"	✓	✓
Measures assessing "alliance decision making"	✓	✓
Measures assessing "alliance assets sharing"	✓	✓
Measures assessing "partners' post-dissolution activities"		✓
Measures assessing "alliance parties' operational conflicts"	✓	✓
Measures assessing "trust among alliance parties"	✓	✓
Measures assessing "alliance supporters"		✓

As detailed in Section 6.3.1, a combination of objective and subject performance measures is used in the APMS (see Table 6.27).

6.3.2.7 Combination of Traditional & Alliance-Specific Measures

Traditional performance measures are those also used for evaluating internal operations. Alliance-specific performance measures are those for evaluating alliances only. In the APMS, alliance-specific performance measures are combined with traditional measures to assess alliance performance (see Table 6.28).

Traditional performance measures are used in this APMS to assess (1) "partners' resource contributions", (2) "alliance objectives", (3) "alliance geographic location", (4) "alliance managers", (5) "task allocation among alliance parties", and (6) "cross-partner teams". Alliance-specific performance measures are also applied to these issues to tackle alliance-specific aspects.

Table 6.28 Combination of traditional and alliance-specific performance measures

(See Appendix 3 'Alliance-Specific' column for details)

Measures	Traditional	Alliance-specific
Measures assessing "alliance parties' resource contributions"	✓	✓
Measures assessing "alliance parties' dependency"		✓
Measures assessing "alliance objectives"	✓	✓
Measures assessing "resource protection"		✓
Measures assessing "alliance geographic location"	✓	✓
Measures assessing "alliance managers"	✓	✓
Measures assessing "task allocation among alliance parties"	✓	✓
Measures assessing "cross-partner teams"	✓	✓
Measures assessing "alliance decision making"		✓
Measures assessing "alliance assets sharing"		✓
Measures assessing "partners' post-dissolution activities"		✓
Measures assessing "alliance parties' operational conflicts"		✓
Measures assessing "trust among alliance parties"		✓
Measures assessing "alliance supporters"		✓

6.3.3 Priority of Alliance Performance Measures

It is useful to prioritise the alliance performance measures discussed above, so that the assessment can be done at relatively lower cost. Table 6.29 divides the alliance performance measures into "**common**" and "**specific**", and into **ABC** priorities.

"**Common**" means that a performance measure should be applied no matter what the alliance scenario is: e.g. the measures assessing "alliance parties' resource contributions".

"**Specific**" means that a performance measure should be applied to certain alliance scenarios: e.g. the measures assessing "alliance assets sharing" apply when alliance assets are in existence.

The **ABC** prioritisation of alliance performance measures is similar to the ABC classification system for inventory management (Greene, 1997). The alliance performance measures are classified into A (**absolutely essential**), B (**essential**) and C (**desirable**), as shown in Figure 6.2:

- Around **21%** of the alliance performance measures are classified into **A**, which delivers **absolutely essential** value to the alliance:

  if failing in the A measures, it is (almost) **certainly** that the alliance would fail

- Around **43%** of the measures are classified into **B**, which delivers **essential** value to the alliance:

  if failing in the B measures, it is **highly possible** that the alliance would fail

- Around **55%** of the measures are classified into **C**, which delivers **desirable** value to the alliance:

  if failing in the C measures, alliance performance would be **undermined**, although this might not lead to the failure of the alliance

Note that (21% + 43% + 55%) > 1: this is because some performance measures belong to multiple classes depending on specific alliance scenarios.

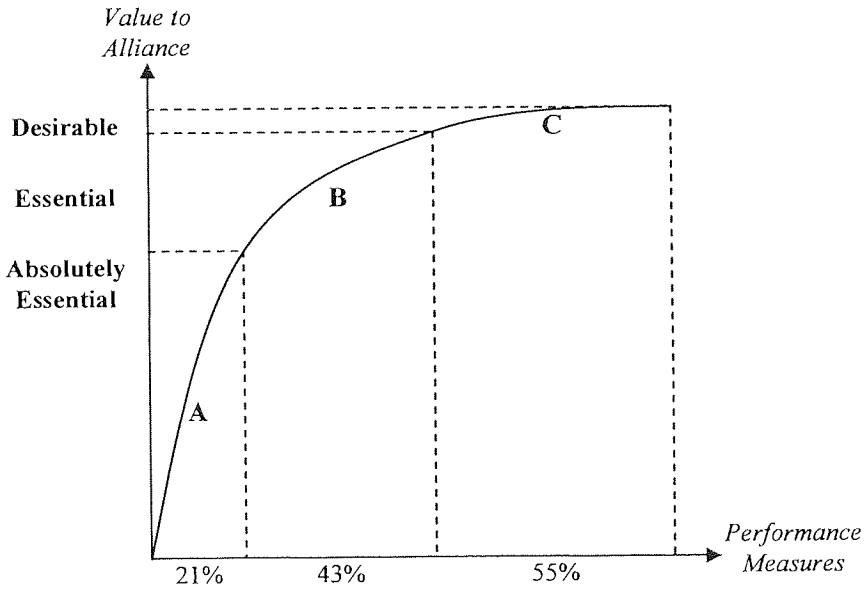


Figure 6.2 ABC prioritisation of alliance performance measures

Table 6.29 lists the prioritisation of the alliance performance measures according to the above criteria.

Table 6.29 Priority of alliance performance measures (Com. - Common; Spe. - Specific)

Performance measures assessing external operations	Com.	Spe.	A	B	C
1 alliance parties' resource contributions					
(1) Whether alliance parties' resource contributions complement each other	✓		✓ Why: Resource complementation is a prerequisite to the formation and continuation of an alliance		
(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives	✓			✓ Why: Insufficient total can cause possible failure of achieving alliance objectives, thus it is highly possible that partners' benefits cannot be guaranteed	
(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)	✓		✓	✓	✓ Why: Depending on alliance scenarios: e.g. technical expertise can be decisive for an R&D alliance, while management skills might be just beneficial but not decisive
(4) Whether alliance parties have actually contributed the resources they have agreed to contribute	✓		✓ Why: Actual contribution of resources by partners is a prerequisite to the continuation of an alliance		
2 alliance parties' dependency					
(1) Our dependency on our partners	✓				✓ Why: Not decisive to alliance success, but might influence alliance parties' commitment
(2) Our partners' dependency on us	✓				✓ Why: same as (1)
(3) Compatibility among alliance parties' objectives	✓			✓ Why: Longevity of an alliance's win-win situation has a significant influence on the continuation of an alliance	
(4) Our risks due to the alliance	✓				✓ Why: Depending on how damaging and possible the perceived risks are, they might cause different degrees of negative influence on partners' willingness to input resources, on their perceived benefits, on communication openness, etc.
(5) Our partners' risks due to the alliance	✓				✓ Why: same as (4)
3 alliance objectives					
(1) The alliance objectives create a mutually acceptable win-win situation	✓		✓ Why: Win-win situation is a prerequisite to the formation and continuation of an alliance		
(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)	✓		✓ Why: An alliance is perceived by a partner as unsuccessful if the partner cannot gain desired benefits through the alliance		
(3) Whether the alliance objectives are achievable (such as feasibility report)	✓			✓ Why: It is highly possible that benefits to partners cannot be delivered if alliance objectives cannot be achieved	

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)	✓			✓	Why: same as (3)
4 resource protection					
(1) Whether our company's resources have been put under effective protection		✓			✓ Why: Depending on the importance of the competencies concerned; perceived risks might cause different degrees of negative influence on partners' perceived benefits, on communication openness, etc.
(2) Whether our company's resources under protection have been damaged		✓	✓	✓	✓ Why: Depending on the importance of the competencies damaged, the results might be devastating, or just an offset of a small portion of the benefits gained through the alliance
(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance		✓	✓	✓	✓ Why: same as (2)
(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred		✓			✓ Why: same as (1)
5 alliance geographic location					
(1) Whether the alliance geographic location helps achieve alliance objectives		✓	✓	✓	✓ Why: Depending on alliance scenarios, geographic locations can have different degrees of influence on alliance success: e.g. locations can be decisive for supply chain partnerships, but less influential for R&D alliances
(2) Whether the alliance geographic location helps protect our company's resources		✓			✓ Why: Depending on the importance of the competencies to be protected, perceived risks might cause different degrees of negative influence on partners' willingness to commit, on their perceived benefits, on communication openness, etc.
6 alliance managers					
(1) Alliance managers' characteristics, such as their expertise	✓				✓ Why: Although not decisive to alliance success, but could influence alliance performance
(2) Whether alliance managers have effectively conducted their responsibilities	✓			✓	✓ Why: Depending on what responsibilities are concerned, degrees of influence on alliance performance could be different: e.g. failure to communicate with shareholders could cause an alliance to be withdrawn, but lack of open communication with partnering managers might not cause a devastating result, although could undermine the trust among them

7	**task allocation among alliance parties**				
(1)	Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)	✓		✓	Why: In some alliance scenarios, partners are brought into an alliance for the resources they possessed to carry out certain tasks: e.g. market knowledge for marketing, manufacturing expertise for production. Misallocation of tasks wastes precious resources, thus highly possible to cause alliance failure.
(2)	Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)		✓	✓	Why: Depending on the importance of the competencies to be protected, perceived risks might cause different degrees of negative influence on partners' willingness to input resources, to commit to the tasks, etc.
(3)	Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)		✓	✓	Why: Benefits from task allocation could help enourage partners' commitment, thus improving alliance performance
(4)	Whether task allocation avoids task duplication	✓		✓	Why: Effects like cost increase due to task duplication undermines alliance performance
8	**cross-partner teams**				
(1)	Whether each cross-partner team has its clear purpose	✓		✓	Why: Many alliances take form of cross-partner teams. A team without a clear purpose can hardly achieve alliance objectives
(2)	Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)	✓		✓	Why: Cross-partner teams are the fundamental blocks of an alliance. It is hardly possible to achieve alliance objectives if failed in team purposes
(3)	Cross-partner team members' characteristics, such as their expertise	✓		✓	Why: Such characteristics could undermine team performance
(4)	Whether team members can effectively communicate with each other	✓		✓	Why: Communication among team members determines the effectiveness of information sharing among them, which is critical to inter-partner collaboration
(5)	Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)		✓	✓	Why: Depending on the importance of the competencies to be protected, perceived risks might, to different extent, deter open communication, commitment, etc.
9	**alliance decision making**				
(1)	Whether key alliance decisions are made with alliance parties' consensus	✓		✓	Why: Without alliance parties' consensus, the decisions can hardly be implemented. Even if implemented, the rapport between partners would be damaged.

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support	✓		✓ Why: Without stakeholders' support, the decisions can hardly be implemented. Even if implemented, the rapport with the stakeholders would be damaged, thus very difficult to continue the alliance.
10 alliance assets sharing			
(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets		✓	✓ Why: If not clearly distinguished, unnecessary loss and partner disputes might occur, thus to some degree offsetting the benefits gained through the alliance, and undermining alliance performance
(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions		✓	✓ Why: Unfair share of alliance assets would undermine an alliance's win-win situation, which is a prerequisite to alliance formation and continuation
(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us		✓	✓ Why: Depending on how serious the risks are, perceived potential competition might, to different extent, deter partners' collaboration and commitment
11 partners' post-dissolution activities			
(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised	✓		✓ Why: Depending on the potential damage the competition risks could cause, the risks might, to different extent, deter partners' collaboration and commitment
12 alliance parties' operational conflicts			
(1) Alliance parties' operational conflicts with the alliance	✓		✓ Why: Such conflicts undermine alliance parties' commitment to the alliance, and might escalate to an extent leading to the alliance parties' withdrawal from the alliance
(2) Alliance parties' operational conflicts with each other	✓		✓ Why: Such conflicts might escalate to an extent leading to distrust among alliance parties, thus damaging their collaboration performance
13 trust among alliance parties			
(1) Whether alliance parties are comfortable with their partners' performance	✓		✓ Why: Disappointment with partners' performance could strongly discourage the continuation of the alliance with the partners
(2) Alliance parties' commitment to the alliance	✓		✓ Why: Commitment has strong influence on alliance performance; the resulted trust or distrust further reinforces or reduces partners' willingness to commit
(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)	✓		✓ Why: Distrust caused by dishonest behaviour undermines partners' willingness to cultivate long-term partnership, thus aiming for short-term and opportunistic benefits

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)	✓			✓	Why: Interpretation of alliance under-performance as caused by a partner's under-commitment could strongly discourage the continuation of the alliance with the partner
(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them	✓				✓ Why: Because culture is inherent in behaviours, damaging effects of cultural conflicts can escalate quickly to negatively influence rapport, communication, perception of commitment, etc.
(6) Whether open communication exists among alliance parties	✓			✓	Why: Communication among alliance parties determines the effectiveness of information sharing among them, which is critical to inter-partner collaboration
(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks	✓				✓ Why: Appreciation of such behaviours helps establish genuine friendship among alliance parties, which gives positive effects on alliance performance and long-term prospect
14 alliance supporters					
(1) Whether sufficient supporters of the alliance exist on the side of each alliance party	✓			✓	Why: Existence of sufficient alliance supporters on the side of each alliance party is a prerequisite to the formation and continuation of an alliance
(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions	✓			✓	Why: Capability of exerting strong influence is an essential feature of effective alliance supporters
% of total alliance performance measures			10/47 ≈ 21%	20/47 ≈ 43%	26/47 ≈ 55%

6.4 Summary

Following an explanation of VME Performance Measurement System (VMEPMS), this chapter detailed fourteen categories of performance measures assessing alliance performance: alliance parties' resource contributions; alliance parties' dependency; alliance objectives; resource protection; alliance geographic location; alliance managers; task allocation among alliance parties; cross-partner teams; alliance decision making; alliance assets sharing; partners' post-dissolution activities; alliance parties' operational conflicts; trust among alliance parties; and alliance supporters. The collective of these performance measures exhibits important features overcoming the gaps perceived in the literature: assessing inputs, processes, and outputs; balancing among Balanced Scorecard's four perspectives; win-win configuration among alliance parents; perspectives of alliance performance measurement; performance measures' appropriate alliance stages; combination of objective and subjective performance measures; and combination of traditional and alliance-specific performance measures.

This chapter concludes the last module of the Reference Model, and answers the 3rd research question. Chapter 7 starts to summarise the three modules established so far, and test the reference model's reliability and validity.

7 Reference Model Summary and Field Case Studies

7.1 Introduction

Chapter 3 explained the research methodology used in this research, the research design, and the data analysis methods adopted. It also briefly introduced the reliability and validity of this research. Based on the Conceptual Framework established in Chapter 3, Chapters 4, 5, 6 detailed the three modules of the corresponding Reference Model.

This chapter first summarises the modules proposed in previous chapters, and their functions in transforming a manufacturing company into a VME. After briefing the case study companies' profiles to reinforce this research's reliability, this chapter goes to detail the case study findings in the forms of both individual case study analyses and cross case observations.

7.2 Summary of the Reference Model

A Reference Model is a previously agreed upon and validated standard system (Williams & Vosniakos, 1997). It defines system elements common to all implementation previously defined within the model's scope, but independent of the specific requirements of a particular implementation (Doumeingts et al., 1995; Williams et al., 1993). A company can then develop solutions using the Reference Model as a foundation. The Reference Model proposed in this research has three modules.

The **research questions** answered by the Reference Model are:

(1) How to make decisions of operational externalisation?

(2) How to transform to a VME from the aspect of functional structure?

(3) How to evaluate a VME's performance?

Each research question is answered by one of the three modules, as shown in Table 7.1.

Table 7.1 Relationship between research questions and modules

Research Questions	Corresponding Modules	Corresponding Chapters
(1) How to make decisions of operational externalisation?	**Module 1** – EI Decisions and VME Metabolism	Chapter 4
(2) How to transform to a VME from the aspect of functional structure?	**Module 2** – EI Management Function	Chapter 5
(3) How to evaluate a VME's performance?	**Module 3** – VME Performance Measurement	Chapter 6

7.2.1 Summary of Module 1 – EI Decisions and VME Metabolism

The 1st module (see Chapter 4) answers the 1st research question. It can be summarised as follows:

(1) Operating along **VME metabolism** provides a mechanism of VME transformation

(2) Classification of resources sought by manufacturing companies through alliances

① Products

② Services

③ Customers

④ Knowledge

⑤ Equipment

⑥ Financial resource

⑦ Human resource

⑧ Supply chain

⑨ Brand

⑩ Relationships

(3) A **template** for EI decision making

(4) Approaches for effective EI decisions

① Joint analysis across **functions**

② Joint analysis across **firms**

③ **Regular review** for long-term tasks

④ Continuous **value stream optimisation** towards lean manufacturing

7.2.2 Summary of Module 2 – EI Management Function

The 2nd module (see Chapter 5) answers the 2nd research question. It can be summarised as follows:

(1) A VME's **functional structure** can be built around the VME's **value streams** which are supervised by **EI management functions** (see Figure 5.4, Chapter 5).

(2) **EI management functions** can take the following responsibilities to ensure proper operating along the VME metabolism:

① Ensuring value stream optimisation

② Improving EI compatibility

③ Internal resource allocation for EI

④ Gaining stakeholders' support for EI

⑤ Designing competency protection

⑥ Evaluating EI performance

⑦ EI knowledge management

7.2.3 Summary of Module 3 – VME Performance Measurement

The 3rd module (see Chapter 6) answers the 3rd research question. It can be summarised as follows:

(1) **VME performance measurement system** (VMEPMS) consists of two dimensions (see Figure 6.1):

① Evaluation of a VME's external operations

② Evaluation of a VME's internal operations

(2) The following **performance measures** (see Table 7.2, also shown in Appendix 3) can be used to evaluate **external** operations.

Table 7.2 Performance measures assessing external operations

M3.1 alliance parties' resource contributions
(1) Whether alliance parties' resource contributions complement each other
(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives
(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)
(4) Whether alliance parties have actually contributed the resources they have agreed to contribute
M3.2 alliance parties' dependency
(1) Our dependency on our partners
(2) Our partners' dependency on us

(3) Compatibility among alliance parties' objectives
(4) Our risks due to the alliance
(5) Our partners' risks due to the alliance
M3.3 alliance objectives
(1) The alliance objectives create a mutually acceptable win-win situation
(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)
(3) Whether the alliance objectives are achievable (such as feasibility report)
(4) Measures assessing alliance objective achievement (e.g. net profit/sales)
M3.4 resource protection
(1) Whether our company's resources have been put under effective protection
(2) Whether our company's resources under protection have been damaged
(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance
(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred
M3.5 alliance geographic location
(1) Whether the alliance geographic location helps achieve alliance objectives
(2) Whether the alliance geographic location helps protect our company's resources
M3.6 alliance managers
(1) Alliance managers' characteristics, such as their expertise
(2) Whether alliance managers have effectively conducted their responsibilities
M3.7 task allocation among alliance parties
(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)
(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)
(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)
(4) Whether task allocation avoids task duplication
M3.8 cross-partner teams
(1) Whether each cross-partner team has its clear purpose
(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)
(3) Cross-partner team members' characteristics, such as their expertise
(4) Whether team members can effectively communicate with each other
(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)
M3.9 alliance decision making
(1) Whether key alliance decisions are made with alliance parties' consensus
(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support
M3.10 alliance assets sharing
(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets
(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions
(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us
M3.11 partners' post-dissolution activities
(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised
M3.12 alliance parties' operational conflicts
(1) Alliance parties' operational conflicts with the alliance

(2)	Alliance parties' operational conflicts with each other
M3.13 trust among alliance parties	
(1)	Whether alliance parties are comfortable with their partners' performance
(2)	Alliance parties' commitment to the alliance
(3)	Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)
(4)	How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)
(5)	Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them
(6)	Whether open communication exists among alliance parties
(7)	Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks
M3.14 alliance supporters	
(1)	Whether sufficient supporters of the alliance exist on the side of each alliance party
(2)	Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

7.2.4 Why The 3 Modules

The **research problem** is: How to transform a traditional manufacturing company into a Virtual Manufacturing Enterprise?

The above three modules are considered as contributing to the transformation of a traditional manufacturing company into a VME due to their capability of interaction for achieving the **VME metabolism** (see Figure 7.1)

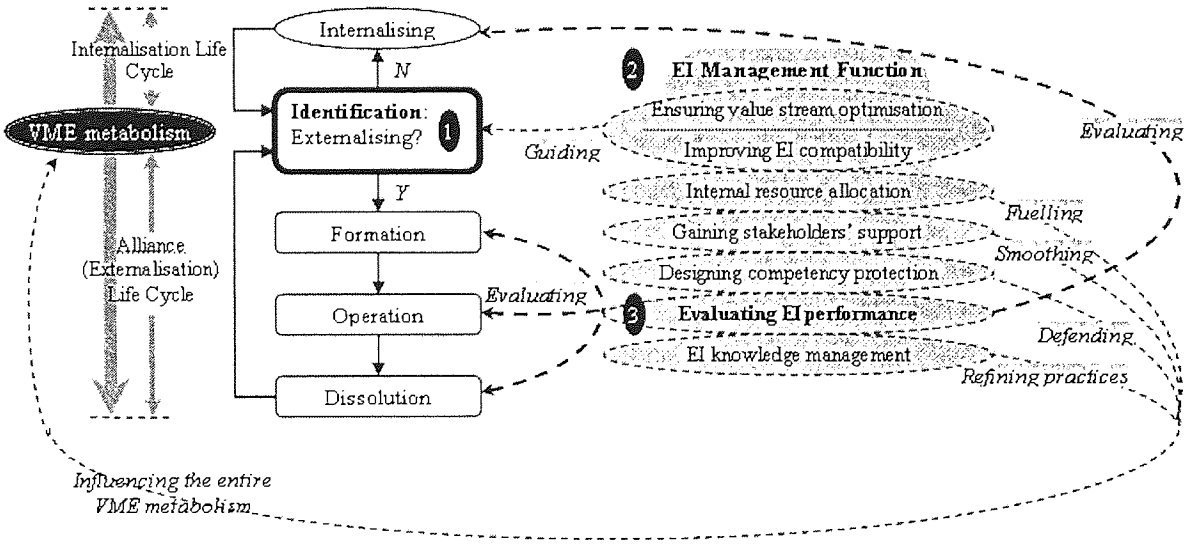


Figure 7.1 Interaction of the three modules to achieve the VME metabolism

(1) For the "**Identification**" stage

The 1st module provides an EI analysis template directly targeted for facilitating the "identification" stage. The 2nd module includes functions of "ensuring value stream optimisation" and "improving EI compatibility" to guide proper configuration of external & internal operations. It also integrates functions of fuelling ("internal resource allocation"), smoothing ("gaining stakeholders' support"), and refining ("EI knowledge management") the "identification" practices.

(2) For the "**Alliance**" & "**Internalisation**" life cycles

The EI Management Function and other functions along the value streams form the VME functional structure. This structure provides a mechanism to fuel, smooth, and refine relevant practices required at various stages of the "Alliance" & "Internalisation" life cycles. It also helps build a defending system (through the function "designing competency protection") to ensure that no competency leakage would happen during life cycle operations.

Using the "VME Performance Measurement System" (the 3rd module), the EI Management Function and other functions along the value streams monitor & control the performance of both external & internal operations, which is an important element for improving VME performance.

Identifying good/best practices of alliance formation & operation (e.g. Das and Teng, 2003) is one of the research categories in the literature. This research does not fall in this category, but indicates that "EI knowledge management" is a crucial factor in continuous improvement of EI practices.

Thus, the Reference Model provides the following **functions**:

- ***Guiding***: the Model provides an EI analysis template guiding the Identification stage; it also clarifies the relationship between lean operation and virtual manufacturing, and how value stream optimisation guides EI configuration.
- ***Fuelling***: the "internal resource allocation" responsibility of the EI Management Function helps fuel a company's internal & external operations properly.
- ***Smoothing***: the "gaining stakeholders' support" responsibility of the EI Management Function helps smooth a VME's operations throughout its entire VME metabolism.
- ***Defending***: the "designing competency protection" responsibility of the EI Management Function helps establish a defending system for a VME to protect its competencies from leakage and damage during its operations along the VME metabolism.

- ***Evaluating***: the Model indicates how a VME can be evaluated, and provides a detailed Alliance Performance Measurement System for evaluating external operations across the entire alliance life cycle.
- ***Refining***: the Model justifies the importance of Knowledge Management (KM) to continuous refinement of EI practices, and thus distinguishes itself from other models in the literature regarding alliance formation & operation best practices. The integration of "Knowledge Management" into the EI Management Function ensures that KM would be conducted for continuous improvement of EI practices towards value stream optimisation.

7.3 Case Study Companies

7.3.1 Profiles of Case Study Companies

Using the sampling strategy explained in Chapter 3, seven companies were studied, each of which has a unique profile along a range of different characteristics:

Note: The numbers (e.g. 3462) are the Standard Industrial Classification Codes (D&B, 2002).

(1) **Company A**

Operating in the 'Iron and steel forgings (3462)' industry, the company's main products are forgings of carbon steel, low alloy steel, and stainless steel used for pressure vessels and chemical machines of petrochemical and chemical factories. The company has around 50 employees. With its headquarter in China, the company's markets are located in China and Japan.

Since its foundation, the company persisted in *"good combination, grand scale production and nice service for clients"*, and formed extensive alliances with **suppliers** and **clients**. The company delegated almost all of its manufacturing activities to suppliers, and itself focused on NPD. Through these alliances, the company saved large amounts of fixed assets (factories) investment, effectively tracked industrial trends, secured orders, and kept one step ahead of its competitors.

After several years' successful operation, the company is now gradually investing on building its own new factories. Meanwhile, it began to reduce its collaborations with suppliers step by step. The objective is to build up the production capacity to satisfy normal amount of orders, and external suppliers are called upon only when orders exceed the capacity. This means that collaborations with suppliers are reduced but won't be removed completely.

(2) **Company B**

Operating in the 'Steel foundries (3325)' industry, the company's main products are various steels for forging, heavy steel castings and alloy steel ingots for fields of fossil power, nuclear power, ship building, metallurgy and chemical industries, etc. The company has around 290 employees. With its headquarter in China, the company's markets are located in China.

The company has alliances with **suppliers** and **clients**. The major objective of alliances with **suppliers** is to ensure product quality. Alliances with **clients** are mainly for tracking industrial trends, securing orders, reducing customer requirement uncertainty, and new product development. Through alliances with **clients**, the company effectively keeps steps ahead of its competitors in identifying customer needs and developing new products. For each component (or service) to be supplied, the company has relationships with at least two **suppliers**, which to some degree prevents their opportunistic behaviours.

(3) **Company C**

Operating in the 'Motor vehicles and motor vehicle equipment (3710)' and 'Motor vehicle parts and accessories (3714)' industries, the company's main products are mini/cargo vans, and auto parts. The company has around 21,000 employees. With its headquarter in China, the company's markets are located in China.

The company has alliances with **suppliers**, **distributors**, **clients**, and **universities**. It also set up joint ventures with **foreign auto manufacturers**. The major purposes of its alliances with **suppliers** are for NPD and controlling product quality. Its alliances with **distributors** are used for market analysis and shelf space control, and alliances with **clients** are for NPD. It also keeps close relationships with local **universities** for using their technologies, human resource, and laboratories. Under the impetus of Chinese industrial policies, the company set up joint ventures with major **auto manufacturers** around the world with the purposes of attracting foreign investment and improving its own management skills and product technologies.

(4) **Company D**

Operating in the 'Construction machinery and equipment (3531)' industry, the company's main products are construction tower crane & components. The company has around 150 employees. With its headquarter in China, the company's markets are located in South East Asia.

Currently, the company has a technology transfer alliance with **an Italy company** producing construction towers. The Italy partner also allows the company to use its brand to market products.

Since the company is still in its startup stage, it has not yet set up alliances with suppliers, clients, etc. but these alliances are currently in planning by the company.

(5) **Company E**

Operating in the 'Metal heat treating (3398)' industry, the company provides heat treatment for parts of power station appliance and forgings of pressure vessels. The company has around 65 employees. With its headquarter in China, the company's markets are located in China.

In addition to its alliances with **clients** for tracking industrial trends, securing orders, reducing customer requirement uncertainty, and developing new products, it also has a joint venture with a **local governmental authority**. The joint venture attempted to strengthen the company's production capacity in order to accommodate the perceived industrial trend. The local authority's ownership of land and factory, and its relationships with local governmental bodies, are very helpful for the joint venture's quick startup & smooth operation.

(6) **Company F**

Operating in the 'General industrial machinery and equipment (3569)' industry, the company's main product is lathe. The company has around 200 employees. With its headquarter in the UK, the company has a global market.

In addition to partnerships with the suppliers who have the expertise that the company does not have (e.g. latest auto loading lathe), the company starts to form close collaboration with customers to lift its technology and become more customer focused. The company also has manufacturing partnership in China to allow it to lower costs.

(7) **Company G**

Operating in the 'Motor vehicle parts and accessories (3714)' industry, the company's main product is driveline. The company has around 18,000 employees. With its headquarter in the UK, the company has a global market.

In addition to **supply chain partnerships**, and **close collaboration with customers** (e.g. resident engineers within customers), the company also has **joint ventures** for developing new products, and **joint ventures** with foreign partners for entering new geographic areas such as China.

7.3.2 Theoretical Niche of the Selected Cases – the External Reliability

As explained in Section 3.4.3 "Sampling Strategy" and Section 3.6 "Validity and Reliability", the **theoretical niche** of case study companies demonstrates the **scope** within which a qualitative research can be **replicated**; in other words, the research's **external reliability**. In this research, the theoretical niche of the case study companies is summarised in Table 3.3, and repeated here in Table 7.3:

Table 7.3 External reliability (i.e. theoretical niche) of this field research (replication of Table 3.3)

		A	B	C	D	E	F	G
Industry (Code)	Iron and steel forgings (3462)	✓						
	Steel foundries (3325)		✓					
	Motor vehicles and motor vehicle equipment (3710)			✓				
	Motor vehicle parts and accessories (3714)			✓				✓
	Construction machinery and equipment (3531)				✓			
	Metal heat treating (3398)					✓		
	General industrial machinery and equipment (3569)						✓	
Size	Small ≤100	✓ 50				✓ 65		
	100< Medium ≤250				✓ 148		✓ 200	
	250< Large		✓ 290	✓ 21,000				✓ 18,000
Location	China (developing)	✓	✓	✓	✓	✓		
	UK (developed)						✓	✓
Market Scope	National		✓ China	✓ China		✓ China		
	Regional	✓ China; Japan			✓ South East Asia			
	Global						✓	✓

7.3.2.1 Categories and Range of Values

To help illustrate the theoretical niche, four characteristics are selected. They are described as follows.

- **Industry**: is classified according to the Standard Industrial Classification Codes (D&B, 2002). The numbers (e.g. 3462) are industrial codes.
- **Size**: has three values, ranging from **small**, **medium**, to **large** according to whether the company had up to 100, up to 250, or over 250 employees respectively (Denton & Hodgson, 1997). Although there is no universal definition of Small, Medium, or Large (Williams, 1998), the

classification of the size of an organisation according to the number of employees is well established (Hughes et al., 1994; Weaver et al., 1995)

- **Location**: has two values, **China** and **UK**, representing developing countries and developed countries respectively.
- **Market scope**: has three values, ranging from **national** (e.g. within China), **regional** (e.g. within Asia), to **global** (worldwide).

7.4 Case Study Results

Case studies were carried out through the process described in Section 3.4.1 "Data Collection Methods". The data collected from each case study was then processed using the "Case Study Analysis Template" (see Appendix 4). The case study findings are described in this section to demonstrate the **Reference Model's function** of helping firms identify what they need to do in order to transform to VMEs.

7.4.1 Summary of Case Study Findings

7.4.1.1 Company A

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- The company uses joint analysis across functions for its EI decisions, which helps bring together useful knowledge from within the company. For example, marketing, engineering, and production functions are gathered together for deciding the level of cooperation with suppliers for developing specific new products. These functions possess information regarding customer needs, engineering and production capacities that greatly influence the decisions.
- The company regularly reviews its EI decisions for long-term tasks, which helps ensure such decisions' up-to-date effectiveness. For example, the company regularly (twice a year) reviews its relationships with suppliers to see whether specific alliances should be continued or discontinued according to industrial trends, own capacity development, suppliers' performance, etc.

Do not (Weaknesses):

- The company doesn't use any approach to make sure that its value streams can be continuously optimised towards lean operation. This triggers a risk that the company's external and internal operations were configured not for the purpose of adding value to its products/services.

- The company doesn't use joint analysis across firms for its EI decisions, which means that useful knowledge from outside the company can't be brought together, thus increasing the possibility of making wrong decisions. For example, no suppliers were involved in the company's decision-making process for internalising many of its operations once outsourced to suppliers, such as heat-treating. Although the decision facilitated to overcome outsourcing's cost and delivery problems, the company lost the opportunity to further strengthen its supplier relationships to jointly overcome the problems, and also made the company less flexible by adding fixed assets for non-core operations.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Improving EI compatibility: This practice helps improve synergy of external and internal operations. For example, when investing on building new factories, the company checked the compatibility between its alliances with suppliers and the operations to be internalised through the new factories, and began to eliminate its collaborations with suppliers step by step. New collaborations with suppliers are also set up for the company to learn needed expertise from them.
- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. In the company, large resource allocations (e.g. building factories) are controlled by the Chief Engineer and General Manager; small resource allocations are controlled by functional managers (e.g. the production manager is responsible for allocating site coordinators to suppliers).
- Gaining stakeholders' support for EI: This practice helps reduce stakeholders' objections to the company's external and internal operations, elicit their suggestions, and co-design EI operations to gain their support. For example, the company regularly (twice a year) visits its clients and communicate effectively on its operational issues. Useful suggestions were usually provided by the clients for shaping future collaboration.
- Designing competency protection: This practice helps protect the company's competencies. For example, the company has designed information controlling procedures to help prevent technology leakage.
- Evaluating EI performance: This practice helps control the performance of the company's EI operations. For example, the company evaluates its alliances with suppliers to see whether the performance reaches expectation; if not, operational adjustments (e.g. helping suppliers learn more) follow.

Do not (Weaknesses): The company doesn't have the following practices

- Ensuring value stream optimisation: Lack of this practice triggers a risk that the company's external and internal operations are configured mindlessly not for the purpose of adding value to its products/services. For example, no analysis has been made for the company's current stock

management approach as to whether, how & how much the approach contributes to lead-time and cost performance.

- EI knowledge management: Lack of knowledge management practices greatly deterred the company from refining its EI practices to achieve higher performance. For example, no efforts were made by the company for preserving its alliance managers' knowledge, and facilitating information sharing among them; no analysis template was generated through previous experience of outsourcing and insourcing decisions (e.g. outsourcing and insourcing heat-treating, physical & chemical testing, etc.) to reduce work and error duplication; no training is provided to alliance managers and on-site coordinators for them to cope with alliance issues.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

A.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

All performance measures for assessing "*alliance parties' resource contributions*" are used by the company. This helps ensure that partners' resource contributions are individually complementary, and collectively sufficient for achieving alliance objectives. For example, the company formed alliances with suppliers according to whether their equipment can be effectively combined with its expertise, and whether the collectiveness is sufficient for satisfying customer needs.

Do Not Use (Weaknesses)

None

A.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(1) Our dependency on our partners

(4) Our risks due to the alliance

These performance measures help identify the company's level of dependency on its partners: e.g. its dependency on suppliers for using their equipment, and its risks of expertise leakage and suppliers' underperforming.

Do Not Use (Weaknesses)

(2) Our partners' dependency on us

(3) Compatibility among alliance parties' objectives

(5) Our partners' risks due to the alliance

Neglecting the above three measures means that inter-partner dependency (especially in the long term) cannot be clearly identified. For example, the company is not clear about its suppliers' dependency on it, and their risks due to the alliances. It is also not clear about its suppliers' long-term objectives, thus the alliances' long-term stability.

A.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures for assessing "*alliance objectives*" are used by the company. This helps ensure that achieving alliance objectives would produce acceptable & beneficial results for each of the alliance parties. For example, in its supplier partnerships, the company saved equipment investment; while the suppliers learned new production expertise, and also secured a client.

Do Not Use (Weaknesses)

None

A.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

(1) Whether our company's resources have been put under effective protection

(2) Whether our company's resources under protection have been damaged

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

These measures help assess the company's resource protection approaches and their outcomes. For example, the company deliberately designed its production tasks outsourced to suppliers so that no single supplier could have a chance to get an overview of the company's entire expertise.

Do Not Use (Weaknesses)

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Neglecting this measure triggers a risk that the company might overlook signals of partners' competency-acquisition intentions, thus missing a chance of identifying such intentions at an early alliance stage. For example, the company is not sure whether its suppliers have activities with such intentions as setting up competing businesses. An early identification of partners' intentions of competency acquisition can guide the company's subsequent competency protection design.

A.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

This measure helps ensure that the location design favours alliance objective achievement. For example, suppliers' learning occurs at their factories, which facilitates their learning by doing. Suppliers' locations are also one of the major considerations for improving delivery performance.

Do Not Use (Weaknesses)

(2) Whether the alliance geographic location helps protect our company's resources

Improper design of alliance geographic location may cause competency leakage. Although the current choice of alliance locations has less chance to cause competency leakage, if the company allows its suppliers to learn in its factories (especially over a long period), competency leakage may occur through the suppliers' observation, conversation with on-site operators, recording (e.g. via taking pictures & videos) and even dishonest behaviours (e.g. stealing technical documents).

A.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Alliance managers' characteristics, such as their expertise

(2) Whether alliance managers have effectively conducted their responsibilities

All performance measures for assessing "*alliance managers*" are not used by the company. Ignoring the assessment of alliance managers' characteristics can become the root cause of ignoring alliance manager selection and training. Since alliance managers' characteristics significantly influence alliance performance, selecting unqualified managers puts the alliances in dangers from the very beginning. It might be too late to take any rescue actions, or practically unfeasible to replace managers, when negative results have occurred. Assessing whether alliance managers have effectively conducted their responsibilities is the ultimate way of telling whether an alliance manager is qualified for his job. Neglecting the assessment of this aspect blurs the company's view of its alliance managers' performance.

A.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

(4) Whether task allocation avoids task duplication

All performance measures for assessing "*task allocation among alliance parties*" are used by the company, which helps ensure that task allocation is designed for both task performance and competency protection. For example, when allocating production tasks to suppliers, the company not only checks that the suppliers have the right equipment and expertise, but also makes sure that no single supplier can have an overview of the company's entire expertise.

Do Not Use (Weaknesses)

None

A.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

(4) Whether team members can effectively communicate with each other

These performance measures help assess the effectiveness of team purposes. For example, teams were set up for teaching suppliers production techniques, the results of which were reflected in the fact that whether suppliers' product quality has been improved. In addition, assessing team members' communication effectiveness facilitates information flow among team members, thus improving team efficiency.

Do Not Use (Weaknesses)

(3) Cross-partner team members' characteristics, such as their expertise

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

Ignoring the assessment of cross-partner team members' characteristics can become the root cause of ignoring cross-partner team members' selection and training; since the characteristics (e.g. communication skills) significantly influence team performance, selecting unqualified team members puts the team tasks in dangers from the very beginning. For example, the company needs to ask questions like "*whether the on-site coordinators dispatched to suppliers are qualified for tackling alliance issues*". In addition, improper design of cross-partner teams may cause competency leakage due to the learning that usually occurs among team members. For example, the company needs to ask questions like "*do the on-site coordinators dispatched to suppliers possess knowledge that is considered to be protected from leaking to the suppliers*"; if yes, the coordinators need to be properly trained to protect the knowledge in their day-to-day interactions with the suppliers.

A.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

To get partners' support & cooperation, it is necessary to gain their consensus about key alliance decisions. For example, a change of product design has to be effectively communicated to relevant suppliers. Similarly, effective communication with stakeholders about key alliance decisions also smoothes alliance operations due to the stakeholders' support. The company uses these two performance measures.

Do Not Use (Weaknesses)

None

A.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

These three performance measures are **not relevant** to the company, since no alliance assets are involved in its alliances.

A.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

The performance measure helps reduce the company's risks resulted from its partners' post-dissolution activities. For example, alliances with suppliers are designed so that no single supplier can have an overview of the company's entire expertise. This means that even if a supplier intends to operate competing business after the alliance, it is not able to acquire the company's entire expertise from the alliance.

Do Not Use (Weaknesses)

None

A.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

During alliance formation stage, potential conflicts need to be assessed and prevented at an early stage. During alliance operation stage, conflicts also need to be monitored and removed before they escalate to a level which will produce severe negative effects. The company claimed that such conflicts were not assessed because they never happened. However, "never happened" doesn't mean "won't happen". In addition, in case that a supplier operates or intends to operate competing business while still having alliance with the company, the conflicts may be hidden, but the risk is great. When the conflicts escalate to a level which produces severe negative effects (e.g. the supplier establishes a strong market position), it might be too late

to rescue. This means that in order to prevent such risks, the company needs to investigate into key aspects, rather than just observing the apparent phenomena.

A.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

These measures help assess trust from the aspects of partners' performance, commitment, morality, openness, and willingness to act on other partners' behalf, which have strong influence on inter-partner trust.

Do Not Use (Weaknesses)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

If an alliance party perceives the gaps as caused by its partners' under-commitment, the trust and satisfaction of the party on its partners will be reduced, thus causing many other negative effects, such as the party's uncooperative behaviours, restricted information exchange, and unstable alliance relationship. Cultural behaviours also have strong influence on inter-partner trust. The company perceived that its staff's individual cultural behaviours caused distrust by its suppliers. However, such perceptions are just random occurrence, rather than regular assessment.

A.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

All performance measures for assessing "*alliance supporters*" are used by the company. This helps smooth alliance formation and operation through supporters' influence and efforts. For example, whether alliance supporters exist on the side of clients, and whether the alliance supporters can strongly influence the clients'

decisions, are crucial factors for forming and maintaining close partnerships with clients. The General Manager of the company invested considerable time in developing personal relationships with the key decision makers on the client sides.

Do Not Use (Weaknesses)

None

Overall Conclusion

The case study result demonstrated that the Reference Model designed in this thesis could help Company A identify its strengths and weaknesses for VME transformation.

The following recommendations were given to the company:

> The company's value streams need to be continuously optimised through formal approaches, such as the creation of a dedicated function. Value stream partners (e.g. suppliers, customers) need to be joined in the company's decision making processes of externalising/internalising its operations. The company is now making significant investment in building new factories, and began to reduce its collaborations with suppliers step by step. The above two activities can help judge whether, how, and how much this strategic movement is actually adding value to the company's products/services.
>
> Knowledge gained from the company's external & internal operations (e.g. how to improve suppliers' product quality) needs to be formally managed with the purpose of continuously improving the relevant performance. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) alliance parties' dependency; (2) resource protection; (3) alliance geographic location; (4) alliance managers; (5) cross-partner teams; (6) alliance parties' operational conflicts; (7) trust among alliance parties.

The following feedback was given by the company:

> This research confirmed our original strategy, and warned us of the potential risks of the current strategy. It also introduced some useful ideas to us, such as lean manufacturing, cross-firm analysis, and knowledge management.
>
> We never realised before the diversity of alliance performance measurement. Some of these issues mentioned in the research questionnaire have caused real problems in our alliance

experience. The alliance performance measurement approach helped us identify the issues that should be assessed but not given sufficient attention at the moment.

Hope to see some guidance regarding the implementation of lean manufacturing.

As to cross-firm analysis, we think our suppliers/customers won't provide relevant information to us if our company is not big enough, or they are not aware of the benefits out of it, thus causing difficulties in effective cross-firm analysis. At the same time, trust also plays an important role.

7.4.1.2 Company B

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- Joint analysis across functions is used for EI decisions. This helps bring together useful knowledge from different functions within the company. For example, marketing, purchasing, production planning, R&D, and quality functions are brought together to decide the level of cooperation with suppliers for developing and producing products. These functions possess information about customer needs, suppliers' capability, production capacity, engineering, and quality control that greatly influence the decisions.
- EI decisions for long-term tasks are regularly reviewed. This helps update decisions to ensure their effectiveness. For example, the company regularly reviews its relationships with suppliers to see whether specific alliances should be continued or discontinued according to its product strategy and suppliers' performance.

Do not (Weaknesses):

- No approach is used to ensure continuous value stream optimisation towards lean operation, which puts the company in a blindness of configuring its external & internal operations not for the purpose of removing wastes, and adding value to its products/services.
- Joint analysis across firms is not used for EI decisions, which increases the risk of making wrong decisions due to a lack of useful knowledge/information from outside the company. For example, no suppliers were involved in the company's efforts of strengthening its purchasing process.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Coordinating EI to improve their compatibility: This helps improve synergy of external and internal operations. For example, the company regularly checks the compatibility between its alliance portfolio and its product strategy, exploring potential synergy between them.

- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. In the company, resource allocations are normally decided by relevant functional managers.
- Gaining stakeholders' support for EI: This practice necessitates effective communication with stakeholders to reduce their objections and increase their support to EI proposals, thus maintaining good stakeholder relationships. For example, the company has regular meetings with its suppliers, discussing issues regarding its product strategies, new products, quality control, etc, thus discovering potential areas of cooperation that benefit both parties.
- Designing competency protection: This helps protect the company's competencies. For example, the company has a policy that "each supplier can only be involved with a maximum of one of its core technologies". This policy is followed when building alliances with suppliers.
- Evaluating EI performance: This helps control both external and internal operations' performance. For example, the company evaluates its alliances with suppliers from aspects such as resource contributions, dependency, alliance objectives, competency protection, etc.

Do not (Weaknesses): The company doesn't have the following practices

- Ensuring value stream optimisation: Lack of this practice puts the company at a risk that its EI configuration is not for the purpose of value creation. For example, no analysis has been made of the company's current order processing, production planning, purchasing, and more importantly their holistic process, as to whether, how & how much the process contributes to the company's value stream enhancement.
- EI knowledge management: Lack of knowledge management practices deterred the company from refining its external & internal operations for better performance. For example, alliance managers' knowledge gained from their experience was not captured, and no efforts were made for facilitating information sharing; no documents recording best alliance practices were generated through past alliance experience; no approach was taken to ensure employees' continuous development.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

B.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

All performance measures for assessing "*alliance parties' resource contributions*" are used by the company. These measures can help assess whether partners' resources are individually complementary, and collectively sufficient for alliance objectives. For example, the company recently formed an alliance with a local R&D institution for developing manufacturing equipment to improve its manufacturing capacity. Each alliance party' expertise is complementary to each other, and the collective knowledge is perceived as sufficient for achieving the alliance objective.

Do Not Use (Weaknesses)

None

B.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(1) Our dependency on our partners

(2) Our partners' dependency on us

(4) Our risks due to the alliance

(5) Our partners' risks due to the alliance

These performance measures assess inter-partner dependency & risks, thus helping identify alliance stability, and subsequent actions for stability improvement. For example, the company has a policy of "sharing risks with suppliers". It assessed its suppliers' risks, and took measures to reduce them, thus improved trust, and enhanced alliance stability.

Do Not Use (Weaknesses)

(3) Compatibility among alliance parties' objectives

Neglecting the identification of objective compatibility, especially for long term objectives, means a vague awareness of partners' long term dependency. For example, the company is not sure about its suppliers' long-term objectives, e.g. whether a supplier intends to strengthen its supplier position in the long term, and plans to invest for this objective, or it is going to operate competing businesses in the future.

B.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures for assessing "*alliance objectives*" are used by the company. These measures help identify whether achieving alliance objectives would actually produce win-win situation for each alliance party. For example, both the company and its suppliers can achieve clear and predictable benefits from their alliances: for the company, it secured reliable suppliers for continuous improvement of its product quality, while the suppliers secured a large client through close collaboration.

Do Not Use (Weaknesses)

None

B.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

(1) Whether our company's resources have been put under effective protection

(2) Whether our company's resources under protection have been damaged

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

These measures assess resource protection approaches and their outcomes. For example, the company deliberately designed its supplier alliance portfolio so that each supplier can only be involved with a maximum of one of its core technologies.

Do Not Use (Weaknesses)

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Neglecting this measure triggers a risk that signals of partners' intentions of competency acquisition might be overlooked; the company might not be able to identify such intentions at an early alliance stage, thus no guidance for its subsequent competency protection design.

B.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

This measure helps ensure that alliance location facilitates alliance objective achievement. For example, supplier training usually occurs at suppliers' factories, which facilitates their learning by doing.

Do Not Use (Weaknesses)

(2) Whether the alliance geographic location helps protect our company's resources

Neglecting this measure triggers competency leakage risks caused by improper design of alliance geographic location. Although the current choice of alliance locations is less likely to cause competency leakage, the company needs to be cautious if it allows its suppliers to learn in its factories (especially over a long period), because competency leakage may occur through the suppliers' observation, conversation with on-site operators, recording (e.g. via taking pictures & videos) or even dishonest behaviours (e.g. stealing technical documents).

B.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

(2) Whether alliance managers have effectively conducted their responsibilities

This performance measure helps tell whether an alliance manager is qualified for his job. The company has monthly and annual reviews of its alliance managers' performance.

Do Not Use (Weaknesses)

(1) Alliance managers' characteristics, such as their expertise

Ignoring assessment of alliance managers' characteristics can become the root cause of ignoring alliance manager selection and training. Since alliance managers' characteristics significantly influence alliance performance, selecting unqualified managers puts the alliances in dangers from the very beginning. It might be too late to take rescue actions, or practically unfeasible to replace managers, when negative results have occurred.

B.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

(4) Whether task allocation avoids task duplication

All performance measures for assessing "*task allocation among alliance parties*" are used by the company. This helps ensure that task allocation takes into consideration both task performance and competency protection. For example, when allocating production tasks to suppliers, the company not only checks that the suppliers have the right expertise, but also makes sure that each supplier can only be involved with a maximum of one of its core technologies.

Do Not Use (Weaknesses)

None

B.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

These measures help assess the effectiveness of team purposes. For example, cross-partner teams were formed to improve suppliers' expertise, the results of which were reflected in suppliers' product quality improvement.

Do Not Use (Weaknesses)

(3) Cross-partner team members' characteristics, such as their expertise

(4) Whether team members can effectively communicate with each other

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

Ignoring the assessment of cross-partner team members' characteristics can become the root cause of ignoring the selection and training of cross-partner team members; since the characteristics (e.g. communication skills) greatly influence team performance, selecting unqualified team members puts the team tasks in dangers from the very beginning. For example, the company needs to ask questions like "*whether the people we dispatched to our suppliers for improving their expertise are qualified for tackling alliance issues*".

Ineffective communication causes negative effects on information flow among team members, deterring teams from achieving their purposes. In addition, cross-partner teams may cause competency leakage due to the learning that usually occurs among team members. Thus, such teams need to be properly design to reduce the risks. For example, the company needs to ask questions like "*do the people we dispatched to our suppliers for improving their expertise possess knowledge that is considered to be protected from leaking to the suppliers*"; if yes, the people need to be properly trained to protect the knowledge in their day-to-day interactions with the suppliers.

B.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

Alliance parties can exert great influence on alliance decisions, and their subsequent implementation. Therefore, it is important to gain relevant partners' consensus about key alliance decisions. For example, changes in the company's product quality system (e.g. improvement of quality standards, changes of quality checking procedures) have to be effectively communicated to relevant suppliers to ensure their following. Similarly, effective communication with stakeholders about key alliance decisions also helps smooth alliance operations due to the availability of stakeholders' support.

Do Not Use (Weaknesses)

None

B.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

These three performance measures are **not relevant** to the company, since no alliance assets are involved in its alliances.

B.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

This performance measure helps reduce the company's risks due to its partners' post-dissolution activities. When perceiving such risks, the company would normally include "non-competition" clauses into partnership agreement (effective for a limited period after partnership dissolution).

Do Not Use (Weaknesses)

None

B.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

These two kinds of operational conflicts were not assessed by the company because "they never happened". However, "never happened" does not mean "won't happen", and further, because they have never been assessed, "never happened" does not mean "never happened in fact". For example, in case that a supplier operates or intends to operate competing business while still having alliance with the company, the conflicts may be well hidden.

B.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

These performance measures help assess trust from the aspects of partners' performance, commitment, morality, openness, and willingness to act on other partners' behalf, which have strong influence on inter-partner trust.

Do Not Use (Weaknesses)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

If an alliance party perceives the gaps as caused by its partners' under-commitment, its trust on the partners will reduce, producing negative effects, such as its uncooperative behaviours, and restricted information exchange. Cultural behaviours also have strong influence on trust. The company has a number of suppliers located in the northern part of China, while the company itself locates in Shanghai, a southern city. The company recognised that the northern-southern cultural difference sometimes caused misunderstanding.

B.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

All performance measures assessing "*alliance supporters*" are used. This helps smooth alliance formation and operation. The company commented that "no matter it was an alliance with suppliers, with clients, or with some research institutes, existence of powerful supporters on both sides strongly influenced the alliance stability. Many times, the leaving of a supporter from a partner signalled the end of the alliance."

Do Not Use (Weaknesses)

None

Overall Conclusion

The case study result discussed above demonstrated that the Reference Model helped Company B identify its strengths and weaknesses for VME transformation.

The following recommendations were given to the company:

Formal approaches need to be used to continuously improve the company's value streams. Such an approach could be the creation of a dedicated team across functions and value stream parties. Value stream parties (e.g. suppliers, customers) should be invited to join the company's decision making regarding operation externalisation/internalisation. The company has made significant investment in its purchasing process with the purposes of cutting costs & ensuring production. Collaboration with suppliers for improving the purchasing performance might be another useful approach in addition to the upgrading of its purchasing software system and joint analysis between the purchasing and production planning functions.

It would also be beneficial if the company could establish a formal knowledge management system to store, refine and utilise the vast amount of knowledge gained through its experience. This could help continuously improve the practices related to the company's alliance and internal

operations. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) alliance parties' dependency; (2) resource protection; (3) alliance geographic location; (4) alliance managers; (5) cross-partner teams; (6) alliance parties' operational conflicts; (7) trust among alliance parties.

The following feedback was given by the company:

> Through the interviews and the feedback, we became aware of lean manufacturing, and how the configuration of external and internal operations could help achieve the lean operation. We looked into our current processes, and identified areas of improvement.
>
> We had vast experience in partnerships with suppliers and customers, however, few activities have been done to systematically collect and analyse the knowledge gained and to share the knowledge within the company or with our partners. It would be useful to see details regarding how knowledge management practices could be customised and applied in our company.
>
> We are very interested in how to involve our suppliers and customers into value stream optimisation. Hope to see some details.

7.4.1.3 Company C

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- Joint analysis across functions is used. Such analyses help bring together useful information/knowledge from within the company. For example, R&D, Accounting, Technical, and Strategic Development functions were normally gathered together for decisions of foreign joint ventures.
- EI decisions for long-term tasks are regularly reviewed. This helps maintain the decisions' effectiveness over long term. For example, the company regularly reviews its joint venture performance to see whether situations have changed over time, or whether its original decisions are still valid. It terminated its joint venture with a major US auto manufacturer after realising that the joint venture products were not well accepted in its northern Chinese market.

Do not (Weaknesses):

- No approach is used to ensure continuous optimisation of value streams towards lean operation. This triggers a risk that EI operations have no/negative effects on its value stream performance.

- Joint analysis across firms is not used for EI decisions. This increases the possibility of making wrong decisions due to a lack of useful information/knowledge from outside the company. For example, during the company's decision making process of forming a joint venture with a major US Auto company to produce SUVs for northern Chinese market, no retailers & customers were involved for local market analysis. This joint venture turned out to be a market failure due to low market response to the joint venture products.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Coordinating EI to improve their compatibility: This practice helps explore potential synergy between external and internal operations. The company regularly examines compatibility between its supplier partnership portfolio and its product & purchasing strategies, improving their holistic performance.
- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. In the company, large resource allocation is normally decided jointly by the President and Vice Presidents; small resource allocation is normally decided by relevant functional managers.
- Gaining stakeholders' support for EI: In the company, this practice is performed by the President, Vice Presidents, and functional managers: e.g. President and Vice Presidents for shareholders; Public Relation department for government; Marketing department for customers. It helps reduce stakeholders' objections, and increase their support to EI proposals, thus smoothing subsequent operations.
- Designing competency protection: This practice helps protect the company's competencies. For example, the company requires investigation to be taken before proceeding to form close partnership with a supplier. The investigation focuses on whether the supplier provides similar services to the company's competitors, and what is the resulting consequence if the partnership is formed. According to the investigation results, restrictions might be included in the agreement if the partnership proceeds to formation.
- Evaluating EI performance: This helps monitor & control EI operations' performance. The company evaluates its joint ventures from aspects of alliance objectives, decision making, alliance assets sharing, etc.

Do not (Weaknesses): The company doesn't have the following practices

- Ensuring value stream optimisation: Lack of this practice increases the possibility that the company's external and internal operations are not adding values to its value streams. For example, no analysis has been made of the company's current NPD process as to whether, how & how much the process adds values to its products/services.

- EI knowledge management: Although debriefing meetings might capture employees' insights, information, lessens, etc. no formal & systematic KM practices are in place for managing the resulting knowledge. Lack of formal knowledge management practices deter the company from continuously optimising its external & internal operations.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

C.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

These measures can help assess in detail the complementarity & sufficiency of partners' resource contributions. For example, in its joint ventures with foreign auto manufacturers, the company mainly sought partners' resources from aspects of technical and managerial expertise, which complement its advantages in labour costs and land & factory ownerships.

Do Not Use (Weaknesses)

None

C.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(1) Our dependency on our partners

(2) Our partners' dependency on us

(4) Our risks due to the alliance

Accessing inter-partner dependency helps the company understand how stable an alliance is. Assessing its risks due to an alliance gives guidance for designing approaches to avoid/reduce the risks.

Do Not Use (Weaknesses)

(3) Compatibility among alliance parties' objectives

(5) Our partners' risks due to the alliance

Neglecting a clear identification of objective compatibility, especially in the long term, indicates a vague awareness of partners' long term dependency, and the company's potential risks in the long term. The company has a strategy of forming joint ventures with international competitors to develop, manufacture and market new products in its domestic market. Such partners' objectives are very likely to be incompatible with the company's, thus influencing the stability of the alliances or even put the company's domestic market in danger. For example, after its American partner took over the joint venture, it is now directly competing with the company in the northern Chinese market.

Partners' perception of risks strongly influences their perceived win-win situations. Identifying such risks can help the company reduce the perceived risks, thus improving its partners' trust, and enhancing their perceived benefits.

C.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures for assessing "*alliance objectives*" are used by the company. This helps identify whether the achievement of alliance objectives could generate benefits acceptable to each alliance party. For example, in its close collaboration with suppliers, both parties can achieve clear and predictable benefits: for the company, reliable component supply can be secured; for the suppliers, they won a large long term client who is almost predominant in the Northern Chinese auto market.

Do Not Use (Weaknesses)

None

C.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

(1) Whether our company's resources have been put under effective protection

This performance measure helps assess the company's approaches of competency protection: e.g. the company has a clear set of regulations regarding how its documents should be managed so that confidential information/knowledge won't leak out.

Do Not Use (Weaknesses)

(2) Whether our company's resources under protection have been damaged

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Not using the first two measures indicates a lack of assessment by the company of the actual effectiveness of its competency protection approaches. Neglecting the last performance measure increases the risk of overlooking signals of partners' intentions of competency acquisition.

C.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

This performance measure helps design alliance location for objective achievement. For example, the company's joint ventures were normally located at the northern part of China for using local labour, the company's supply and distribution networks, and its existing lands and factories.

Do Not Use (Weaknesses)

(2) Whether the alliance geographic location helps protect our company's resources

Improper design of alliance location may cause competency leakage. This is particularly true when alliance operations are carried out at the company's factories & laboratories, since in such situations, its partners (e.g. suppliers) may be able to acquire its expertise through observation, conversation, recording (e.g. via taking pictures & videos) or even dishonest behaviours (e.g. stealing technical documents).

C.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

(2) Whether alliance managers have effectively conducted their responsibilities

This performance measure helps judge an alliance manager's qualification according to his work results. For example, the company has regular reviews of its joint venture managers' performance.

Do Not Use (Weaknesses)

(1) Alliance managers' characteristics, such as their expertise

Emphasising alliance managers' characteristics helps build effective alliance manager selection and training procedures. Since alliance managers' characteristics significantly influence alliance performance, selecting unqualified managers puts the alliances in dangers from the very beginning. Special characteristics are required for alliance managers, especially when it comes to managing joint ventures with western partners whose managers have quite different culture.

C.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

(4) Whether task allocation avoids task duplication

These measures help improve task performance through proper task allocation. In its foreign joint ventures, Managers from the company were usually responsible for human resource, due to their knowledge about local labour and regulations. Managers from foreign partners were usually in charge of NPD, quality control, and production. Assistant managers from the company were allocated for NPD, quality control and production for learning purpose.

Do Not Use (Weaknesses)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

If cannot be regularly used or refreshed, specific expertise may deteriorate. Ignoring this performance measure increases such a risk.

C.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

(3) Cross-partner team members' characteristics, such as their expertise

The first two performance measures help assess the effectiveness of team purposes. For example, cross-partner teams were formed as the top-management bodies of its joint ventures, the performance of which was mainly reflected in these joint ventures' profitability, and the company's learning results. Assessing cross-partner team members' characteristics helps the company establish sound team-member selection and training procedures: e.g. the company has standard procedures for selecting and training its joint venture managers.

Do Not Use (Weaknesses)

(4) Whether team members can effectively communicate with each other

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

Effective communication is particularly important for cross-partner teams due to issues like culture difference, trust, and language barrier, which are all critical issues to the company's foreign joint ventures. In addition, cross-partner teams may cause competency leakage because such teams are usually facilitating environments where learning could easily happen through day-to-day interactions among team members.

C.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

Alliance parties & stakeholders can exert great influence on alliance decisions, and subsequent implementation. Therefore, it is important to have relevant partners' & stakeholders' consensus and support. It is a common practice among senior managers (from each of the joint venture parties) to reach consensus on key decisions. And normally it is also required to report the decisions back to parent companies.

Do Not Use (Weaknesses)

None

C.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

These measures help avoid partners' disputes on assets ownership, & increase their trust and commitment. The use of these performance measures is reflected, for example, in its joint venture contracts in terms of assets ownership, and profit sharing.

Do Not Use (Weaknesses)

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

Not using this measure increases the company's competition risk. Although the company's current joint venture portfolio does not show a clear relevance to such risks, when intellectual assets are involved in the company's future alliances, it is suggested that such risks should be taken into consideration.

C.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

Not using this measure increases the company's competition risk after alliances dissolve. For example, in its joint venture with an US auto manufacturer, after the US partner took over the joint venture, it became a competitor to the company in the northern Chinese market. The joint venture not only helped the US partner gain knowledge about the local market, but also helped it establish local supply chain in the northern Chinese market.

C.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

These measures help detect & solve potential/existing conflicts. A senior manager of the company indicated that "open conversation and communication in friendly atmosphere are very important for identifying & solving conflicts, alliance managers' personal characteristics and skills are crucial for such situations."

Do Not Use (Weaknesses)

None

C.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

These performance measures help assess trust from the aspects of partner performance, commitment, morality, and performance gap interpretation, which have strong influence on inter-partner trust.

Do Not Use (Weaknesses)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

Cultural behaviour interpretation, communication openness, and willingness to act on partners' behalf, are three important aspects influencing inter-partner trust. Ignoring the assessment of these three aspects might put trust in danger.

C.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

These two performance measures help assess whether the company has utilised alliance supporters to facilitate its alliance formation and operation. The company has common practices at the right beginning of the alliance formation stage to seek support of key decision makers on the sides of alliance partners.

Do Not Use (Weaknesses)

None

Overall Conclusion

The above case study result indicated the strengths and weaknesses of Company C in VME transformation. It illustrated the Reference Model's diagnostic function.

The following recommendations were given to the company:

> Formal approaches need to be in place to ensure continuous improvement of the company's value streams. Such approaches could be the creation of a dedicated team across functions and value stream parties, and setting up improvement targets on key processes. Joint analysis with value stream parties could also be adopted through close collaboration with key suppliers, distributors, service providers and clients. The company has many years' experience in the Northern Chinese market, and has established extensive and steady networks with local suppliers, distributors, service providers and clients. Making good use of these networks could greatly benefit the company.
>
> It is also beneficial if the company could have formal knowledge management practices to improve the effectiveness of knowledge capturing and sharing. For example, the company's size justifies the creation of an Intranet as a portal where useful information/knowledge could be stored, retrieved and shared among its staff and with its value stream partners. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) alliance parties' dependency; (2) resource protection; (3) alliance geographic location; (4) alliance managers; (5) task allocation among alliance parties; (6) cross-partner teams; (7) alliance assets sharing; (8) partners' post-dissolution activities; (9) trust among alliance parties. Some of these measures are particularly relevant to the company's foreign joint venture operations.

The following feedback was given by the company:

> This research provided a useful tool for assessing alliance performance. Some of the assessment issues included did cause problems in our alliance experience.
>
> We did not think too much before about joint analysis of value streams with external parties, but joint analysis across departments has been a common practice. We can see the feasibility of joint analysis with our suppliers to improve the performance of the supply chain. However, due to the cultural issues of the industry, lack of trust and a sense of collaboration might be the biggest barriers. It would be nice to see how to improve trust with suppliers, and enhance the collaboration culture in them.

7.4.1.4 Company D

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- Joint analysis across functions is used for EI decisions. Such analyses help channel together useful information from within the company, thus improving decision making. For example, R&D, Sales, and Production functions were usually gathered together for deciding product & marketing strategies and related alliance operations.
- EI decisions for long-term tasks are regularly reviewed to check their up-to-date effectiveness. For example, the company regularly reviews its technology transfer alliance to see whether any situational change (e.g. its technology advance) would challenge its original decision.

Do not (Weaknesses):

- No approach is used to ensure continuous value stream optimisation towards lean operation. This triggers a risk that the company's EI decisions are not adding value to its products/services.
- Joint analysis across firms is not used for EI decisions. This might cause wrong decisions due to insufficient collaboration with external parties. For example, no analysis has been made jointly with supply chain parties as to how to improve supply chain performance.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Coordinating EI to improve their compatibility: This practice helps avoid conflicts and improve synergy between external and internal operations. The company's technology transfer alliance was formed as an external support for achieving its product & market strategies on the South East Asia market.
- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. In the company, internal resource allocation is normally decided jointly by the President and Vice Presidents.
- Gaining stakeholders' support for EI: In the company, this practice is performed by the President, Vice Presidents, and functional managers: e.g. President and Vice Presidents for shareholders and strategic partners; Office for local government bodies. This practice helps smooth alliance formation and subsequent operation.
- Evaluating EI performance (high level evaluation): This helps control the company's entire operations, both external and internal. For example, its technology transfer alliance is assessed from aspects of alliance objectives, operational conflicts, trust, etc.

Do not (Weaknesses): The company doesn't have the following practices

- Ensuring value stream optimisation: Lack of this practice increases the risk of wasting time, financial & human resources in operations which cannot add values to the company's products/services. For example, no analysis has been made of the company's current supply chain and manufacturing processes as to whether, how & how much these processes add values to its products/services.
- Designing competency protection: So far, the company thinks itself as possessing no competencies compared to leading players in the world; thus no need to design competency protection. However, the company also acknowledged the fact that its technologies are advancing rapidly since setting up the technology transfer alliance with the Italian partner who possesses leading expertise in construction tower crane. Further, it recognised the fact that it now has expertise not possessed by local competitors in China. Therefore, potential risks can be perceived if competency protection is not in place.
- EI knowledge management: Although information sharing would occur in briefing & debriefing meetings, no formal & systematic KM practices are in place for managing the company's knowledge gained from EI experience. Lack of formal knowledge management practices might deter the company from continuously improving its external & internal operations.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

D.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

All performance measures for assessing "*alliance parties' resource contributions*" are used by the company. This helps ensure that partners' resource contributions are individually complementary, and collectively sufficient for alliance objectives. For example, the company has a technology transfer alliance with an Italian manufacturer of construction tower crane. The company's relationships with local governmental bodies, access to cheap local labour, and its distribution networks in South East Asia, complement its Italian partner's expertise and brand. This combination is perceived as feasible for achieving the South East Asia market.

Do Not Use (Weaknesses)

None

D.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(1) Our dependency on our partners

(2) Our partners' dependency on us

(3) Compatibility among alliance parties' objectives

(4) Our risks due to the alliance

(5) Our partners' risks due to the alliance

Accessing inter-partner dependency helps the company get insights into alliance stability. Assessing inter-partner risks helps the company understand how its partners perceive their risks, thus giving guidance to risk reduction, and enhancing perceived win-win situations. The company understands that its technology transfer partner faces a big risk regarding its brand. This understanding highlights the company's emphasis on quality control.

Assessing objective compatibility, especially in the long term, helps clarify alliances' long-term stability, and potential risks. In its technology transfer alliance, the Italian partner's long-term objective is to set up supplying & manufacturing bases in China, and build its reputation on the Asia market. The company's long-term objective is to became a stable manufacturing partner to the Italian manufacturer, and establish a stable market in South East Asia. Thus, long-term compatibility can be perceived.

Do Not Use (Weaknesses)

None

D.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures for assessing "*alliance objectives*" are used by the company. This helps identify each alliance party's benefits upon achieving alliance objectives, and the level of win-win situation. For

example, in its technology transfer alliance, the Italian partner secured a long-term reliable partner in Asia, and reduced its manufacturing costs; the company gained opportunity to acquire leading expertise in manufacturing construction tower crane, and strong brand support for its products.

Do Not Use (Weaknesses)

None

D.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Whether our company's resources have been put under effective protection

(2) Whether our company's resources under protection have been damaged

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

No performance measures assessing "resource protection" are used, because so far, the company thinks itself as possessing no competencies compared to leading players in the world; thus no need to design competency protection. However, the company also acknowledged the fact that its technologies are advancing rapidly since setting up the technology transfer alliance with the Italian partner who possesses leading expertise in construction tower crane. Further, it recognised the fact that it now has expertise not possessed by local competitors in China. Therefore, potential risks can be perceived if competency protection is not in place.

D.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

This performance measure helps achieve alliance objectives through designing proper alliance location. For example, the company's learning process in its technology transfer alliance regularly takes place in the company's factory, where experts from the Italian partner teach the company through "learning by doing".

Do Not Use (Weaknesses)

(2) Whether the alliance geographic location helps protect our company's resources

Competency protection is not currently a consideration by the company, so this performance measure is not used. However, it is suggested that alliance geographic location needs to be designed with the consideration of competency protection; improper design may cause competency leakage.

D.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

(2) Whether alliance managers have effectively conducted their responsibilities

Whether an alliance manager can effectively conduct his/her responsibilities is the ultimate way to tell the manager's qualification. Such judgements usually took place formally in the company through reporting and regular assessment meetings.

Do Not Use (Weaknesses)

(1) Alliance managers' characteristics, such as their expertise

Neglecting the assessment of alliance managers' characteristics might put alliances in dangers from the very beginning. The company selects alliance managers mainly according to their industrial experience, but largely ignores alliance-specific characteristics, such as negotiability, and trustworthiness. This triggers risks that managers might use traditional management approaches to manage alliances, which can cause alliance inefficiency even failure.

D.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

(4) Whether task allocation avoids task duplication

These measures help improve task performance through proper task allocation. In its technology transfer partnership, the company is responsible for manufacturing, and marketing in the South East Asia market, and the partner is responsible for smooth technology transfer. Such an allocation helps improve the company's manufacturing expertise, & utilise its local distribution networks, thus establishing a solid manufacturing & selling base for the partner in Asia.

Do Not Use (Weaknesses)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

Since the company is currently using its technology transfer partnership to increase its competencies, this performance measure is **not particularly relevant** to the company.

D.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

These two performance measures help assess the effectiveness of team purposes. For example, cross-partner teams were formed for technology transfer, the performance of which was mainly reflected in product quality improvement.

Do Not Use (Weaknesses)

(3) Cross-partner team members' characteristics, such as their expertise

(4) Whether team members can effectively communicate with each other

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

Ignoring the assessment of cross-partner team members' characteristics might result in selecting unqualified members, thus negatively influencing team performance. Effective communication is particularly important for the company's technology transfer partnership, due to issues like culture difference, trust, and language barrier.

Since the company is currently using its technology transfer partnership to increase its competencies, the design of cross-partner teams is **not particularly relevant** to the company's competency protection.

D.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

These performance measures help the company secure its partners' and stakeholders' support to alliance decisions and subsequent implementation.

Do Not Use (Weaknesses)

None

D.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

These three performance measures are **not relevant** to the company, since no alliance assets are involved in its alliances.

D.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

This performance measure helps prevent post-alliance competition risks. Although the company didn't perceive such risks for itself, it did perceive such risks for its technology transfer partner, in the case that it could successfully acquire expertise, and establish its own brand. Since the company's long-term objective is not to establish its own brand, but to become the partner's long-term Asia partner, such risks will not actually happen.

Do Not Use (Weaknesses)

None

D.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

These performance measures help detect potential/existing conflicts, giving guidance to design of solutions. The company indicates that good communication and joint operational design are very important to avoid such conflicts.

Do Not Use (Weaknesses)

None

D.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

These performance measures help assess trust from the aspects of partners' performance, commitment, morality, and performance gap interpretation, which have great influence on inter-partner trust.

Do Not Use (Weaknesses)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

Cultural behaviour interpretation, communication openness, and willingness to act on partners' behalf, are three important aspects influencing inter-partner trust. Ignoring the assessment of these three aspects might put trust in danger. Culture and communication issues are particularly important to the company's technology transfer partnership (with the Italian manufacturer) due to large geographical and national culture difference and language barriers.

D.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

The existence of strong alliance supporters at both sides of an alliance can greatly facilitate alliance formation and operation, and is also a crucial factor in alliance success. One of initial steps taken by the

company in forming its technology transfer partnership was to seek support from the Italian manufacturer's senior managers.

Do Not Use (Weaknesses)

None

Overall Conclusion

The case study result demonstrated the Reference Model's diagnostic function of helping Company D identify its strengths and weaknesses for VME transformation.

The following recommendations were given to the company:

Formal approaches need to be adopted to ensure continuous optimisation of the company's value streams. Such approaches could be the creation of a dedicated team across different functions within the company, and setting up improvement targets on key processes. Value stream parties could also be involved if feasible. The company has begun to think of establishing close collaboration with key suppliers, distributors, and clients. Joint analysis of value streams with relevant parties might be a good start for identifying potential long-term partners.

Through the technology transfer partnership with its Italian partner, the company began to increase technical capabilities, and distinguish itself from other local manufacturers. So it is now perhaps the time to consider how to protect and maintain this newly established competency, so that it won't leak to (potential) competitors, or deteriorate over time. The company is now considering the design of a systematic approach for competency protection.

It is also perceived as beneficial if formal knowledge management practices could be established to facilitate the capturing and sharing of good practices within the company. This could to some extent solve the problems facing the company of over-reliant on certain individuals, and lack of proper training approaches. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) resource protection; (2) alliance geographic location; (3) alliance managers; (4) cross-partner teams; (5) trust among alliance parties.

The following feedback was given by the company:

This research alerted us about the importance of expertise protection, and we are beginning to think of how to protect our expertise and prevent it from deterioration and leaking to competitors.

We are interested to see how knowledge management could help us solve the staff training issue.

We have learned something from the alliance performance measurement system. Some of the performance measures are difficult to use formally, but the awareness of these performance measures has itself improved our collaboration skills. Alliance performance could become more stable & controllable if all alliance parties could realise the various issues included in the system, and begin to deliberately assess them formally or mentally.

7.4.1.5 Company E

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- Joint analysis across functions is used for EI decisions. This helps get together useful information from relevant functions of the company. For example, the company's decision of forming a joint venture with one of the local governmental authorities in Shanghai is made based on the joint analyses across its functions of marketing, production, technology, accounting, and equipment management. These functions bring together information about customer needs, production capability, technical requirements, financial and equipment situations that greatly influence the decisions.
- EI decisions for long-term tasks are regularly reviewed to ensure their long-term effectiveness. For example, the company has quarterly internal reviews (not open to its partner) of its joint venture to justify its continuing/discontinuing.

Do not (Weaknesses):

- No approach is used to ensure continuous optimisation of value streams towards lean operation. This puts the company in risks of adding no value to its products/services through its external and internal operations.
- Joint analysis across firms is not used for EI decisions, which increases the possibility of making wrong decisions, since useful information from outside the company cannot be reached.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Coordinating EI to improve their compatibility: This helps avoid conflicts and explore potential synergy among external and internal operations. For example, the company regularly checks the compatibility between its alliance portfolio and its product strategy, increasing synergy between them. Its alliance with a local governmental authority is designed for the adjustment of its product strategy towards a predicted industrial trend.

- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. In the company, resource allocations are normally decided by relevant functional managers.
- Gaining stakeholders' support for EI: The company has regular meetings with its clients, discussing issues regarding both parties' product strategies, new products, quality control, etc, thus discovering potential areas of further cooperation that benefit both parties, and reaching consensus.
- Designing competency protection: This helps effectively protect the company's competencies. For example, personnel allocation was carefully designed for its joint venture to prevent key staff/knowledge leakage.
- Evaluating EI performance: This helps monitor the company's external and internal operations to control their performance. For example, the company evaluates its joint venture performance from aspects of resource contributions, dependency, alliance objectives, competency protection, etc.

Do not (Weaknesses): The company doesn't have the following practices

- Ensuring value stream optimisation: Lack of this practice triggers a risk that the company might configure its external and internal operations not for the purpose of removing wastes and adding values to its products/services. For example, no formal analysis has been made as to how the company's current alliance configuration benefits its entire process of order taking, order processing, production planning, purchasing, manufacturing, and delivery.
- EI knowledge management: Although alliance managers are encouraged to produce reports regularly documenting their alliance experience and learning, no formal & systematic knowledge management practices are in place for managing their knowledge, such as knowledge capturing, sharing. Lack of such practices might deter the company from improving its external & internal operations.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

E.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

All performance measures for assessing "*alliance parties' resource contributions*" are used by the company. These measures can help assess whether partners' resources are individually complementary, and collectively sufficient for alliance objectives. For example, in the company's joint venture with a local governmental authority, the company contributed equipment, expertise, and the majority of the human resource; while the local authority's ownership of lands and factories, and its relationships with local governmental bodies, are very helpful for the joint venture's quick startup & smooth operation.

Do Not Use (Weaknesses)

None

E.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(1) Our dependency on our partners

(2) Our partners' dependency on us

(4) Our risks due to the alliance

In addition to inter-partner dependency, the company also assesses its risks due to alliances. Such assessment not only helps identify alliances' stability, but also gives guidance for the company to reduce its risks. For example, in its joint venture with a local governmental authority, the company considered the risk of competency leakage, which forms the basis upon which the company designed its joint venture staff allocation to prevent the risk.

Do Not Use (Weaknesses)

(3) Compatibility among alliance parties' objectives

(5) Our partners' risks due to the alliance

Neglecting the identification of objective compatibility, especially in the long term, reflects a lack of insights into partners' long term dependency. For example, the company didn't investigate whether its joint venture partner had intentions of setting up competing business. Not assessing partners' risks due to alliances means a lack of insights into one of the key factors influencing partners' willingness to enter or continue an alliance.

E.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures for assessing "*alliance objectives*" are used by the company. This helps identify whether acceptable results can be produced for each alliance party upon achieving the alliance objectives. For example, both the company and its joint venture partner can achieve clear and predictable benefits: for the company, it saved investment in lands and factories, and utilised its partner's relationships with local governmental bodies to secure a quick startup of its new operation; for the local authority, it secured a large tax payer, and also shared profits from the joint venture.

Do Not Use (Weaknesses)

None

E.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

(1) Whether our company's resources have been put under effective protection

This measure helps the company design effective competency protection approaches. For example, the company deliberately designed its joint venture operation and staff allocation so that its core competencies would not leak out through the joint venture.

Do Not Use (Weaknesses)

(2) Whether our company's resources under protection have been damaged

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Not using the first two measures indicates a lack of assessment of the actual effectiveness of its competency protection approaches. Neglecting the last measure triggers a risk of overlooking signals of partners' competency acquisition.

E.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

This measure helps design alliance location to facilitate objective achievement. For example, when deciding the joint venture location, the company took into consideration product delivery performance, and convenience of information exchange.

Do Not Use (Weaknesses)

(2) Whether the alliance geographic location helps protect our company's resources

Improper design of alliance location may cause competency leakage. Actually, such a situation has already occurred in its collaborations with clients for developing new products. Such collaborations normally took place in the company's factory and laboratory. One of its clients successfully learned its core expertise, and gradually terminated collaboration with the company, and internalised similar heat-treating operations.

E.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

(1) Alliance managers' characteristics, such as their expertise

(2) Whether alliance managers have effectively conducted their responsibilities

All performance measures for assessing "*alliance managers*" are used by the company. This helps select and train alliance managers, and tell whether they are actually qualified according to their performance.

Do Not Use (Weaknesses)

None

E.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

(4) Whether task allocation avoids task duplication

All performance measures for assessing "*task allocation among alliance parties*" are used by the company. This helps ensure that task allocation facilitates both task performance improvement and competency protection. For example, the company is responsible for the day-to-day operational management of the joint venture due to its vast experience in the business, while the local partner is responsible for coordinating the joint venture's relationships with local governmental bodies. The company also carefully designed its staff allocation in the joint venture to ensure competency protection. Since the front line workers are all coming from local labour market, the joint venture actually improved local labour's skills, which is a big benefit for the local partner.

Do Not Use (Weaknesses)

None

E.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

The first two measures help assess the effectiveness of team purposes. For example, in the company's cooperation with its clients, cross-partner teams were formed to improve the company's understanding of its clients' requirements, which was reflected in product quality improvement. The company also carefully designed its staff allocation in the joint venture, which helps prevent competency leakage due to the learning that usually occurs in cross-partner teams.

Do Not Use (Weaknesses)

(3) Cross-partner team members' characteristics, such as their expertise

(4) Whether team members can effectively communicate with each other

Ignoring the assessment of cross-partner team members' characteristics can become the root cause of ignoring the selection and training of cross-partner team members. Since the characteristics (e.g. communication skills) greatly influence team performance, selecting unqualified team members puts the team tasks in dangers from the very beginning.

Ineffective communication negatively influences information flow among team members, thus deterring teams from achieving their purposes. This may be important for the company's joint venture, since its partner locates in the suburb of Shanghai, where the local labour's accent is very different from the standard Shanghai language.

E.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

Alliance parties can exert great influence on alliance decisions, and subsequent implementation. Therefore, it is important to gain relevant partners' consensus about key alliance decisions. This is particularly

important for the company's joint venture, since its partner is the local governmental authority, who can exert great influence on the company's local operations. The company also regularly exchanges information with its clients regarding the design of its product strategies, quality control, etc. which it believes can help enhance its customer relationships.

Do Not Use (Weaknesses)

None

E.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

All performance measures for assessing "*alliance assets sharing*" are used by the company. This helps reduce future disputes on assets ownership, increase partners' commitment & trust, and reduce competition risks. The use of these performance measures is reflected in, for example, the joint venture contract in terms of assets ownership, profit sharing, and clauses restricting competition.

Do Not Use (Weaknesses)

None

E.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

This performance measure helps reduce the risk that a potential competitor uses an alliance to increase its competitiveness. The use of this performance measure is reflected in, for example, the joint venture contract, and the company's design of joint venture staff allocation.

Do Not Use (Weaknesses)

None

E.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

Neglecting the assessment of alliance parties' operational conflicts might allow such conflicts escalate to an unsolvable level, damaging alliance performance, or even destroying the alliance.

E.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

These performance measures help assess trust from the aspects of partners' performance, commitment, morality, openness, and willingness to act on other partners' behalf, which have strong influence on inter-partner trust.

Do Not Use (Weaknesses)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

If performance gaps are perceived by some partner as caused by others, trust might deteriorate. Cultural behaviours also have strong influence on trust. Cultural issues might be particularly important for the company's joint venture, since most managers of the joint venture come from the central part of Shanghai, while other employees come from the local labour force, which has quite different life style, and a much

lower level of education and income. Language barrier also exists, since the local people most speak with quite different accent from the standard Shanghai language

E.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

All performance measures assessing "*alliance supporters*" are used. This helps smooth alliance formation and operation. At the very beginning of its joint venture formation, the company established good relationship with the key persons in charge of the local area's business development. These persons have strong voice in the local governmental authority's decision making, and they also have strong personal relationships with the heads of other local governmental bodies.

Do Not Use (Weaknesses)

None

Overall Conclusion

The case study result discussed above demonstrated that the Reference Model has helped Company E identify its strengths and weaknesses for VME transformation.

The following recommendations were given to the company:

Formal approaches, such as dedicated teams for achieving improvement targets on key processes, need to be in place to ensure continuous value stream optimisation. Key (potential) clients should be involved if feasible in its decision making regarding operation externalisation/internalisation.

Knowledge gained from the company's external & internal operations (e.g. how to set up & manage joint ventures) needs to be formally managed with the purpose of improving the performance of similar operations in the future. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) alliance parties' dependency; (2) resource protection; (3) alliance geographic location; (4) cross-partner teams; (5) alliance parties' operational conflicts; (6) trust among alliance parties.

The following feedback was given by the company:

The alliance performance measurement system is comprehensive. We learned new knowledge from using this system to assess our alliance performance. We think it is necessary to reassess the issues mentioned in the feedback, so that we can have an accurate evaluation of our alliance performance.

Due to the size of our company, cross-firm joint analysis is very difficult to achieve, unless our clients can also realise its importance, and come to us for help.

7.4.1.6 Company F

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- Continuous optimisation of value streams towards lean operation is ensured in the company through, e.g. Product Strategy Committee meetings. This gives proper guidance of collaboration with value stream parties.
- Joint EI analysis across functions either comes up through Product Strategy Committee meetings or else through formal monthly management meetings. This helps bring together useful information from within the company.
- EI decisions for long-term tasks are regularly reviewed to ensure their long-term effectiveness. Such reviews normally took place through formal monthly management meetings.

Do not (Weaknesses):

- Joint analysis across firms is not used for EI decisions, which increases the possibility of making wrong decisions, since useful information from outside the company, such as from suppliers and customers, cannot be reached.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Ensuring value stream optimisation: This practice helps the company target its EI operations towards value creation of its products/services. Product Strategy Committee meetings are used to ensure continuous improvement of value streams.
- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. Ultimately the MD is responsible, but with strong input from the management team (board of directors) as well as external consultant.

- Designing competency protection: This practice helps protect the company's competencies. For example, the company designed its alliance tasks, cross-partner teams, and partners' post-dissolution activities, in order to put its competencies under effective protection.
- Evaluating EI performance: This helps monitor thus control the company's external and internal operations. For example, the company evaluates its alliance performance from aspects of resource contributions, alliance objectives, geographic location, alliance managers, task allocation, cross-partner teams, decision making, partners' post-dissolution activities, operational conflicts, trust, etc.

Do not (Weaknesses): The company doesn't have the following practices

- Coordinating EI to improve their compatibility: Conflicts might exist among the external and internal operations of the company, and potential synergy might also wait to be explored.
- Gaining stakeholders' support for EI: Lack of this practice might cause stakeholders' opposing or in-cooperation to the company's EI operations.
- EI knowledge management: Formal & systematic KM practices are not in place, such as capturing experts' knowledge, establishing environment facilitating knowledge sharing, and disseminating knowledge among staff. Knowledge sharing is an important issue for the company due to its large international presence. Lack of formal & systematic approaches for managing knowledge might deter the company from continuously optimising its external & internal operations.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

F.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

These performance measures can help assess whether partners' resource contributions are individually complementary, and collectively sufficient for achieving alliance objectives. The use of these measures is reflected in contracts/agreements.

Do Not Use (Weaknesses)

None

F.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(4) Our risks due to the alliance

Detecting such risks can provide guidance to the subsequent design of risk reduction.

Do Not Use (Weaknesses)

(1) Our dependency on our partners

(2) Our partners' dependency on us

(3) Compatibility among alliance parties' objectives

(5) Our partners' risks due to the alliance

Neglecting these measures blurs the company's perception of inter-partner dependency (especially in the long term). The company does not assess its partners' risks due to the alliance. Partners' such risk perception can be an important factor in alliance stability.

F.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures assessing "*alliance objectives*" are used. This helps identify alliance objective achievability, and partners' mutual benefits upon achieving the objectives.

Do Not Use (Weaknesses)

None

F.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

(1) Whether our company's resources have been put under effective protection

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

The first measure helps the company design effective competency protection approaches. For example, competency protection is designed from the aspects of task allocation, cross-partner teams, and post-dissolution activities. The second measure helps assess the results of competency protection through observing partners' or other companies' competencies status.

Do Not Use (Weaknesses)

(2) Whether our company's resources under protection have been damaged

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Not using the first measure indicates a lack of assessment by the company of its competency protection approaches' actual effectiveness. Neglecting the last measure triggers a risk that signals of partners' competency acquisition might be overlooked.

F.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

(2) Whether the alliance geographic location helps protect our company's resources

Alliance locations might influence both alliance performance (e.g. locations of suppliers) and competency protection (e.g. locations of R&D partnerships). These two performance measures help the company assess both types of influence.

Do Not Use (Weaknesses)

None

F.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

(1) Alliance managers' characteristics, such as their expertise

(2) Whether alliance managers have effectively conducted their responsibilities

All performance measures assessing "*alliance managers*" are used by the company. This gives guidance to alliance manager selection and training, helps judge whether they are qualified according to actual alliance performance.

Do Not Use (Weaknesses)

None

F.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

(4) Whether task allocation avoids task duplication

These measures help ensure that task allocation facilitates both alliance performance improvement and competency protection. The company indicated that although sometimes tasks might be deliberately duplicated, most times avoiding task duplication should be a criterion.

Do Not Use (Weaknesses)

None

F.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

(3) Cross-partner team members' characteristics, such as their expertise

(4) Whether team members can effectively communicate with each other

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

Cross-partner teams are assessed by the company from the aspects of purpose, team members' characteristics, communication, and competency protection. Assessing these aspects help more effectively control cross-partner teams for improving their performance and protecting competencies.

Do Not Use (Weaknesses)

None

F.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

Alliance parties and stakeholders might be able to exert great influence on alliance decisions, and subsequent implementation. Therefore, it is important to gain their consensus & support to key alliance decisions. The company also indicated that there might be situations where a partner was forced to accept a decision; however, such a situation was rare.

Do Not Use (Weaknesses)

None

F.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

None

Do Not Use (Weaknesses)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

These three performance measures are **not relevant** to the company, since no alliance assets are involved in its alliances.

F.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

An alliance might help a potential competitor increase its competitiveness. This performance measure helps monitor and control such a risk. The company indicated that this performance measure tended to be valid for a limited period, usually through contracts or international patents.

Do Not Use (Weaknesses)

None

F.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

These types of conflicts might negatively influence alliance performance. Use of the two performance measures help monitor, thus control such conflicts.

Do Not Use (Weaknesses)

None

F.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

These performance measures help assess trust from the aspects of partners' performance, commitment, morality, interpretation of performance gaps, interpretation of cultural behaviours, communication, and willingness to act on partners' behalf. Each of these aspects has strong influence on inter-partner trust. The company indicates that trust-related issues are very important soft side of an alliance relationship. Without this soft side ready, the alliance is deemed to fail even when all physical assets are ready.

Do Not Use (Weaknesses)

None

F.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

All performance measures assessing "*alliance supporters*" are used. This helps smooth alliance formation and operation through supporters' influence & efforts.

Do Not Use (Weaknesses)

None

Overall Conclusion

Company F's strengths and weaknesses for VME transformation have been identified through applying the Reference Model to the company's scenario. This demonstrated the Reference Model's relevant diagnostic function.

The following recommendations were given to the company:

Value stream parties (e.g. suppliers, customers) should be joined in the company's decision making processes of externalising/internalising its operations. The company also needs to check the compatibility among its existing alliances and internal operations to improve their synergy. Although managers have been authorised large autonomy in their decision making, gaining stakeholders' support might still be a sensible behaviour to smooth the decision making regarding operation externalisation/internalisation, and subsequent implementation.

Knowledge gained from the company's external & internal operations (e.g. how to learn from partnerships) needs to be formally managed with the purpose of continuously improving the relevant operations' performance. The company now starts to form close collaboration with customers to lift its technology. Knowledge management might be able to make such collaboration more effective, and transfer good learning practices among its alliances with different customers. The company's manufacturing partnerships in China also pose a challenge: how to involving its remote foreign partners into its value stream improvement. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) alliance parties' dependency; (2) resource protection.

No feedback was given by the company.

7.4.1.7 Company G

Module 1: EI Decisions & VME Metabolism

Do (Strengths):

- Continuous optimisation of value streams towards lean operation is ensured in the company through setting improvement targets on all key processes. This gives guidance of forming proper collaboration with value stream parties.
- Joint analysis across functions is used for EI decisions. The company operates a process based organisation that goes across functions. This helps get together useful information from relevant functions within the company.
- EI decisions for long-term tasks are regularly reviewed to ensure their long-term effectiveness. The approaches used include: annual formal management review supported by periodic regional operating reviews of performance.

Do not (Weaknesses):

- Joint analysis across firms is not used for EI decisions, which increases the possibility of making wrong decisions, since useful information from outside the company, especially from parties along the value streams, such as suppliers and customers, cannot be reached.

Module 2: EI Management Function

Do (Strengths): The company has the following practices

- Ensuring value stream optimisation: This practice helps the company target its EI configuration towards value stream optimisation. The company has improvement targets on all key processes to ensure their continuous improvement.
- Coordinating EI to improve their compatibility: This practice can help avoid conflicts and explore potential synergy among external and internal operations.
- Internal resource allocation for EI: As necessities, internal resources were allocated for both external and internal operations. Process owners who are responsible for the achievement of executive approved KPIs (key performance indicators) are responsible for resource allocation.
- Designing competency protection: Competency protection is designed from the aspects of cross-partner teams, alliance assets sharing, contractual restrictions, etc., which helps prevent competency leakage and deterioration.
- Evaluating EI performance: This helps monitor thus control the company's external and internal operations. For example, the company evaluates its joint venture performance from aspects of resource contributions, partner dependency, alliance objectives, alliance managers, task allocation, cross-partner teams, decision making, partners' post-dissolution activities, operational conflicts, trust, etc.

Do not (Weaknesses): The company doesn't have the following practices

- Gaining stakeholders' support for EI: Lack of this practice might cause stakeholders' opposing or in-cooperation to the company's EI operations.
- EI knowledge management: Although some KM related activities can be perceived in the company, e.g. staff may be consulted on how to improve alliance performance, formal & systematic KM practices are not in place, such as environment facilitating knowledge sharing, and capturing experts' knowledge. Knowledge sharing is an important issue for the company due to its large international presence. Lack of formal & systematic approaches for managing knowledge might deter the company from continuously improving its external & internal operations.

Module 3 – VME Performance Measurement

The company evaluates both external and internal operations. For assessing its external operations, the company uses & doesn't use the following performance measures:

G.M3.1 Alliance parties' resource contributions (4 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' resource contributions complement each other

(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

These measures can help assess whether partners' resources are individually complementary, and collectively sufficient for alliance objectives. The use of these measures is reflected in the relationship definition in contracts.

Do Not Use (Weaknesses)

(4) Whether alliance parties have actually contributed the resources they have agreed to contribute

Neglecting this performance measure might blur the company's sights of its partners' operational efficiency and commitment. For example, in its joint ventures in China, assessing whether the local partners contribute resources as agreed can help judge their operational efficiency, and commitment to the joint ventures.

G.M3.2 Alliance parties' dependency (5 performance measures in total)

Use (Strengths)

(1) Our dependency on our partners

(2) Our partners' dependency on us

(3) Compatibility among alliance parties' objectives

(4) Our risks due to the alliance

(5) Our partners' risks due to the alliance

All performance measures assessing "*alliance parties' dependency*" are used by the company. These measures help clearly identify alliance stability, and inter-partner dependency & risks, thus giving the company a macro-control mechanism for its alliances: the company could take actions to increase its partners' dependency on it, reduce their risks, and improve long-term objective compatibility, so that alliances could become more stable.

Do Not Use (Weaknesses)

None

G.M3.3 Alliance objectives (4 performance measures in total)

Use (Strengths)

(1) The alliance objectives create a mutually acceptable win-win situation

(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

(3) Whether the alliance objectives are achievable (such as feasibility report)

(4) Measures assessing alliance objective achievement (e.g. net profit/sales)

All performance measures assessing "*alliance objectives*" are used by the company. This helps identify whether mutually acceptable & beneficial results could be produced upon achieving the alliance objectives.

Do Not Use (Weaknesses)

None

G.M3.4 Resource protection (4 performance measures in total)

Use (Strengths)

(1) Whether our company's resources have been put under effective protection

(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance

The first measure helps the company design effective competency protection approaches. For example, competency protection is designed from the aspects of cross-partner teams, alliance assets sharing, and contractual restrictions. The second measure helps assess the results of competency protection through observing partners' or other companies' competencies status.

Do Not Use (Weaknesses)

(2) Whether our company's resources under protection have been damaged

(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Not using the first measure indicates a lack of assessment by the company of the actual effectiveness of its competency protection approaches. Neglecting the last measure triggers a risk that signals of partners' competency acquisition might be overlooked.

G.M3.5 Alliance geographic location (2 performance measures in total)

Use (Strengths)

(1) Whether the alliance geographic location helps achieve alliance objectives

(2) Whether the alliance geographic location helps protect our company's resources

Alliance locations might influence both alliance performance (e.g. locations of suppliers for delivery performance) and competency protection (e.g. locations of R&D partnerships for blocking partners' access to core R&D facilities). These two performance measures help assess both types of influence.

Do Not Use (Weaknesses)

None

G.M3.6 Alliance managers (2 performance measures in total)

Use (Strengths)

(1) Alliance managers' characteristics, such as their expertise

(2) Whether alliance managers have effectively conducted their responsibilities

All performance measures for assessing "*alliance managers*" are used by the company. This gives guidance to the selection and training of alliance managers, and the judgement of their qualification according to actual alliance performance.

Do Not Use (Weaknesses)

None

G.M3.7 Task allocation among alliance parties (4 performance measures in total)

Use (Strengths)

(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)

(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

These measures help ensure that task allocation facilitates both performance improvement and competency protection. Sometimes, a task might not be allocated to the most suitable supplier, but the company will make it to be the most suitable.

Do Not Use (Weaknesses)

(4) Whether task allocation avoids task duplication

The company might deliberately duplicate tasks among its partners to identify the most suitable one. This provides **opposite evidence**.

G.M3.8 Cross-partner teams (5 performance measures in total)

Use (Strengths)

(1) Whether each cross-partner team has its clear purpose

(3) Cross-partner team members' characteristics, such as their expertise

(4) Whether team members can effectively communicate with each other

(5) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)

Cross-partner teams are assessed by the company from the aspects of purpose, team members' characteristics, communication, and competency protection. Assessing these aspects help more effectively control cross-partner teams for improving their performance and protecting competencies.

Do Not Use (Weaknesses)

(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)

Ignoring the assessment of team purpose achievement makes the team performance less controllable towards its objectives.

G.M3.9 Alliance decision making (2 performance measures in total)

Use (Strengths)

(1) Whether key alliance decisions are made with alliance parties' consensus

(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

Alliance parties and stakeholders might be able to exert great influence on alliance decisions, and subsequent implementation. Therefore, gaining their consensus & support to key alliance decisions facilitates the decision making and implementation.

Do Not Use (Weaknesses)

None

G.M3.10 Alliance assets sharing (3 performance measures in total)

Use (Strengths)

(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us

All performance measures for assessing "*alliance assets sharing*" are used by the company. This helps reduce future disputes on assets ownership, increase partners' commitment and trust, and reduce competition risks. The use of these performance measures is reflected, for example, in the joint venture contract in terms of assets ownership, profit sharing, and clauses restricting competition. However, the company also indicated that once decision regarding alliance assets sharing has been made at the formation stage, no change in the future. This means although alliance assets might be shared fairly at the beginning, situations might change that the assets are no long shared fairly as time passes.

Do Not Use (Weaknesses)

None

G.M3.11 Partners' post-dissolution activities (1 performance measure in total)

Use (Strengths)

(1) Whether our competition risks caused by our partners' post-dissolution activities have been minimised

An alliance might help a potential competitor increase its competitiveness. This performance measure helps monitor and control such a risk.

Do Not Use (Weaknesses)

None

G.M3.12 Alliance parties' operational conflicts (2 performance measures in total)

Use (Strengths)

(1) Alliance parties' operational conflicts with the alliance

(2) Alliance parties' operational conflicts with each other

These types of conflicts might negatively influence alliance performance. Use of the two performance measures help monitor, thus identify such conflicts at an early stage before they escalate to a level beyond control.

Do Not Use (Weaknesses)

None

G.M3.13 Trust among alliance parties (7 performance measures in total)

Use (Strengths)

(1) Whether alliance parties are comfortable with their partners' performance

(2) Alliance parties' commitment to the alliance

(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)

These performance measures help assess trust from the aspects of partners' performance, commitment, morality, and interpretation of performance gaps, which have strong influence on inter-partner trust.

Do Not Use (Weaknesses)

(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them

(6) Whether open communication exists among alliance parties

(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks

Neglecting these performance measures might increase risks of trust deterioration among partners due to the issues of conflicting cultural behaviours, restricted information flow, and partners' unwillingness to act on others' behalf.

G.M3.14 Alliance supporters (2 performance measures in total)

Use (Strengths)

(1) Whether sufficient supporters of the alliance exist on the side of each alliance party

(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

All performance measures assessing "*alliance supporters*" are used. This helps smooth alliance formation and operation through supporters' influence & efforts on each side of the alliance parties.

Do Not Use (Weaknesses)

None

Overall Conclusion

The Reference Model helped Company G identify its strengths and weaknesses for VME transformation. This demonstrated the Reference Model's relevant diagnostic function.

The following recommendations were given to the company:

> Joint analysis across its value stream parties (e.g. suppliers, customers) should be used for the company's decision making regarding operation externalisation/internalisation. Although managers have large autonomy in their decision making, gaining stakeholders' support might still be a sensible way to smooth the decision making regarding operation externalisation/internalisation, and the subsequent implementation.
>
> Knowledge from the company's external & internal operations (e.g. market knowledge, technical expertise) needs to be formally managed. The company's current main product "driveline" has reached a mature stage. Developing "young" product(s) with growing market is challenging the company. Leveraging the company's existing knowledge assets accumulated throughout years may be able to offer solutions. The company is now embarking on its knowledge management initiative. When evaluating alliance performance, additional performance measures, as detailed in the above case study result, need to be included for assessing the following issues: (1) resource protection; (2) cross-partner teams; (3) trust among alliance parties.

No additional feedback was given by the company.

7.4.2 Cross Case Observations

The case study results generated from the Reference Model have backed up its **function** of helping firms identify what they need to do in order to transform to VMEs. When these individual case study results are being cross-observed, some interesting phenomena can be seen.

7.4.2.1 Similarity across Firms

A number of similarities can be perceived across the case study companies.

Module 1: EI Decisions & VME Metabolism

Do (strength)

- Joint analysis across functions

- Regular review of EI decisions for long-term tasks

All case study companies carry out joint analysis across functions for their EI decisions, and regularly review EI decisions for long-term tasks. These practices turn out to be performed in all case study companies regardless of their industries, locations, sizes, and market scopes. These practices are perceived by the case study companies as must for doing proper jobs. Most times, it is necessary to communicate among different functions in order to get required information & knowledge, and also involve all relevant functions from an early stage. Companies also set regular reviews at the very beginning of long-term tasks for controlling purpose.

Do Not (weakness)

- Joint analysis across firms

None of the case study companies has this practice. Generally speaking, the companies do not want to involve external firms into EI analysis due to a lack of trust and/or unawareness of potential benefits. Joint analysis across firm means an extensive exchange of information, which requires a high degree of trust.

Module 2: EI Management Function

Do (strength)

- Internal resource allocation for EI
- Evaluating EI performance

These two practices are necessary for performing and controlling EI operations, thus carried out by all of the case study companies. In general, internal resource allocation is controlled centrally, although managers' levels of autonomy may differ from each other.

Do Not (weakness)

- EI knowledge management

None of the case study companies has formal and systematic approaches for managing their EI knowledge. This is largely due to managers' unawareness of the benefits that could be delivered by knowledge management practices. Only company G is currently launching a knowledge management initiative.

Module 3 – VME Performance Measurement

Use (Strengths)

Both external and internal operations are assessed in each of the case study companies, no matter their industries, locations, sizes, and market scopes.

The following performance measures are used by all case study companies, which reflect unanimous emphasis among the companies on the relevant issues. Especially, all performance measures assessing "alliance parties' resource contributions", "alliance objectives", "alliance decision making", and "alliance supporters" are used across all case study companies, because they are considered as the most important alliance issues.

- *(Measures assessing "alliance parties' resource contributions"; 4 out of 4 measures are used by all case study companies)*

  M3.1 (1) Whether alliance parties' resource contributions complement each other

  M3.1 (2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives

  M3.1 (3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)

  M3.1 (4) Whether alliance parties have actually contributed the resources they have agreed to contribute

- *(Measures assessing "alliance parties' dependency"; 1 out of 5 measures is used by all case study companies)*

  M3.2 (4) Our risks due to the alliance

- *(Measures assessing "alliance objectives"; 4 out of 4 measures are used by all case study companies)*

  M3.3 (1) The alliance objectives create a mutually acceptable win-win situation

  M3.3 (2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)

  M3.3 (3) Whether the alliance objectives are achievable (such as feasibility report)

  M3.3 (4) Measures assessing alliance objective achievement (e.g. net profit/sales)

- *(Measures assessing "alliance geographic location"; 1 out of 2 measures is used by all case study companies)*

  M3.5 (1) Whether the alliance geographic location helps achieve alliance objectives

- *(Measures assessing "task allocation among alliance parties"; 2 out of 4 measures are used by all case study companies)*

  M3.7 (1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)

  M3.7 (3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)

- *(Measures assessing "cross-partner teams"; 1 out of 5 measures is used by all case study companies)*

  M3.8 (1) Whether each cross-partner team has its clear purpose

- *(Measures assessing "alliance decision making"; 2 out of 2 measures are used by all case study companies)*

  M3.9 (1) Whether key alliance decisions are made with alliance parties' consensus

  M3.9 (2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support

- *(Measures assessing "alliance assets sharing"; 2 out of 3 measures are used by all case study companies)*

  M3.10 (1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets

  M3.10 (2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions

- *(Measures assessing "trust among alliance parties"; 3 out of 7 measures are used by all case study companies)*

  M3.13 (1) Whether alliance parties are comfortable with their partners' performance

  M3.13 (2) Alliance parties' commitment to the alliance

  M3.13 (3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)

- *(Measures assessing "alliance supporters"; 2 out of 2 measures are used by all case study companies)*

  M3.14 (1) Whether sufficient supporters of the alliance exist on the side of each alliance party

  M3.14 (2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions

Do Not Use (Weaknesses)

Only one performance measure [M3.4 (4)] is not used by any of the case study companies. Some case study companies never thought about the relevant risks; others are aware of the risks, but not actually monitoring them.

- *(Measures assessing "resource protection"; 1 out of 4 measures is not used by all case study companies)*

  M3.4 (4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred

Case study companies were selected according to their industries, locations, sizes, and market scopes. Since each case study company is selected to be in a different industry, "industry" is not used to sort case study results for cross case observation. "Location", "size", and "market scope" are used for cross case observation.

7.4.2.2 Cross Case Observation by "Location"

Case study results are sorted by "location" to identify potential patterns between the Chinese and the UK case study companies (see Appendix 5).

Module 1: EI Decisions & VME Metabolism

- Continuous optimisation of value streams towards lean operation

Do (strength): the UK case study companies (F; G)

Do Not (weakness): the Chinese case study companies (A; B; C; D; E)

Chinese case study companies all exhibit lack of practices related to value stream optimisation: none of them takes any approach to ensure the value streams' continuous improvement. In comparison, UK case study companies are more aware of "lean operations", and actively improve their value stream performance. The managers of the Chinese companies are generally unaware of "lean operations". They also didn't feel competition pressure strong enough to force them to scrutinise their value streams for waste reduction and value creation.

Module 2: EI Management Function

- Ensuring value stream optimisation

Do (strength): the UK case study companies (F; G)

Do Not (weakness): the Chinese case study companies (A; B; C; D; E)

For the same reason stated above, the Chinese case study companies all exhibit a lack of function to ensure value stream optimisation.

- Gaining stakeholders' support for EI

Do (strength): the Chinese case study companies (A; B; C; D; E)

Do Not (weakness): the UK case study companies (F; G)

Lack of "gaining stakeholders' support for EI" is perceived as a weakness of the UK case study companies. However, regarding shareholders, this reflects a higher level of trust between shareholders and managers in the UK companies, and a higher degree of autonomy authorised to the UK managers.

Module 3 – VME Performance Measurement

- **M3.5 (2)** Whether the alliance geographic location helps protect our company's resources

Do (strength): the UK case study companies (F; G)

Do Not (weakness): the Chinese case study companies (A; B; C; D; E)

This performance measure is used by all of the UK case study companies, but not by any of the Chinese case study companies. One reason is that the UK case study companies have more established R&D facilities (people, mechanism, equipment, technologies). Alliance partners are more likely to target such facilities for competency acquisition through partnerships.

Generally speaking, the UK case study companies use more performance measures to assess their external operations than the Chinese case study companies (see Table 7.4). However, the reason is considered as more about "market scope" rather than "location", as explained in Section 7.4.2.4.

Table 7.4 UK case study companies use more performance measures than Chinese case study companies

		No. of measures **not** used
UK case study companies	F	9
	G	8
Chinese case study companies	A	16
	B	14
	C	15
	D	15
	E	12

7.4.2.3 Cross Case Observation by "Size"

Case study results are sorted by "size" to identify potential patterns between the small, medium, and large sized case study companies (see Appendix 6). However, no pattern is observed for any of the three modules.

7.4.2.4 Cross Case Observation by "Market Scope"

Case study results are sorted by "market scope" to identify potential patterns among the case study companies with national, regional and global market scope (see Appendix 7). Since the case study companies with global market scope are all UK companies, similar patterns are observed as those patterns when sorted by "location".

Module 1: EI Decisions & VME Metabolism

- Continuous optimisation of value streams towards lean operation

Do (strength): the case study companies with global market scope (F; G)

Do Not (weakness): the case study companies with regional (A; D) & national market scope (B; C; E)

From the aspect of "market scope", companies with global markets gained more experience through surviving their local and regional markets, and competing on global markets, realising how value stream improvement is crucial for their business. In addition, where distant supply chains are involved in international collaboration, how to reduce lead time, cut supply chain cost, and how to control product quality, also become extremely important to global market success.

Module 2: EI Management Function

- Ensuring value stream optimisation

Do (strength): the case study companies with global market scope (F; G)

Do Not (weakness): the case study companies with regional (A; D) & national market scope (B; C; E)

For the same reasons stated above, the case study companies with global market scope all exhibit a function of ensuring value stream optimisation.

- Gaining stakeholders' support for EI

Do (strength): the case study companies with regional (A; D) & national market scope (B; C; E)

Do Not (weakness): the case study companies with global market scope (F; G)

Lack of "gaining stakeholders' support for EI" is perceived as a weakness of the case study companies with global markets. However, regarding shareholders, this reflects a higher level of trust between shareholders and managers, and a higher degree of autonomy authorised to local managers.

Module 3 – VME Performance Measurement

- **M3.5 (2)** Whether the alliance geographic location helps protect our company's resources

Do (strength): the case study companies with global market scope (F; G)

Do Not (weakness): the case study companies with regional (A; D) & national market scope (B; C; E)

The case study companies with global markets tend to take into consideration the alliance geographic location's influence on competency protection. Such knowledge is gained from their global alliance experience where foreign partners might intend to acquire their competencies through working geographically together. This is why most international joint ventures in China do not involve core R&D activities.

Generally speaking, the case study companies with global markets use more performance measures to assess their external operations than the companies with regional & national markets (see Table 7.5). This is perhaps because global companies have more alliances (especially international alliances) in place which require deeper cooperation, thus more requirements on controlling alliance performance. There is also slight difference between companies with regional markets and companies with national markets; however, the difference is not obvious.

Table 7.5 Global firms use more performance measures than regional & national firms

		No. of measures **not** used
Global	F	9
	G	8
Regional	A	16
	D	15
National	B	14
	C	15
	E	12

7.4.2.5 Conclusion of Cross Case Observations

The majority of the practices in the Reference Model have been observed in the case study companies. There were also some practices not observed in any of the case study companies: joint analysis across firms; EI knowledge management; and the use of the alliance performance measure "*Whether our partners set up facilities (such as a factory, a team, etc.) for their own use (without our permission), in which our resources under protection can be used/generated/transferred*". These are the areas where both the Chinese and the UK case study companies need to improve.

As to "continuous optimisation of value streams towards lean operation", within the theoretical niche of this research, the Chinese companies and the companies with national/regional market scope generally exhibited a lack of awareness of its importance. To achieve VME transformation, they need to introduce "lean thinking" into their operations, and invest significant effects and resources in the building of a mechanism to ensure continuous improvement of value streams.

As to "gaining stakeholders' support for EI", within the theoretical niche of this research, the UK companies and the companies with global market scope might need to think about how to combine the benefit of authorising high autonomy to managers' with the benefit of gaining stakeholders' support.

As to "alliance performance measurement", within the theoretical niche of this research, the Chinese case study companies and the companies with national/regional market scope need to adopt more performance measures for controlling their alliance performance.

"Size" of the companies within the theoretical niche has no significant influence on the companies' practices related to the Reference Model, since no particular pattern was observed when the case study results were sorted by "size".

7.4.3 Feedback from Case Study Companies

After each case study company was given the respective case study result, it has an opportunity to comment on the case study result or the project in general from three aspects:

(1) Completeness of the Reference Model

(2) Representation of Current Process

(3) Additional Feedback

Questions were designed to represent these three aspects (see Appendix 8 "Case Study Feedback Questionnaire").

Due to the change of personnel in Company F, contact in this case study company was lost. Feedback from this company was therefore not obtained, although the case study result has been given to it.

7.4.3.1 Completeness of the Reference Model

To gather companies' feedback regarding the completeness of the Reference Model, "what missing" questions were designed, for example:

- Are there any practice(s) that are missing from the feedback, but could improve the effectiveness of the decision making regarding whether external or internal operations should be used for a certain task? [Yes/No]
- Are there any practice(s) that are missing from the feedback, but could help manage external & internal operations to improve their holistic performance? [Yes/No]

The feedback from the case study companies indicated that the Reference Model exhibited a complete coverage, and no relevant issues were missed.

7.4.3.2 Representation of Current Process

To gather companies' feedback regarding the Reference Model's representation of the case study companies' current processes, a space was given at the end of each feedback, allowing the companies to indicate mis-interpretation if perceived, for example:

One item of feedback given to the company:

- Joint analysis across firms is not used for EI decisions, which increases the possibility of making wrong decisions, since useful information from outside the company, especially from parties along the value streams, such as suppliers and customers, cannot be reached.

	Please cross (✗) if the relevant information you gave has been **wrongly** interpreted

No negative feedback was obtained from the case study companies indicating any wrong interpretation of the information given by the companies during the field research.

7.4.3.3 Additional Feedback

Case study companies were asked to comment on the feedback given to them or the project in general, as indicated in Appendix 8 "Case Study Feedback Questionnaire":

- If there are any other suggestions or comments that you wish to make about the feedback or the project in general, please add them here

The comments made by the case study companies (see Chapter 7 Section 7.4.1) indicate that this research has produced practical benefits for them. The companies acknowledged their weaknesses identified through this research, and expressed strong interest in lean operation, cross-firm analysis, resource protection, knowledge management, and alliance performance measurement. This reflects a need to add new modules to the existing Reference Model, as indicated in Chapter 9 Section 9.6 "Recommendations for Future Work".

Some reasons for the difficulties of achieving cross-firm value stream analysis could be identified in the comments:

- distrust among value stream parties;
- unaware of the relevant benefits;
- insufficient influence of a company as a "driver" of cross-firm analysis;
- lack of collaborative culture

From the comments, it can also be seen that the alliance performance measurement system proposed in this research has been recognised and adopted by the companies as a comprehensive and practical tool for controlling their partnership performance.

7.5 Summary

This chapter first summarised the three modules of the Reference Model proposed in Chapters 5, 6, 7, and explained why the collective of these modules could help achieve the transformation of a manufacturing company into a VME: the six functions provided by the interactions of these modules help a manufacturing company operate along the VME metabolism. Then this chapter briefed the profiles of the seven case study companies to reinforce the reliability of this research which has been introduced in Chapter 3. Through both individual case study analyses and cross case observations, it was illustrated that the Reference Model could help identify companies' weaknesses and strengths in terms of VME transformation.

8 Discussion

8.1 Introduction

The research problem answered by this thesis is that:

> **How to transform a traditional manufacturing company into a Virtual Manufacturing Enterprise?**

In order to find solutions to this problem, three high-level research questions are raised:

(1) How to make decisions of operational externalisation?

(2) How to transform to a VME from the aspect of functional structure?

(3) How to evaluate a VME's performance?

The first question has been addressed in Chapter 4; the second in Chapter 5; and the third in Chapter 6. This chapter brings together all the issues raised during the research and discusses them together in relation to the overall research problem. This chapter also discusses the Research Methodology used to develop and validate the Reference Model in terms of its strengths and weaknesses.

8.2 EI Decisions and VME Metabolism

The literature review (Chapter 2) found that no research had been done so far answering the research problem "How to transform a traditional manufacturing company into a VME". However, some areas were identified in the literature which provided clues to the answer. Two of those were "Alliance Life Cycle" and "Decision to Alliance". They formed the basis upon which the first module of the Reference Model is built.

It was concluded from the literature that "alliance life cycle" generally consists of three stages: formation; operation; dissolution. Based on this "alliance life cycle" model, "VME metabolism" was proposed in Chapter 4 to establish a mechanism for VME transformation (see Figure 4.1): operating along the VME metabolism to ensure a wise combination of external and internal operations.

At the centre of the VME metabolism is the "Identification" stage for deciding how external and internal operations are to be combined. This stage plays a crucial role in guiding a manufacturing company in its operating along the VME metabolism closing loop, therefore, needs to be emphasised in this research. A review of the literature regarding "Decision to Alliance" identified some gaps in the literature (see Chapter 2 Section 2.5):

- Explanations for EI decision making are limited in their application, in other words, lack of generality.
- Factors causing specific forms (e.g. outsourcing, joint venture, etc.) to satisfy specific motives were not clarified. Further, no clear boundaries are in place among factors, motives, and tasks.
- The core competency perspective has not been well explained by the current resource-based theory.

To fill these gaps, Chapter 4 Section 4.4 proposed three "resource combination" based factors to explain the three common motives (increasing outputs; reducing inputs; reducing risks):

- Resource combination effectiveness
- Resource combination management complexity
- Resource combination flexibility

To clarify the meaning of "resource combination", Chapter 4 Section 4.3 classified into 12 types the resources that might be required by a manufacturing company. The relevant case studies illustrated examples of "resource combination".

Each of the three factors has certain relationships with one/more of the motives, as shown in Figures 4.2, 4.3, 4.4. These relationships formed the boundary between underlying factors and motives, and composed an analysis template for EI decision making. This template was applied to several case studies to reinforce its effectiveness (see Chapter 4 Section 4.4.3).

An examination of the proposed template disclosed that the "core competency" perspective (i.e. only goods & services considered as core competencies should be produced internally) is essentially an objective, rather than a criterion. In other words, a firm needs to balance among the three motives to decide its ways of performing tasks, while working towards the objective that all of the three motives show strongest positive support for outsourcing non-core tasks.

After proposing the template, two approaches were explained for providing proper guidance when making EI decisions:

(1) Regular reviews of long term tasks

(2) Value stream joint analysis towards lean manufacturing

The second approach is particularly important from both practical and theoretical perspectives. It demonstrates that joint analyses across a manufacturing company's functions, and across the parties along the company's value streams, provide much guidance for the decision making regarding how external and internal operations could be combined to achieve lean manufacturing. It connects two important research fields: "virtual manufacturing" and "lean manufacturing".

8.3 EI Management Function

The purpose of the first module is to provide a mechanism of VME transformation, and a template for EI decision making. It also indicates how joint analyses across value stream functions and firms could guide a manufacturing company's configuration of its external and internal operations towards the achievement of lean operation.

Now the question is how to ensure a proper implementation of the proposed mechanism of VME transformation, in other words, how to ensure an effective operation along the VME metabolism.

To answer this question, the second module of the Reference Model was proposed in Chapter 5. This module designed "EI Management Function" with seven responsibilities (see Chapter 5 Section 5.3) to ensure an effective operation along the VME metabolism.

The literature review described in Chapter 2 Section 2.6 indicated the following limitations of an "Alliance Management Function":

- No boundary was clearly made between the "Alliance Management Function" and other functions (e.g. production department, project teams).
- "Alliance Management Function" focuses on external operations, not covering internal operations, thus has its limitations in managing a combination of external and internal operations.

To overcome the limitations, the "EI Management Function" upgraded the responsibilities of the "Alliance Management Function", and added new responsibilities (see Table 5.2).

(1) "Coordinating alliances to improve their compatibility" upgraded to "Improving EI compatibility"

(2) "Internal resource allocation for alliances" upgraded to "Internal resource allocation for EI"

(3) "Gaining stakeholders' support for alliances" upgraded to "Gaining stakeholders' support for EI"

(4) "Evaluating alliance performance" upgraded to "Evaluating EI performance"

(5) "Alliance knowledge management" upgraded to "EI knowledge management"

(6) "Ensuring value stream optimisation" added as a new responsibility

(7) "Designing competency protection" added as a new responsibility

These responsibilities "guide", "fuel", "smooth", "defend", "evaluate", and "refine" (see Table 5.3) a manufacturing company's operation along the VME metabolism, and help effectively manage a combination of external and internal operations by other functions along the company's value streams.

To make it more clear the relationship between "Virtual Manufacturing" and "Lean Manufacturing", and more pragmatic to realise the relationship, Chapter 5 designed a functional structure for VMEs (see Chapter 5 Section 5.4). This functional structure is built around a VME's value streams which are supervised by EI management functions (see Figure 5.4). Under this structure, the boundary can be perceived more clearly between the EI management function and other functions along value streams. Organising a VME around value streams is perceived as a useful way to reinforce the relationship between lean operation and virtual manufacturing, and emphasises the importance of lean operation in guiding a VME to achieve a wise combination of external and internal operations.

"Knowledge Management" is one of the major research areas in recent years. Its integration into the EI Management Function indicated how "knowledge management" could help improve virtual manufacturing performance, and achieve VME transformation.

8.4 VME Performance Measurement

Chapter 4 explained a mechanism of VME transformation. Chapter 5 designed an approach to ensure a proper implementation of the mechanism. The last module of the Reference Model dealt with one of the responsibilities of the "EI Management Function": evaluating EI performance. Some gaps were perceived in the literature regarding "Alliance Performance Measurement" (Chapter 2 Section 2.8).

- No framework is found covering the entire 'inputs → processes → outputs'.
- Alliance objectives are separated from partners' objectives.
- Alliances are measured as stand-alone entities, less considering partners' benefits and risks.
- Alliance performance is still assessed using traditional measures for individual companies, rather than measures specific for alliances.
- No framework is found clearly indicating whose perspective is used for performance measurement – that of one parent, two parents, or the alliance management.
- No framework is found clearly indicating at which alliance stage various alliance performance measures are appropriate.

To solve these deficiencies, this research started to identify the factors that would influence alliance performance, and categorised them into fourteen groups. Then the performance measures under each group were identified and further categorised according to (see Appendix 3):

(1) Inputs, processes or outputs (Chapter 6 Section 6.3.2.1)

To further classify performance measures according to whether they are for inputs, processes, or outputs helps check whether these performance measures cover the entire "input→process→output". The performance measures after this further classification demonstrates a well covering over the entire "input→process→output" (see Table 6.23).

(2) Balanced Scorecard Dimensions (Chapter 6 Section 6.3.2.2)

Kaplan and Norton's (1992; 1996; 2001) balanced scorecard is a well-established system targeting the assessment of a company's performance. It establishes that a company's performance needs to be balanced from four perspectives: financial; customer; learning & growth; internal business processes. These four perspectives are well balanced in the APMS (see Table 6.24).

(3) Perspectives: alliance perspective or own perspective (Chapter 6 Section 6.3.2.4)

All alliance performance measures were classified into two perspectives: from the alliance perspective; from partners' own perspectives (see Appendix 3 'Perspective' column). Which perspective is used depends on how firms perceive the issues in questions. For example, if alliance parties all value the importance of open communication about their risks due to the alliance, this issue may well be jointly assessed by the alliance parties, thus from the perspective of the alliance, rather than own perspective. Clarifying whose perspective is used increases the practicability of the alliance performance measures.

(4) Alliance stages: formation, operation, dissolution, or post-dissolution (Chapter 6 Section 6.3.2.5)

Alliance performance measures were categorised according to the alliance stage(s) at which they might be used to see whether they have covered the entire alliance life cycle, plus the post-dissolution stage. It was identified that most performance measures need to be used from the alliance formation stage, through the operation stage, until the dissolution stage (see Table 6.26).

(5) Objective or subjective measures (Chapter 6 Section 6.3.2.6)

A classification of the performance measures by their objective/subjective nature demonstrated that the alliance performance measurement system proposed in this research closely integrated objective measures with subjective measures for most of the assessment dimensions (See Table 6.27).

(6) Traditional measures, or measures specific for alliances (Chapter 6 Section 6.3.2.7)

A classification of performance measures into traditional ones and alliance-specific ones clearly indicates that this APMS pays more attention to alliance specific issues than other frameworks in the literature. All of the groups include performance measures specifically designed for assessing alliance performance (See Table 6.28).

8.5 Scope of the Reference Model

The scope of the reference model is depicted in Figure 8.1. Outside the scope are the major research fields closely related to, but not detailed in this research. Most of these outside research fields have attracted heavy attention in the literature; only "knowledge management" is relatively new (Revilla et al. 2005). As to "performance measurement", since "internal operation performance measurement" has been well established in the literature, only "alliance performance measurement" was detailed in this reference model to solve the perceived deficiencies in the literature.

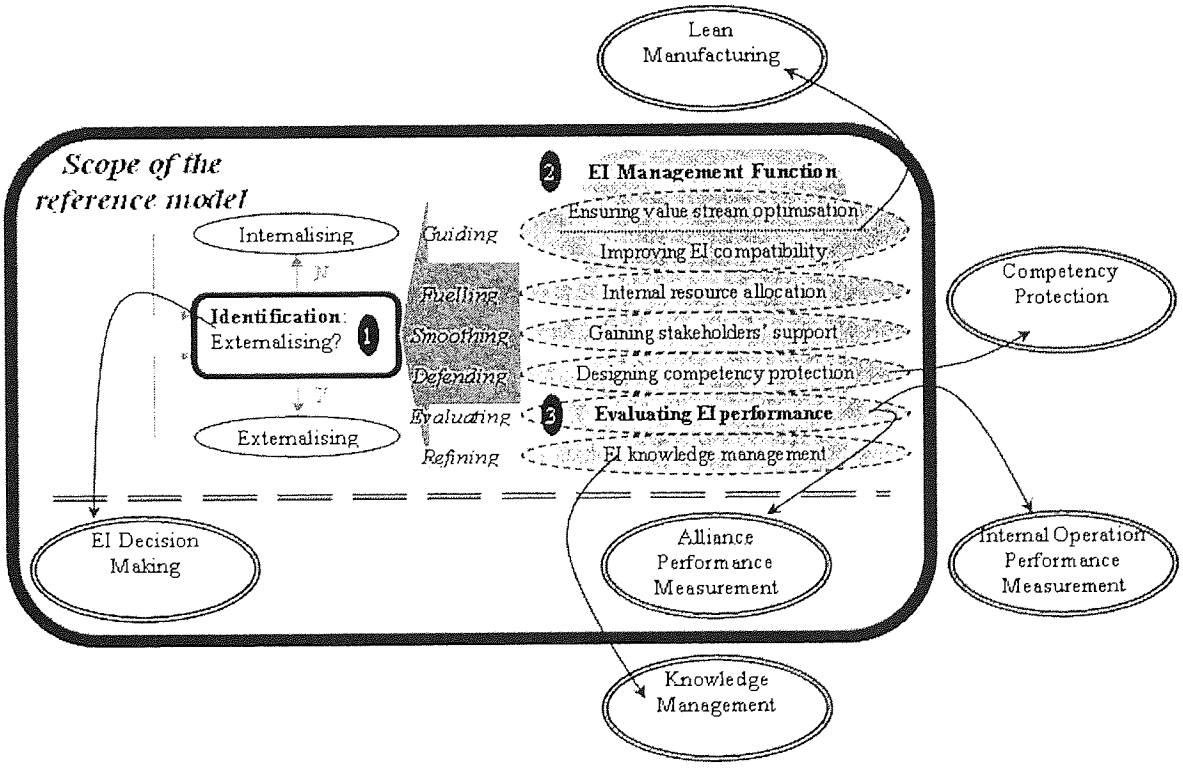


Figure 8.1 Scope of the reference model & its relationships with major research fields in the literature

The three modules detailed in the reference model addressed the three high-level research questions: i.e. how to make decisions of operational externalisation; how to transform to a VME from the aspect of functional structure; how to evaluate a VME's performance. The combination of the 1st and 2nd

modules solved the overall research problem: i.e. how to transform a traditional manufacturing company into a Virtual Manufacturing Enterprise.

8.6 Validity of the Reference Model

The validity of the Reference Model is tested in this research mainly through **triangulation** evidence support. Multiple data sources are used for seeking evidence:

- the literature
  - researcher views
  - case studies in the literature
- the industrial companies (field case studies)

Researcher views, literature case studies, and field case studies complement each other, giving triangulation evidence support to the Reference Model.

One thing to note is that although negative evidence was not listed here, it was used to refine the Reference Model throughout this research, rather than being neglected. For example, field case study companies generally commented that "learning effect" was not generally evaluated for assessing the performance of cross-partner teams, except that such learning was an objective of setting up the teams. According to this comment, "learning effect" was removed from the set of performance measures for assessing cross-partner teams.

Sometimes, negative evidence might be an exception to general situations. For example, field case study company G objected to the performance measure of "*Whether task allocation avoids task duplication*", since task duplication was deliberately used by this company to increase competition among partners. However, this objection was not perceived as sufficiently strong to deny the general suitability of the performance measure, since all of the other six case study companies gave their support.

This section summarises the triangulation evidence support to the Reference Model, as shown in Table 8.1.

Table 8.1 Summary of triangulation evidence support to the Reference Model

Module 1	
(1) Operating along VME metabolism provides a mechanism of VME transformation	
■ Researcher views	
■ Literature case studies	AT&T (Medcof, 1997; Dussauge and Garrette, 1999); BAE SYSTEMS (Internet); Boeing (Brouthers et al., 1995); DSM and Tosoh (Groot and Merchant, 2000); EADS (Internet); JVC (Yan & Luo, 2001); Rolls-Royce (http://www.rolls-royce.com/media/); Sandvik (Hyder & Eriksson, 2005); Sextant Avionique & Texas Instruments (Dussauge and Garrette, 1999); Sony (Goerzen, 2005); Stork and Wärtsilä (Douma et al., 2000)
■ Field case studies	Evidence was obtained through informal discussions with field case study companies, including SFQMC, SJA, COMEDIL, and SSQHTC. All these case study companies demonstrated proper EI analysis stages followed by entering alliance/internalisation life cycles.
Comments	Due to the fact that no research was found in the literature focusing on VME transformation, evidence supporting this Reference Model element was obtained from case studies, through both literature review and field research. A number of case studies have been found demonstrating proper EI analysis stages followed by entering alliance/internalisation life cycles. This helps ensure a wise combination of external and internal operations.
For details, please see	Chapter 4 Section 4.2
(2) Classification of resources sought by manufacturing companies through alliances	
■ Researcher views	Dussauge and Garrette (1999); Wu and Callahan (2005)
■ Literature case studies	Butachimie joint venture (Dussauge and Garrette, 1999); GE & SNECMA joint venture (Yan & Luo, 2001); IBM-Siemens-Toshiba alliance (Brouthers et al. 1995; Cullen et al. 2000; Browning, 1994); joint venture between Honeywell and the Chinese National Petroleum Company (Yan & Luo, 2001); Matra-Renault alliance (Dussauge and Garrette, 1999); NUMMI joint venture between General Motors and Toyota (Dussauge and Garrette, 1999); Omega joint venture (Groot and Merchant, 2000); Stork-Wärtsilä joint venture (Douma et al. 2000)
■ Field case studies	Evidence was obtained through informal discussions with field case study companies, including SFQMC, SJA, COMEDIL, and SSQHTC. These companies formed alliances to access partners' resources, including expertise, equipment, brand, and relationship.
Comments	Supporting evidence was mainly obtained from literature and field case studies. Researcher views provided relatively less evidence, which reinforced the perceived gap in the literature.
For details, please see	Chapter 4 Section 4.3.1
(3) A template for EI decision making	
① Motives	
■ Researcher views	Harvey and Lusch (1995); Munns et al. (2000); Nielsen (2003); Tsang (1998); Yasuda (2004)
■ Literature case studies	Boeing (Brouthers et al., 1995); DSM (Groot and Merchant, 2000); Sextant Avionique (Dussauge and Garrette, 1999); Stork Werkspoor Diesel (Douma et al., 2000); Tosoh (Groot and Merchant, 2000); Wärtsilä Diesel (Douma et al., 2000)
■ Field case studies	Supporting evidence was found in COMEDIL, SFQMC, SJA, and SSQHTC regarding their motives to entering into alliances.
Comments	A large amount of evidence regarding specific motives of entering alliances was obtained from all three sources. These specific motives could all be classified under the three categories of motives proposed in this research. This gave strong support to the "motives" of the template.
For details, please see	Chapter 4 Section 4.4.1

(3) Resource combination based factors which influence motives	
■ Researcher views	Amesse et al. (2004); Bresman et al. (1999); Brouthers et al. (1995); Byrne (1993); Chakrabarti et al. (1994); Contractor (1984); Das & Teng (1999); Davidson and McFetridge (1984); de Man & Duysters (2004); Duysters (1996); Garette & Dussauge (2000); Glaister and Buckley (1998); Kogut and Zander (1993); Lambe & Spekman (1997); Larsson et al. (1998); Mason (1993); McCutcheon and Stuart (2000); McCutchen & Swamidass (1994); McCutchen & Swamidass (1996); McCutchen & Swamidass (2004); Mody (1993); Rangan & Yoshino (1996); O'Dwyer and O'Flynn (2005); Rangan & Yoshino (1996); Tsang (1998); Yan & Luo (2001)
■ Literature case studies	Dell (Cravens, et al., 2000); HSC (Groot and Merchant, 2000); IBM, Siemens, and Toshiba (Brouthers et al., 1995; Cullen et al., 2000; Browning, 1994); Matra & Renault (Dumont and Garrette, 1996; Dussauge and Garrette, 1999); Molex alliances (O'Dwyer and O'Flynn, 2005); NUMMI (Rangan and Yoshino, 1996); Smit and Wijsmuller (Douma et al., 2000); Stork Werkspoor Diesel & Wärtsilä Diesel (Douma et al., 2000); Tambrands (Mockler, 2000)
■ Field case studies	The field case studies in SSQHTC, SFQMC, and SJA provided supporting evidence to the relationships between underlying factors and motives.
Comments	Many scenarios regarding the factors' influence on the motives were found in researcher views and literature case studies. Similar scenarios were also identified in some of the field case study companies. These scenarios helped depict the general relationships between the factors and the motives, and gave strong support to the types of influence that the factors could exert on firms' motives of EI decision making.
For details, please see	Chapter 4 Section 4.4.2
(4) Continuous optimisation of value streams towards lean operation	
■ Researcher views	Bowersox et al. (1999); Cagliano et al. (2004); Hines et al. (1998); Rafuse (1996); Womack and Jones (2005)
■ Literature case studies	Compaq (Bowersox et al., 1999); Dell (Bowersox et al., 1999); Fujitsu (Womack and Jones, 2005); Gateway (Bowersox et al., 1999); Hewlett-Packard (HP) (Bowersox et al., 1999); IBM (Bowersox et al., 1999); LAI (Nightingale, 1998); Marks & Spencer (Rafuse, 1996); Sainsbury (Rafuse, 1996); Tesco (Rafuse, 1996; Womack and Jones, 2003); Wal-Mart (Rafuse, 1996)
■ Field case studies	The field research found that the UK case study companies (600 Lathes; GKN Driveline) exhibited a higher performance than the Chinese case study companies (SFQMC; SHMF; SJA; COMEDIL; SSQHTC) from the aspect of continuous value stream optimisation. This helps the UK companies more smartly configure their external and internal operations for achieving lean operation.
Comments	Evidence was mainly obtained from researcher views and literature case studies. The UK field case study companies also provided supporting evidence. No supporting scenarios were found in the Chinese field case study companies, which reflected a common weakness of these Chinese firms. In addition, little evidence was found in the literature and the field research regarding how small companies ensure continuous value stream optimisation, which signals a common weakness, unpopularity, and/or difficulties of doing so in small firms.
For details, please see	Chapter 4 Section 4.5.2
(5) Joint analysis across functions	
■ Researcher views	Hines et al. (1998)
■ Literature case studies	Tesco (Womack and Jones, 2003)
■ Field case studies	The importance of joint analysis across functions to the effectiveness of EI decision making was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.

Comments	Not much evidence was found in the literature, from both researcher views and case studies, regarding the importance of cross-functional analysis for effective EI decision making. The fact that supporting evidence regarding this importance was obtained from all field case study companies implies a relevant gap in the literature. This might be caused by the following reasons: cross-functional analysis was common in practice, not just for EI decisions, but also for other purposes; there is a recent trend in the literature focusing on the collaboration among value stream parties, thus inter-functional collaboration might be a neglected area, and needs to be researched.
For details, please see	Chapter 4 Section 4.5.2
(6) Joint analysis across firms	
■ Researcher views	Bowersox et al. (1999); Cagliano et al. (2004); Hines et al. (1998); Rafuse (1996); Womack and Jones (2005)
■ Literature case studies	Compaq (Bowersox et al., 1999); Dell (Bowersox et al., 1999); Fujitsu (Womack and Jones, 2005); Gateway (Bowersox et al., 1999); Hewlett-Packard (HP) (Bowersox et al., 1999); IBM (Bowersox et al., 1999); LAI (Nightingale, 1998); Marks & Spencer (Rafuse, 1996); Sainsbury (Rafuse, 1996); Tesco (Rafuse, 1996; Womack & Jones, 2003); Wal-Mart (Rafuse, 1996)
■ Field case studies	
Comments	Supporting evidence was found in both researcher views and literature case studies. None of the field case study companies exhibited cross-firm joint analysis due to reasons such as distrust among value stream parties, lack of awareness of the relevant benefits, insufficient influence of a company as a "driver" of cross-firm joint analysis, lack of collaborative culture on the sides of value stream parties. This is thus perceived as a common weakness across the field case study companies. In addition, no small firms were identified in the literature as exhibiting cross-firm joint analysis, which might be an indication that the degree of influence a company can exert on its value stream parties plays an important role on driving them into close collaboration for value stream optimisation.
For details, please see	Chapter 4 Section 4.5.2
(7) Regular review of EI decisions for long-term tasks	
■ Researcher views	
■ Literature case studies	Matra & Renault (Dussauge and Garrette, 1999); Toyota & Denso (Ahmadjian and Lincoln, 2001)
■ Field case studies	Supporting evidence was obtained from all of the case study companies (SFQMC; SHMF; SJA; COMEDIL; SSQHTC; 600 Lathes; GKN Driveline), showing that regular review of EI decisions for long-term tasks helps maintain the effectiveness of such decisions.
Comments	Major evidence was obtained from literature case studies and the field research. However, no relevant researcher views were found in the literature, which might signal a neglect by researchers. Maybe it needs to be further researched.
For details, please see	Chapter 4 Section 4.5.1
Module 2	
(1) Responsibilities of EI management function	
□ Ensuring value stream optimisation	
■ Researcher views	Bowersox et al. (1999); Cagliano et al. (2004); Hines et al. (1998); Rafuse (1996); Womack and Jones (2003)
■ Literature case studies	Compaq (Bowersox et al., 1999); Dell (Bowersox et al., 1999); Fujitsu (Womack and Jones, 2005); Gateway (Bowersox et al., 1999); Hewlett-Packard (HP) (Bowersox et al., 1999); IBM (Bowersox et al., 1999); LAI (Nightingale, 1998); Marks & Spencer (Rafuse, 1996); Sainsbury (Rafuse, 1996); Tesco (Rafuse, 1996; Womack and Jones, 2003); Wal-Mart (Rafuse, 1996)

■ Field case studies	Continuous value stream optimisation was only identified in the UK case study companies (600 Lathes; GKN Driveline), but not in the Chinese case study companies (SFQMC; SHMF; SJA; COMEDIL; SSQHTC).
Comments	A large amount of support was found in researcher views and literature case studies. The field case studies showed that the UK case study companies exhibited a higher performance than the Chinese companies in terms of value stream optimisation. This could more effectively help the UK companies combine external and internal operations for achieving lean manufacturing. In addition, no evidence regarding small companies was found in the literature. This indicates a need for research in small companies regarding their value stream optimisation activities.
For details, please see	Chapter 4 Section 4.5.2; Chapter 5 Section 5.3.2
② Improving EI compatibility	
■ Researcher views	Duysters et al. (1999); Hoffmann (2005); Kale et al. (2001)
■ Literature case studies	EADS (Internet); JVCO (Ariño and Doz, 2000); Toyota (Ahmadjian and Lincoln, 2001)
■ Field case studies	Improving EI compatibility was a practice observed in most of the case study companies including SFQMC, SHMF, SJA, COMEDIL, SSQHTC and GKN Driveline.
Comments	Evidence was obtained from all of the three sources, supporting the importance of improving EI compatibility. The literature case studies also indicated that even when no conspicuous incompatibility, a firm's EI configuration might still need to be adjusted to comply with the firm's strategic maneuver, or to improve its overall business performance.
For details, please see	Chapter 5 Section 5.3.1
③ Internal resource allocation for EI	
■ Researcher views	Kale et al. (2001)
■ Literature case studies	Concorde (Dussauge and Garrette, 1999); IBM-Siemens-Toshiba R&D venture (Brouthers et al. 1995); Stork-Wärtsilä joint venture (Douma et al. 2000)
■ Field case studies	Internal resource allocation was a practice observed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Since internal resource allocation for EI is a practice so common in companies, only Kale et al. (2001) explicitly included it as one of the responsibilities of the alliance management function. However, case studies were identified in the literature showing the importance of sufficient internal resource allocation. This importance was further confirmed in all of the field case study companies.
For details, please see	Chapter 5 Section 5.3.1
④ Gaining stakeholders' support for EI	
■ Researcher views	Gillespie & Teegen (1995); Kale et al. (2001)
■ Literature case studies	A Chinese-Japanese IJV (Zhang and Li, 2001); Renault-Volvo (Bruner and Spekman, 1998)
■ Field case studies	Gaining stakeholders' support for EI was a practice observed in most of the case study companies including SFQMC, SHMF, SJA, COMEDIL, and SSQHTC.
Comments	Although supporting evidence was obtained from each of the three sources, relatively smaller amount of evidence was obtained from researcher views and literature case studies when compared to field case studies. This might signal a neglect of stakeholders' influence on EI operations in the literature.
For details, please see	Chapter 5 Section 5.3.1

⑤ Designing competency protection	
■ Researcher views	Baughn et al. (1997); Brouthers et al (1995); Das & Teng, (1996); Das & Teng (1999); de Man & Duysters (2004); Dickson et al. (2005); Dussauge & Garrette (1999); Duysters (1996); Jordan (2004); Langlois (2002); Lui & Ngo (2004); McCutcheon and Stuart (2000); Nair and Stafford (1998); Norman (2001; 2002); Quintas, Lefrere, & Jones (1997); Shultz and Saporito (1995)
■ Literature case studies	
■ Field case studies	Designing competency protection was a practice observed in most of the case study companies including SFQMC, SHMF, SJA, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Although the importance and approaches of competency protection, especially in alliance situations, has gained enormous support from researcher views, little evidence was found in the literature case studies. Due to the fact that evidence was found in most of the field case study companies, the shortage of literature case study evidence reflects a lack of research investigation into real companies regarding competency protection, rather than because companies are not doing it.
For details, please see	Chapter 5 Section 5.3.2
⑥ Evaluating EI performance	
■ Researcher views	Anderson (1990); Arino (2003); Callahan & MacKenzie (1999); Das and Teng (2003); Dixon, Nanni, and Vollmann (1990); Draulans et al. (2003); Geringer and Hebert (1991); Harrigan (1986); Johnson and Kaplan (1987); Kald and Nilsson (2000); Judson (1990); Kale et al. (2001); Kaplan and Norton (1992; 1996); Luo (1996); Lynch and Cross (1991; 1995); Maisel (1992); Mockler (2000); Neely (1998); Yan & Gray (1994); Yan and Luo (2001)
■ Literature case studies	Sears (McLemore, 1999); Boeing (McLemore, 1999); General Electric (http://healthcare.isixsigma.com/library/content/c031028a.asp); Michigan Consolidated Gas (McLemore, 1999); Petrobras (http://www.bscol.com/bsc_portal/success/petrobras/), Australian Healthcare System (http://www.bscol.com/bsc_portal/success/queensland/); Madison Paper Company (http://www.bscol.com/bsc_portal/success/madison/).
■ Field case studies	Evaluating EI performance was a practice observed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	The evaluation of EI performance gained support from each of the three sources. Consensus has been reached among researcher views regarding the importance of evaluating the performance of both external and internal operations. However, few detailed case studies regarding alliance performance measurement were identified in the literature, which might be a reflection of the immature status of alliance performance measurement in practice. Consensus has also been reached among the field case studies companies.
For details, please see	Chapter 2 Section 2.8; Chapter 5 Section 5.3.1
⑦ EI knowledge management	
■ Researcher views	Almeida et al. (2002); Baughn et al. (1997); Bonner et al. (2004); Chen (2004); Das & Teng (1999); Draulans et al. (2003); Drew (1999); Emden et al. (2005); Goerzen (2005); Hermens (2001); Hoang and Rothaermel (2005); Inkpen (1998; 2000); Jordan (2004); Kale et al. (2001); Kandemir and Hult (2005); Norman (2001; 2002); Parise & Henderson (2001); Revilla et al. (2005); Simonin (1999); Tsang (1999)
■ Literature case studies	ABB (Hoegl and Schulze, 2005); AT&T (Armistead and Meakins, 2002); BP & Amoco (Armistead and Meakins, 2002); IBM (Mertins et al 2001); Ricardo (Ward, 2005); Siemens (Davenport & Probst, 2002); Volkswagen (http://www.vw-personal.de/www/en/wissen/wissensmanagement.html)
■ Field case studies	Arup (author's field case studies); Unipart (author's field case studies)
Comments	Large amount of evidence was obtained from both researcher views and literature case studies supporting the importance of EI knowledge management. This reflects a common weakness across the seven field case study companies involved in this research. In addition, few case studies were found in the literature regarding the knowledge management practices in small companies. This might be an area for future research.

For details, please see	Chapter 5 Section 5.3.1
(2) A VME's functional structure can be built around the VME's value streams which are supervised by EI management functions	
■ Researcher views	Bowersox et al. (1999); Cagliano et al. (2004); Cooper (1988a; 1988b; 1990); Cooper and Kaplan (1988); Hines et al. (1998); Johnson (1990); Lamming (1994); Rafuse (1996); Roztocki et al. (2004); Turney (1989); Womack and Jones (2003)
■ Literature case studies	All literature case studies supporting "ensuring value stream optimisation", including: Compaq (Bowersox et al., 1999); Dell (Bowersox et al., 1999); Fujitsu (Womack and Jones, 2005); Gateway (Bowersox et al., 1999); Hewlett-Packard (HP) (Bowersox et al., 1999); IBM (Bowersox et al., 1999); LAI (Nightingale, 1998); Marks & Spencer (Rafuse, 1996); Sainsbury (Rafuse, 1996); Tesco (Rafuse, 1996; Womack and Jones, 2003); Wal-Mart (Rafuse, 1996)
■ Field case studies	
Comments	"EI Management Function" is an innovative concept, and no field case study companies had this function in place at the time of interviews. Thus, supporting evidence has been collected from researcher views and literature case studies, which demonstrates the importance of building a VME functional structure around value streams which are further supervised by EI management functions.
For details, please see	Chapter 5 Section 5.4
Module 3	
(1) VME performance measurement involves evaluation of both external & internal operations	
■ Researcher views	Anderson (1990); Arino (2003); Callahan & MacKenzie (1999); Chalmeta and Grangel (2005); Chowdhury (1992); Cravens et al. (2000); Das and Teng (2003); Demirbag & Mirza (2000); Dixon et al. (1990); Draulans et al. (2003); Geringer and Hebert (1991); Harrigan (1986); Kald and Nilsson (2000); Kale et al. (2001); Kaplan and Norton (1992; 1996); Johnson and Kaplan (1987); Judson (1990); Luo (1996); Lynch and Cross (1991; 1995); Maisel (1992); Mockler (2000); Neely (1998); Yan & Gray (1994); Yan and Luo (2001)
■ Literature case studies	Sears (McLemore, 1999); Boeing (McLemore, 1999); General Electric (http://healthcare.isixsigma.com/library/content/c031028a.asp); Michigan Consolidated Gas (McLemore, 1999); Petrobras (http://www.bscol.com/bsc_portal/success/petrobras/), Australian Healthcare System (http://www.bscol.com/bsc_portal/success/queensland/); Madison Paper Company (http://www.bscol.com/bsc_portal/success/madison/).
■ Field case studies	The importance of evaluating the performance of both external and internal operations was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Compared to internal operations, less evidence was identified from literature case studies for alliance performance assessment, possibly due to the fact that alliance performance measurement was not as well established as that for internal operations. However, consensus has been reached in researcher views, and unanimous agreement was also obtained from the field case studies. Thus it can be considered that strong evidence support was in place.
For details, please see	Chapter 2 Section 2.8; Chapter 5 Section 5.3.1 (4); Chapter 6 Section 6.2
(2) Assessment issues for external operations	
□ Alliance parties' resource contributions	
■ Researcher views	Beamish (1987); Brouthers et al. (1995); Chowdhury (1989); Das and Teng (2000; 2003); Dymsza (1988); Geringer (1988; 1991); Harrigan (1985); Harvey & Lusch (1995); Hitt et al. (2000); Ireland et al. (2002); Killing (1983); Nielsen (2003); Parkhe (1993); Supphellen et al. (2002); Whipple and Frankel (1998)
■ Literature case studies	Sextant-Texas alliance (Dussauge and Garrette, 1999); Matra-Renault partnership (Dussauge and Garrette, 1999); Butachimie joint venture (Dussauge and Garrette, 1999); Nestlé-General Mills joint venture (Dussauge and Garrette, 1999)
■ Field case studies	Evaluating alliance parties' resource contributions was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.

Comments	Much evidence was obtained from each of the three sources supporting the assessment of alliance parties' resource contributions. Consensus was reached among researcher views, and also backed by a lot of literature case studies and the unanimous support from the field research.
For details, please see	Chapter 6 Section 6.3.1.1
② Alliance parties' dependency	
■ Researcher views	Baykasoğlu (2003); Brouthers et al. (1995); Cravens et al. (2000); Dacin et al. (1997); Das and Teng (1996;2000; 2003); Dussauge and Garrette (1999); Garette and Dussauge (2000); Hatfield and Pearce (1994); Hendrick and Ellram (1993); Ireland et al. (2002); Koza and Lewin (2000); Lambe and Spekman (1997); Luo (1998); Lyles (1987); McCutcheon and Stuart (2000); Nielsen (2003); Park and Russo (1996); Rangan and Yoshino (1996); Seabright et al. (1992); Supphellen et al. (2002); Whipple and Frankel (1998); Wong et al. (2005)
■ Literature case studies	GM & Daewoo (Dacin et al., 1997); Matra & Renault (Dussauge and Garrette, 1999); Toyota & Denso (Ahmadjian and Lincoln, 2001)
■ Field case studies	Evaluating alliance parties' dependency was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Consensus was found among researcher views regarding the importance of inter-partner dependency for alliance performance. Evidence in support of this view was also obtained from literature case studies and unanimously from all field case studies. This triangulation evidence support strongly demonstrates the validity of this element.
For details, please see	Chapter 6 Section 6.3.1.2
③ Alliance objectives	
■ Researcher views	Arino (2003); Brinkerhoff (2002); Brouthers et al. (1995); Dacin et al. (1997); Das and Teng (2003); Parhke (1993); Park & Zhou (2005)
■ Literature case studies	A Chinese-Japanese joint venture (Zhang and Li, 2001)
■ Field case studies	The importance of evaluating alliance objectives was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Compared to the other two sources, less evidence was obtained from literature case studies. This might be caused by the fact that the need for a win-win deal in an alliance scenario is a common sense, and the fact that accurate feasibility analysis is difficult to do and often neglected in practice. However, this evidence shortage was complemented by the unanimous support from field case studies.
For details, please see	Chapter 6 Section 6.3.1.3
④ Resource protection	
■ Researcher views	Baughn et al. (1997); Brouthers et al. (1995); Crossan and Inkpen (1995); Das and Teng (1996; 2000); de Man and Duysters (2004); Dussauge and Garrette (1999); Duysters (1996); Hutt et al. (2000); Norman (2001; 2002); O'Dwyer and O'Flynn (2005); Quintas, Lefrere, & Jones (1997)
■ Literature case studies	Airbus (Dussauge and Garrette, 1999); Apple & Microsoft (Norman, 2001); NUMMI between GM and Toyota (Inkpen, 2005)
■ Field case studies	The importance of evaluating resource protection was confirmed in most of the case study companies, including SFQMC, SHMF, SJA, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Relational risks specific to alliance situations were well recognised in the literature. Case studies were also identified in the literature regarding the potential approaches of assessing such risks. Six out of the seven field case studies also gave support to the evaluation of resource protection. Together, these three sources form strong triangulation evidence support.

For details, please see	Chapter 6 Section 6.3.1.4
⑤ Alliance geographic location	
■ Researcher views	Baughn et al. (1997); Das & Teng (1999); Jordan (2004); Norman (2001)
■ Literature case studies	Lufthansa Technik AG & Rolls-Royce (http://www.rolls-royce.com/media/)
■ Field case studies	The importance of evaluating alliance geographic location was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Compared with other assessment issues, relatively less evidence was obtained from researcher views and literature case studies. This might signal that alliance geographic location is a neglected issue. At the same time, all field case study companies showed supporting evidence, which confirmed the importance of alliance location assessment.
For details, please see	Chapter 6 Section 6.3.1.5
⑥ Alliance managers	
■ Researcher views	Bamford and Ernst (2005); Bruner and Spekman (1998); Douma et al. (2000); Ireland et al. (2002); Jagersma (2005); Lambe and Spekman (1997); Spekman et al. (1996)
■ Literature case studies	Hewlett-Packard (Lambe and Spekman, 1997); Renault-Volvo alliance (Bruner and Spekman, 1998)
■ Field case studies	The importance of evaluating alliance geographic location was confirmed in most of the case study companies, including SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Although a number of supporting researcher views were identified, relatively few case studies were found in the literature, probably due to the sensitivity of the issue concerned. However, supporting evidence was obtained in most of the field case study companies, which somewhat overcame the insufficient literature case study support.
For details, please see	Chapter 6 Section 6.3.1.6
⑦ Task allocation among alliance parties	
■ Researcher views	Dussauge and Garrette (1999)
■ Literature case studies	Aero Propulsion Alliance (http://www.rolls-royce.com/media/); Airbus (Dussauge and Garrette, 1999); alliance between Atlas Copco and Sandvik (Hyder and Eriksson, 2005); Concorde (Dussauge and Garrette, 1999)
■ Field case studies	The importance of evaluating task allocation among alliance parties was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Compared to the other two sources, less evidence was obtained from researcher views regarding the assessment of task allocation. This might be caused by the fact that tasks would usually be allocated straightaway according to the resource contributions by different alliance parties. However, supporting case studies were found in the literature indicating a potential complexity. And the importance of assessing task allocation was further confirmed in the field research, indicating the validity of the element.
For details, please see	Chapter 6 Section 6.3.1.7
⑧ Cross-partner teams	
■ Researcher views	Lipnack & Stamps (2000)'s "people-purpose-links-time" model; Munns et al. (2000); Nair and Stafford (1998)
■ Literature case studies	DSM & Gist Brocades (Douma et al. 2000)
■ Field case studies	The importance of evaluating cross-partner teams was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.

Comments	Assessment of cross-partner teams attracted relatively little attention in the literature. Although Lipnack & Stamps (2000)'s "people-purpose-links-time" model provided a solid basis for assessing geographically distributed teams, cross-partner teams might be more complicated. However, supporting evidence was found in all of the field case study companies, thus reflecting a gap in the literature.
For details, please see	Chapter 6 Section 6.3.1.8
⑨ Alliance decision making	
■ Researcher views	Garette and Dussauge (2000); Gillespie and Teegen (1995); Kale et al. (2001); Ring (2000); Saxon (1997)
■ Literature case studies	JVCO (Ariño and Doz, 2000); Renault-Volvo joint venture (Bruner and Spekman, 1998)
■ Field case studies	Evaluating alliance decision making was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	The relevant issues of assessing alliance decision making processes were confirmed in each of the three sources. Case studies were identified in the literature showing the damaging effect of neglecting these issues. Agreement was also reached in the field case study companies.
For details, please see	Chapter 6 Section 6.3.1.9
⑩ Alliance assets sharing	
■ Researcher views	
■ Literature case studies	IBM and Microsoft (Bellis [1] [2]; www.pjprimer.com); ICI Pharma (Child & Faulkner, 1998); Nestlé and General Mills (Dussauge and Garrette, 1999)
■ Field case studies	The importance of evaluating alliance assets sharing was confirmed in some of the case study companies, including SJA, SSQHTC, and GKN Driveline.
Comments	Compared to other assessment issues, "alliance assets sharing" gained less evidence from each of the three sources. This might be caused by the following reasons: alliance assets sharing is usually included as standard clause(s) in alliance agreement, thus less attractive to academic researchers; the influence of alliance assets sharing usually becomes apparent long after the alliance dissolves, thus difficult to anticipate and control. However, case studies were found in the literature showing the devastating results, and also in both the literature and the field research indicating that some degree of prevention could be done to minimise the damaging effects.
For details, please see	Chapter 6 Section 6.3.1.10
⑪ Partners' post-dissolution activities	
■ Researcher views	
■ Literature case studies	IBM and Microsoft (Bellis [1] [2]; www.pjprimer.com); Nestlé and General Mills (Dussauge and Garrette, 1999)
■ Field case studies	The importance of evaluating partners' post-dissolution activities was confirmed in most of the case study companies, including SFQMC, SHMF, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Similar to assessing alliance assets sharing, assessing partners' post-dissolution activities gained less evidence from the literature, possibly due to the fact that such post-dissolution activities were difficult to control in practice. Literature case studies showed the damaging effects such activities could cause, and most field case study companies also gave support to the assessment of such activities. Thus a need for this assessment is confirmed.
For details, please see	Chapter 6 Section 6.3.1.11

⑫ Alliance parties' operational conflicts	
■ Researcher views	Brinkerhoff (2002); Dacin et al. (1997); Das and Teng (2000; 2003); Demirbag and Mirza (2000); Munns et al. (2000); Nordin (2006); Olk (1997); Whipple and Frankel (1998)
■ Literature case studies	A Chinese-Japanese IJV (Zhang and Li, 2001); CFM International (Dacin et al., 1997); JVCO (Ariño and Doz, 2000); SysCo and TeachIT (Nordin, 2006); Texas Instruments and Hitachi (Dacin et al., 1997)
■ Field case studies	The importance of evaluating alliance parties' operational conflicts was confirmed in most of the case study companies, including SJA, COMEDIL, 600 Lathes and GKN Driveline.
Comments	Much evidence was obtained from the three sources supporting the evaluation of alliance parties' operational conflicts. This gives a strong triangulation evidence support.
For details, please see	Chapter 6 Section 6.3.1.12
⑬ Trust among alliance parties	
■ Researcher views	Ariño and Doz (2000); Brinkerhoff (2002); Brouthers et al. (1995); Demirbag and Mirza (2000); Deutsch (1973); Duysters et al. (1999); Gabarro (1978; 1987); Goldman (1966); Hutt et al. (2000); Ireland et al. (2002); Lee (1966); Lewicki and Bunker (1996); McCutcheon and Stuart (2000); Mehta et al. (2006); Mohr and Spekman (1994); Munns et al. (2000); Panteli and Sockalingam, (2005); Styles and Hersch (2005); Volery & Mensik (1998); Whipple and Frankel (1998)
■ Literature case studies	A close supply-customer relationship (McCutcheon and Stuart, 2000); JVCO (Ariño and Doz, 2000); Toshiba, IBM, and Siemens AG (Cullen, Johnson and Sakano, 2000; Browning, 1994)
■ Field case studies	The importance of evaluating trust among alliance parties was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	The importance of trust gained consensus among researcher views, as well as the field case study companies involved in this research. Evidence was also found in the literature case studies showing the negative effects of distrust in an alliance. Thus, assessment of trust as the soft side of an alliance should be considered as a crucial issue.
For details, please see	Chapter 6 Section 6.3.1.13
⑭ Alliance supporters	
■ Researcher views	McCutcheon and Stuart (2000); Nair and Stafford (1998)
■ Literature case studies	Tambrands (Mockler, 2000)
■ Field case studies	The importance of evaluating alliance supporters was confirmed in all of the case study companies, including SFQMC, SHMF, SJA, COMEDIL, SSQHTC, 600 Lathes and GKN Driveline.
Comments	Although the assessment of alliance supporters was observed in all case study companies, less evidence was found in researcher views and literature case studies. This was thus believed as an issue less noticed by other researchers in the literature.
For details, please see	Chapter 6 Section 6.3.1.14

The majority of the elements in the Reference Model obtained triangulation evidence support from researcher views, literature case studies, and field research. Each element has at least two of the three sources where supporting evidence was found. This triangulation evidence support, combined with the causal explanations throughout this thesis, validated the Reference Model proposed in this research.

8.7 Critique of the Research Methodology

8.7.1 Theory Development

The research methodology underlying this research is based on "a systematic approach for empirical research" (Flynn et al, 1990), as described in Chapter 3 Section 3.3. The term "empirical" means that this type of research is field-based, and "uses data gathered from naturally occurring situations or experiments, as opposed to laboratory or simulation studies, where researchers have more control over the events being studied" (Williams, 1998).

To validate the Reference Model established in this research, the empirical research methodology was applied using the theory verification approach. This approach requires that a detailed theory is established and developed before testing procedures are started. The development of the research theory (the phase 1 of Figure 3.2) was divided into the following sub-phases:

- Sub-phase 1: Construction of the Conceptual Framework
- Sub-phase 2: Construction of the Reference Model

The 1st sub-phase involved the specification of an overall research problem and the corresponding high-level research questions defined in Chapter 1 Section 1.2. A review of the available literature within the problem domains (Chapter 2) then identified the areas worth researching, thereby allowing the development of a conceptual framework as defined in Chapter 3 Section 3.2. The 2nd sub-phase involved the construction of each of the three modules of the Reference Model. This required an establishment of a mechanism of VME transformation (Chapter 4), and approaches to ensure a proper implementation of the mechanism (Chapter 5 & Chapter 6).

A limitation of this theory development procedure is the time and resources required to cover the details of each relevant issue in the form of a Reference Model. As indicated in Chapter 7 Section 7.5, the Reference Model proposed in this research concerns the following research areas:

(1) Lean Manufacturing

(2) Competency Protection

(3) Internal Operation Performance Measurement

(4) Alliance Performance Measurement

(5) Knowledge Management

(6) EI Decision

It would have been better if the Reference Model had covered the details of each of these areas. However, in practice, such coverage is not feasible considering the time and resources available:

- Both "Lean Manufacturing" and "Knowledge Management" are heavy research areas, having numerous issues which this research does not have sufficient time to deal with.
- It is practically infeasible to investigate case study companies in all of the relevant areas considering the time available to senior managers participating in this research, and the amount of efforts they are willing to contribute.

In addition, from academic point of view, although closely related, "Lean Manufacturing", "Internal Operation Performance Measurement", and "Knowledge Management" have already become research areas separate from "Virtual Manufacturing". Restating the details of these research areas in the Reference Model would blur the true focus of this research, and to some degree, "re-invent the wheels".

8.7.2 Use of a Multiple Case Study Research Design

As described in Chapter 3 Section 3.4.1, the 'multiple case study' is a well-established technique and has been successfully used to verify and develop theories through empirical field-based research (McCutcheon & Meredith, 1993; Yin, 1989; Brennan et al, 1990; Cohn & Turyn, 1984; Lascelles & Dale, 1990; Titus & Liberatore, 1991; Williams, 1998). The 'multiple case study' was selected for this research from three data collection methods: (1) surveys; (2) experiments; and (3) case studies. The choice is made based on two conditions:

- The nature of the research problem;
- Whether or not control is required over studied manufacturing companies.

Since this research has an exploratory research problem, 'surveys' become not suitable due to their limitation in the number & depth of questions; since control is not required over studied manufacturing companies, 'experiments' also become unsuitable. 'Case studies' do not control the elements of studied objects, and have advantages over 'surveys' in exploring a situation, thus are suitable for this research.

The first issue tackled within a multiple case study research design is the selection of a suitable sample. This was done using the sampling strategy described in Chapter 3 Section 3.4.3. Due to the level of detail in case study research, generalisation is analytical from each case to a broader theory, and not, as in surveys, a statistical generalisation from selected samples to a population (Yin, 1989). Fundamental to this principle is the use of a suitable theoretical niche, as described in Chapter 3

Section 3.6 and Chapter 7 Section 7.3. This important requirement is limited in practice by the individual companies who are willing to cooperate.

Since the main purpose is to look at field case studies in China, then do pilot case studies in the UK, 9 Chinese companies and 2 UK companies were contacted and invited to participate in this research project, with the end result being seven available candidates (5 Chinese companies and 2 UK companies). The characteristics of these companies were grouped together as described in Chapter 7 Section 7.3, demonstrated in Table 7.3; a suitable niche has been established. This ensured that a fundamental requirement of a multiple case study research design had been met and that valid conclusions could be drawn.

Another drawback is that a theory verification approach carries out detailed case studies "in parallel" (see Figure 3.3), as opposed to "in series" required for a theory development approach (Flynn et al 1990). This causes limited scope for making significant modifications to the Reference Model during the case studies: If any major problems had been identified, the necessary alterations would have to be done after conclusions had been derived (Williams, 1998). This also limits opportunities for direct feedback into the Reference Model during its development, since detailed conclusions on the validity of the theory are not derived until after the case studies have been completed (Yin, 1989). To somewhat overcome these weaknesses, pilot case studies were used in this research during the later stages of the theory development to explore potential areas of improvement according to case study companies' direct feedback (see Table 3.1).

8.7.3 Data Collection

During the multiple case studies, the majority of the data was collected through one-to-one or one-to-many interviews that were structured by detailed questionnaires.

The interviews had two objectives: (1) to collect the data used to establish the current situation of a case study company, thus identifying the company's strengths and weaknesses within the Reference Model; (2) to obtain supporting and opposing evidence in order to test and refine the validity of the Reference Model. During the interviews, informal discussion was encouraged to clarify answers, obtain richer evidence, and explore new relevant areas. The case study results (see Chapter 7 Section 7.4 "Case Study Results") and the evidence collected from the field research (see Table 8.1) indicated the achievement of these two objectives.

The questionnaires were designed so that a common analysis template could be used (see Appendix 4 "Case Study Analysis Template") across different case study companies. This facilitated cross case comparison (see Chapter 7 Section 7.4.2 "Cross Case Observations"). The persons interviewed were

all senior managers of the case study companies, and had a good knowledge of the companies' strategies and operations.

8.7.4 Data Analysis

All of the four groups of qualitative data analysis methods were used to construct a progression from more to less structured and formal (Robson, 2002; Drisko, 2000): (1) quasi-statistical methods; (2) template methods; (3) editing methods; (4) immersion methods (see Chapter 3 Section 3.5.1 "Data Analysis Methods").

Data reduction, data display, and conclusion drawing/verification were identified as the three components of data analysis (Miles and Huberman, 1994). A set of techniques were used for each of them to ensure their effectiveness (see Chapter 3 Section 3.5.4 "Components of Data Analysis").

8.8 Summary

This chapter has brought together all the issues raised during the research programme and discussed them together in relation to the research hypothesis. This chapter has also discussed the development of the Reference Model and each of its three modules. This chapter looked at the scope of the Reference Model, and its validity. The Research Methodology used was also discussed, along with its strengths and weaknesses under the research context. This work can now be consolidated by drawing conclusions on the key findings of the research and establishing the subsequent contributions to knowledge.

9 Conclusion

9.1 Introduction

The research reported in this thesis set out to test the following hypothesis:

A Reference Model can be established for the VME transformation.

This thesis has presented a Reference Model that provides support to companies wishing to transform to VMEs. The Reference Model described in this thesis provides a mechanism for VME transformation and approaches for proper implementation of the mechanism. It also studied two relevant areas, EI decision making and alliance performance measurement, to fill the gaps perceived in the literature.

The review of the relevant literature, as described in Chapter 2, helped break down the research problem into several high-level research questions, and develop the conceptual framework as described in Chapter 3 Section 3.2. Chapter 3 also described the research methodology used to develop and test the Reference Model. Chapters 4, 5, and 6 developed each of the three modules of the Reference Model, which was summarised in Chapter 7 Section 7.2. Chapter 7 also discussed the case study results, and how the reliability and validity of this research were achieved. Chapter 8 brought together all of the major issues raised during this research, and discussed them in relation to the overall research problem. This chapter is going to consolidate the work carried out in the previous chapters and draw overall conclusions. It concludes the research findings in terms of both academic contributions and practical implications, and also discusses the limitations of this research and makes suggestions for future work.

9.2 Key Conclusions Regarding the Research Findings

9.2.1 Key Conclusions from the Literature Review

- VME was mainly defined in the literature as "manufacturing companies virtualised through information technologies", or as "networks of manufacturing companies collaborating with each other". Following the latter, the VME definition was adjusted to be compatible with "VME

Transformation" (see Chapter 2 Section 2.2). There was no research found in the literature focusing on VME transformation, however, alliance life cycle, EI decision, Alliance Management Function, competency protection, and alliance performance measurement were identified as capable of providing clues to the answer.

- Alliance life cycle has three common stages identified in the literature: formation stage, operation stage, and dissolution stage (see Chapter 2 Section 2.4). These three stages form one of the three parts of the VME metabolism (see Figure 4.1).
- The current literature provided two main categories of explanations for the choice between external and internal operations: the transaction-cost theory; the resource-based theory (see Chapter 2 Section 2.5). The transaction-cost theory has its limitations and can be integrated into resource-based theory. The resource-based explanations identified in the literature exhibited a lack of generality, blurred boundaries among factors, motives and tasks, and an insufficiency in integrating the "core competency" perspective.
- There has been a relatively small amount of research into the Alliance Management Function (see Chapter 2 Section 2.6). This function was established in some companies as a central function of their externalisation structures (see Chapter 5 Section 5.2). Five general responsibilities of the function were identified for managing a company's alliance operations. However, the Alliance Management Function focuses on external operations only, not covering internal operations, thus has its limitations in managing a combination of external and internal operations.
- Relational risks were identified as particularly relevant to a company's external operations (see Chapter 2 Section 2.7). Various competency protection approaches have been designed in the literature to prevent such risks. These approaches were summarised in Chapter 5 Section 5.3.2.
- Performance measurement of a company's internal activities has been well established in the literature. However, deficiencies were perceived in the literature regarding the performance assessment of a company's alliance (external) activities (see Chapter 2 Section 2.8): (1) No framework is found covering the entire 'inputs → processes → outputs'; (2) Alliance objectives are separated from partners' objectives; (3) Alliances are measured as stand-alone entities, less considering partners' benefits and risks; (4) Alliance performance is still assessed using traditional measures for individual companies, rather than measures specific for alliances; (5) No framework is found clearly indicating whose perspective is used for performance measurement – that of one parent, two parents, or the alliance management; (6) No framework is found clearly indicating at which alliance stage various alliance performance measures are appropriate.

9.2.2 Key Conclusions from the Theory Development

9.2.2.1 The Reference Model

- The Reference Model proposed in this research consists of three modules (see Chapter 7 Section 7.2). The first module provides a mechanism of VME transformation. The second module built a functional structure to help ensure a proper operation of the mechanism.
- According to the second module, six research areas were identified as closely related to VME transformation (see Chapter 8 Section 8.5). The third module detailed one of these six areas, alliance performance measurement, where gaps were perceived in the literature. Another area, EI decision making, was also integrated and detailed in the first module.

9.2.2.2 Module 1

- The VME Metabolism consists of the Identification stage, the Alliance (Externalisation) Life Cycle, and the Internalisation Life Cycle (see Figure 4.1). It provides a mechanism to ensure equal treatment of the options of externalisation and internalisation, and their subsequent implementation. Thus, "operating along VME metabolism" is capable of providing a mechanism of VME transformation (see Chapter 4, Section 4.2).
- Companies' EI decisions are motivated by increasing outputs, reducing inputs, and minimising risks. Each of the three resource-combination-based underlying factors (effectiveness; management complexity; flexibility) has certain relationships with one/more of the three motives, and the combination of these relationships forms an effective template of EI decision making (see Chapter 4 Section 4.4).
- There are 10 types of resources which might be particularly sought by manufacturing companies through collaborating with external parties (see Chapter 4 Section 4.3.1). A company's "resources" can be defined as something that are owned or accessible by the company, and can be used to generate benefits for the company. According to this definition, resources can be tangible or intangible; can be something that can/cannot be manipulated; can exist within/outside the company; it can be something basic or something combined or generated (see Table 4.1).
- Long term tasks are more vulnerable to situational changes. Regular reviews become useful for identifying the effects of such changes on current EI configuration (see Chapter 4 Section 4.5.1).
- Value stream joint analysis towards lean manufacturing provides guidance for EI decision making, as discussed in Chapter 4 Section 4.5.2. Joint analysis includes not only cross-functional analysis, but also cross-firm analysis among value stream parties. Lean manufacturing and virtual manufacturing are closely related to each other, and the logic behind lean thinking is that

companies jointly identify and optimise the value stream for each product regardless of the traditional functional or corporate boundaries.

9.2.2.3 Module 2

- Alliance Management Function can be upgraded into EI Management Function to cover both external and internal operations. To achieve this upgrade, the original five responsibilities of the Alliance Management Function were extended to cover both external and internal operations (see Chapter 5 Section 5.3.1), and two new responsibilities were added (see Chapter 5 Section 5.3.2). These seven responsibilities help guide, fuel, smoothen, defend, evaluate, and refine practices of a manufacturing company in its operation along the VME metabolism (see Figure 7.1), thus ensuring a proper implementation of the VME transformation mechanism.
- VME functional structure can be built around a VME's value streams which are supervised by EI Management Functions. This structure complies with both of the academic and practical trends which are in favour of customer-oriented operations, as described in Chapter 5 Section 5.4. This structure also clarifies the boundary between the EI Management Function and other functions along value streams (see Table 5.3).
- After defining the EI Management Function, "VME transformation" is closely related to six research areas (see Figure 7.4): (1) lean manufacturing; (2) competency protection; (3) internal operation performance measurement; (4) alliance performance measurement; (5) knowledge management; (6) EI decision making. The achievement of VME transformation requires the achievement of each of the six research areas.

9.2.2.4 Module 3

- Fourteen categories of performance measures were identified for evaluating alliance performance, as described in Chapter 6 Section 6.3.1: (1) alliance parties' resource contributions; (2) alliance parties' dependency; (3) alliance objectives; (4) resource protection; (5) alliance geographic location; (6) alliance managers; (7) task allocation among alliance parties; (8) cross-partner teams; (9) alliance decision making; (10) alliance assets sharing; (11) partners' post-dissolution activities; (12) alliance parties' operational conflicts; (13) trust among alliance parties; (14) alliance supporters.
- These fourteen categories of alliance performance measures exhibit features overcoming the deficiencies identified in the literature, as described in Chapter 6 Section 6.3.2: (1) covering the entire 'inputs → processes → outputs'; (2) balancing among the balanced scorecard's four perspectives; (3) assessing alliances not just as stand-alone entities, but considering parents' benefits & risks; (4) clear about from whose perspective performance measures can be used, own

perspective, or that of the alliance; (5) indicating at which alliance stage various alliance performance measures are appropriate; (6) combining objective performance measures with subjective performance measures; (7) traditional performance measures are combined with alliance-specific measures.

9.2.3 Key Conclusions from the Multiple Case Studies

- Within the theoretical niche, the Reference Model developed in this research could help manufacturing companies identify their strengths and weaknesses for VME transformation, as described in Chapter 7 Section 7.4 "Case Study Results".
- Within the theoretical niche, "joint analysis across functions" and "regular review for long-term tasks" are the practices that are commonly adopted by manufacturing companies for their EI decisions. However, manufacturing companies also have a common weakness in "joint analysis across firms" (e.g. value stream parties) for their EI decision making (see Chapter 7 Section 7.4.2.1).
- For managing EI operations, "internal resource allocation" and "performance evaluation (for both external & internal operations)" are the practices that are commonly adopted by manufacturing companies within the theoretical niche. However, the companies exhibit a common shortage of activities to manage the knowledge gained from their experience of EI operations (see Chapter 7 Section 7.4.2.1).
- Within the theoretical niche, manufacturing companies generally assess the following issues most comprehensively in their alliance performance evaluation: "alliance parties' resource contributions", "alliance objectives", "alliance decision making" and "alliance supporters" (see Chapter 7 Section 7.4.2.1). The following issues need more attention: "alliance parties' dependency", "resource protection", "alliance managers", "cross partner teams", "alliance parties' operational conflicts", and "trust among alliance parties".
- As to "continuous optimisation of value streams towards lean operation", within the theoretical niche of this research, the Chinese companies and the companies with national/regional market scope generally exhibited a lack of awareness of its importance, whereas the UK companies and the companies with global market scope exhibited higher performance (see Chapter 7 Sections 7.4.2.2 & 7.4.2.4). To achieve VME transformation, the Chinese companies need to introduce "lean thinking" into their operations, and invest significant effects and resources in the building of a mechanism to ensure continuous improvement of value streams.
- As to "gaining stakeholders' support for EI", within the theoretical niche of this research, the UK companies and the companies with global market scope might need to think about how to

combine the benefit of authorising high autonomy to managers' with the benefit of gaining stakeholders' support (see Chapter 7 Sections 7.4.2.2 & 7.4.2.4).

- As to "alliance performance measurement", within the theoretical niche of this research, the Chinese case study companies and the companies with national/regional market scope need to adopt more performance measures for controlling their alliance performance (see Chapter 7 Sections 7.4.2.2 & 7.4.2.4).
- "Size" of the companies within the theoretical niche has no significant influence on the companies' practices related to the Reference Model, since no particular pattern was observed when the case study results were sorted by "size" (see Chapter 7 Section 7.4.2.3).

9.3 Implications for Theory

This thesis makes several contributions to knowledge.

- This research has designed an analysis template for EI decision making, which overcame the deficiencies of the resource-based explanations identified in the literature. As demonstrated in Chapter 4 Section 4.4, this template is based on the relationships established between three resource-combination based underlying factors (effectiveness; management complexity; flexibility) and three motives for EI decision making (increasing outputs; reducing inputs; minimising risks).
- Although "VME transformation" is a very abstract objective, this research has demonstrated that a mechanism can be found for achieving this objective: operating along the VME metabolism closing loop. To successfully implement this mechanism, VME transformation was broken down in this research into six more tangible areas (see Figure 7.4): (1) lean manufacturing; (2) competency protection; (3) internal operation performance measurement; (4) alliance performance measurement; (5) knowledge management; (6) EI decision making.
- The findings in the literature regarding "Alliance Management Function" were extended in this research for designing an approach to ensure effective operation along the VME metabolism. As described in Chapter 5 Section 5.3.1 & Section 5.3.2, the original responsibilities of the Alliance Management Function were upgraded and new ones added in order to achieve this objective. Based on the upgraded function, a VME functional structure is proposed, as discussed in Chapter 5 Section 5.4. This structure is an innovative concept designed to clarify the position of the upgraded function within a VME, and its boundary with other functions along value streams.
- This research has designed an alliance performance measurement system (APMS) with fourteen categories of performance measures. This APMS possesses features overcoming the gaps perceived in the literature, as discussed in Chapter 6 Section 6.3.2.

- In the literature, "resource" was vaguely defined and categorised at a level too high to be practically useful to manufacturing companies. This research identified 10 types of resources that might be sought by manufacturing companies through alliances, as demonstrated in Chapter 4 Section 4.3.1. Through illustrating the features of these resource categories, the definition of "resource" was clarified (see Table 4.1).
- Another important contribution of this research is that it clarifies the relationships between the two important research areas focused in recent years: (1) virtual manufacturing; (2) lean operation. This research indicates that: lean operation is the objective of operational adjustments; virtual manufacturing is an important form for achieving lean operation.

9.4 Implications for Practice

- Operating along VME metabolism ensures that externalisation and internalisation are treated as equal options for carrying out tasks. This helps avoid the neglect of the assessment of externalising a task as an alternative to internalising the task, which might pose negative effects on task outputs, inputs and/or risks.
- Compared with the transaction-cost and resource-based explanations in the literature, this research provides an EI decision making template which is more generic, comprehensive, and understandable (see Chapter 4 Section 4.4). Combined with the 10 categories of resources discussed in Chapter 4 Section 4.3.1, this template can help manufacturing companies improve their effectiveness in EI decision making.
- The EI Management Function and the VME functional structure designed in this research help drive manufacturing companies towards customer-oriented operations, as discussed in Chapter 5 Section 5.4. For those senior managers interested in VME transformation, the breaking down of this transformation into six operational areas (see Figure 8.1) could help clarify the actions to take.
- The Alliance Performance Measurement System (APMS), as discussed in Chapter 6, could serve as a comprehensive reservoir where firms could pick up relevant performance measures to evaluate their alliances. Firms could choose different performance measures according to: (1) the issues they want to assess, (2) whether the inputs, processes or outputs to assess, (3) which balanced scorecard perspective(s) most relevant to them, (4) what perspective (own or that of the alliance) from which assessment should take place, and (5) the alliance stage(s) at which the performance evaluation is going to be carried out. In this way, comprehensiveness and flexibility could be both achieved.
- This research found that the UK companies exhibited a higher performance than the Chinese companies in terms of continuous value stream optimisation. This helps the UK companies more

smartly configure their external and internal operations for achieving lean manufacturing. This is perhaps where the Chinese companies need to improve.

- The research perceived a common weakness across all field case study companies regarding the use of cross-firm joint analysis for value stream configuration, no matter these companies were large or small, in the UK or in China. Thus firms might need to pay more attention to this issue and gradually strengthen the joint analysis among their value stream parties. As useful guidance to where the efforts should be made, some reasons for the difficulties of implementing cross-firm analysis were also identified: distrust among value stream parties; lack of awareness of the relevant benefits; insufficient influence of a company as a "driver" of cross-firm analysis; lack of collaborative culture on the sides of value stream parties.
- Similarly, a common weakness was perceived across all field case study companies regarding knowledge management.

9.5 Limitations of the Research

It is important to view this research in terms of its limitations. In addition to the scope of the **Reference Model** discussed in Chapter 8 Section 8.5, and the limitation of the **Research Methodology** discussed in Chapter 8 Section 8.7, this research also subjects to some other limitations.

- Although the contents of the Reference Model have been tested and validated (see Section 8.6 "Validity of the Reference Model"), it would have been useful to study the companies through direct observation of the implementation of the Reference Model. Directly observing how the companies customise and implement the Reference Model according to their specific situations would have incorporated knowledge based on practical experience into the Reference Model (Williams, 1998).
- The Reference Model developed within this research has only been sufficiently validated with the companies in China, and pilot tested with the companies in the UK. Although these two countries were selected as representative of developing and developed countries, the Reference Model has not been tested in companies of other countries.
- The VME Transformation mechanism designed in this research is possibly just one of the approaches to transform a traditional manufacturing company into a VME. Another approach might be to identify the best practices at each stage of the VME metabolism. However, the "best practice" approach would be subject to several limitations if adopted: (1) since the VME metabolism almost covers every activity of a manufacturing company, identifying best practices would be practically infeasible in this research; (2) considering the fact that best practices would evolve over time, it was perceived as a higher priority to design a mechanism to ensure such

evolving rather than identifying each best practice; this is why the EI Management Function integrates "knowledge management" as one of its responsibilities.

9.6 Recommendations for Future Work

Although six areas have been identified as directly related to VME transformation, as discussed in Chapter 8 Section 8.5, only two of them (i.e. EI decision making; alliance performance measurement) have been studied in detail in this research. Research could be carried out to add new modules to the existing Reference Model to include the other four areas (i.e. lean manufacturing; competency protection; internal operation performance measurement; knowledge management) which were not studied in this research.

As the Reference Model was developed in this research through a theory verification approach, it would be useful to carry out further research to refine the Reference Model through a theory development approach. Direct observation of how manufacturing companies implement the VME transformation could help identify any additional knowledge that could be added to the Reference Model based on practical experience.

Further research could be carried out in more UK companies to confirm/challenge the case study results of this research. Companies in countries other than the UK and China could also be included to enlarge the boundary limits of the theoretical niche illustrated in Chapter 7 Section 7.3.2.

In its present status, the Reference Model is independent of the characteristics of manufacturing companies. Additional research could be carried out to prioritise the elements within the Reference Model according to firms' characteristics, such as industries, locations, size, etc., so that the Reference Model could help firms focus their precious resources on those issues with higher priorities.

Specific to this area of research, small companies generally attracted much less research attention than large international companies, and therefore little guidance could be found in the literature regarding the issues specific to small companies, such as how to ensure continuous value stream optimisation, and how to establish knowledge management system. Due to the distinguishing features of small companies, e.g. less influence upon their value stream parties, inexistence of large professional community for adopting standard knowledge management practices, specific guidance is needed for small firms to solve the relevant issues.

Although various competency protection approaches, especially in alliance scenarios, have been proposed in the literature, not much case studies could be found. This might become an area where future research should be carried out.

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Appendix 1 Questionnaire (4th Version)

Explanation of terms:

- **Value stream**
  The set of all the specific actions required to bring a specific product (whether a good, a service, or, increasingly, a combination of the two) through the three critical management tasks
  (a) The problem-solving task running from concept through detailed design and engineering to production launch;
  (b) The information management task running from order-taking through detailed scheduling to delivery;
  (c) The physical transformation task proceeding from raw materials to a finished product in the hands of the customer.
- **Analysis template**
  Taking the form such as a table, a diagram, etc., an analysis template lists all potential issues to be analysed, serving as a reminder to prevent omission of considering important issues, and also serving as a tool to organise these issues in logic orders.
- **High-level performance evaluation**
  Compared with detailed performance evaluation, high-level performance evaluation focuses on task outputs, rather than task inputs and processes. Detailed performance evaluation may assess all potential issues relevant to task outputs, inputs and processes.
- **Alliance**
  A way of performing tasks using external resources. Firms do not own the resources accessed through alliances. Alliances can take a number of forms, which can differentiate from one another according to the degree of collaboration. For example, simple outsourcing can be viewed as alliance without much collaboration.
- **Internalised operation**
  A way of performing tasks using internal resources. Firms do own the resources, although the resources might be acquired through a number of ways, such as merge/acquisition.

Documents to be collected if available:

- Copies of formal documents specifying **value streams**
- Copies of formal documents specifying **performance measures**

Company		Number of Employees	
Industry		Location	
Main Products		Market	

PLEASE ATTACH ADDITIONAL SHEETS WHEREVER NECESSARY

1. Does your company have **formal documents** specifying its **value streams** (Yes/No)?

Yes	No	If 'Yes', **examples** (*obtaining documents*)

Does your company use any **approach** to make sure that its **value streams** can be **continuously optimised** (Yes/No)?

Yes	No	If 'Yes', what is the **approach**; **examples**

2. Does your company use any **approach** (such as **joint analysis** across functions & firms, and **analysis template**) to make sure that **all relevant issues** are taken into consideration when deciding to use alliances, or to totally depend on your company's own resources, to perform a task (Yes/No)?

Yes	No	If 'Yes', what is the **approach**; **examples**

3. For **long term** tasks, does your company **regularly review** the decisions (Yes/No)?

Yes	No	If 'Yes', **examples**

4. Please tick (✓) whether you company has the following **practices**.
   If ticked, please indicate **how** the practice is **performed**.

Practices	✓	If ticked, **how** the practice is **performed**
(1) Ensuring value stream optimisation		
(2) Coordinating alliances and internalised operations to improve their compatibility		
(3) Allocating internal resources for alliances and internalised operations		
(4) Collecting, assessing, and supporting staff's proposals of alliances and internalised operations		
(5) Gaining stakeholders' (e.g. shareholders', employees') support for alliances and internalised operations		
(6) Designing competency protection		
(7) Evaluating performance of alliances and internalised operations (high level performance evaluation)		
Knowledge management:		
(8) Capturing staff's knowledge relevant to alliances and internalised operations *(e.g. how to select alliance partners; how to operate a merger, how to manage suppliers, how to improve product quality, etc.)*		
(9) Creating knowledge relevant to alliances and internalised operations		
(10) Educating staff in knowledge relevant to alliances and internalised operations		

5. Does your company evaluate the performance of ... (Yes/No)?

	Yes	No	If 'Yes', (*obtaining documents*)
Performance of alliances (i.e. collaborations with external parties)			
Performance of internalised operations			

6. Please tick (✓) the **alliance performance measures** used (formally & informally) by your company. If a measure is not used, please indicate the **reason**.

	(Areas of) Measures	Used (✓)	If not used, **reason**
6.1	**Measures assessing "alliance parties' resource contributions"**		
	(1) Whether alliance parties' resource contributions complement each other		
	(2) Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives		
	(3) Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)		
	(4) Whether alliance parties have actually contributed the resources they have agreed to contribute		
	Any additional measures:		
6.2	**Measures assessing "alliance parties' dependency"**		
	(1) Our dependency on our partners		
	(2) Our partners' dependency on us		
	(3) Compatibility among alliance parties' objectives		
	(4) Our risks due to the alliance		
	(5) Our partners' risks due to the alliance		
	Any additional measures:		
6.3	**Measures assessing "alliance objectives"**		
	(1) The alliance objectives create a mutually acceptable win-win situation		
	(2) Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)		
	(3) Whether the alliance objectives are achievable (such as feasibility report)		

	(4) Measures assessing alliance objective achievement (e.g. net profit/sales)		
	Any additional measures:		
6.4	**Measures assessing "resource protection"**		
	(1) Whether our company's resources have been put under effective protection		
	(2) Whether our company's resources under protection have been damaged		
	(3) Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance		
	(4) Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred		
	Any additional measures:		
6.5	**Measures assessing "alliance geographic location"**		
	(1) Whether the alliance geographic location helps achieve alliance objectives		
	(2) Whether the alliance geographic location helps protect our company's resources		
	Any additional measures:		
6.6	**Measures assessing "alliance managers"**		
	(1) Alliance managers' characteristics, such as their expertise		
	(2) Whether alliance managers have effectively conducted their responsibilities		
	Any additional measures:		
6.7	**Measures assessing "task allocation among alliance parties"**		
	(1) Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)		
	(2) Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)		
	(3) Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)		
	(4) Whether task allocation avoids task duplication		
	Any additional measures:		
6.8	**Measures assessing "cross-partner teams"**		
	(1) Whether each cross-partner team has a clear purpose		
	(2) Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)		
	(3) Cross-partner team members' characteristics, such as their expertise		
	(4) Whether team members can effectively communicate with each other		
	(5) Whether cross-partner teams facilitate alliance parties to learn from each other		
	(6) Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)		
	Any additional measures:		
6.9	**Measures assessing "alliance decision making"**		
	(1) Whether key alliance decisions are made with alliance parties' consensus		
	(2) Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support		
	Any additional measures:		
6.10	**Measures assessing "alliance assets sharing"**		
	(1) Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets		
	(2) Whether alliance assets can be fairly shared among alliance parties according to resource contributions		

	(3) Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us		
	Any additional measures:		
6.11	**Measures assessing "partners' post-dissolution activities"**		
	(1) After the alliance dissolves, our partners/other companies won't use our partners' resources enhanced/created through the alliance to compete with us		
	Any additional measures:		
6.12	**Measures assessing "alliance parties' operational conflicts"**		
	(1) Alliance parties' operational conflicts with the alliance		
	(2) Alliance parties' operational conflicts with each other		
	Any additional measures:		
6.13	**Measures assessing "trust among alliance parties"**		
	(1) Whether alliance parties are comfortable with their partners' performance		
	(2) Alliance parties' commitment to the alliance		
	(3) Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)		
	(4) How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)		
	(5) Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them		
	(6) Whether open communication exists among alliance parties		
	(7) Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks		
	Any additional measures:		
6.14	**Measures assessing "alliance supporters"**		
	(1) Whether at least one supporter of the alliance exist on the side of each alliance party		
	(2) Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions		
	Any additional measures:		
	Any additional categories of measures:		

Many thanks for your help!
Please write your name and address, including e-mail and telephone number, so that we can send you the results of our analysis.

Name: _____ Email: _____
Tele no.: _____
Address:

_____

_____

Professor A. K. Kochhar
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Appendix 2 Further Questions

This appendix illustrates examples of questions sent to case study companies after interviews for clarification purpose. Such questions are tailored for different companies.

Further Questions for Company F

1. Please tick (✓) the **alliances** in which your company has **experience**.
   If ticked (✓), please briefly describe the alliance **background**, **reasons**, & **what** (e.g. expertise, market knowledge, financial resource) you are seeking from your partner, & your partner is seeking from you.

	✓	If ✓, background, reasons, & what sought
(1) **Supply chain** partnerships		
(2) Collaboration/alliance with **customers**		
(3) Partnerships for **developing new products** (with competitors, R&D institutions, etc.)		
(4) **Manufacturing** partnerships (e.g. achieving scale economies, reducing labour costs, etc.)		
(5) Partnerships for **entering new geographic areas** (e.g. entering Japanese market, entering Chinese market, etc.)		
(6) Partnerships for **entering a new industry**		
(7) Alliances for **learning** from partners (e.g. management expertise, product technologies, etc.)		
(8) Others:		

2. Our last interview has identified the following practices which are/aren't carried out in your company. Please **confirm**, and also give brief **example** for each practice carried out (✓).

		If ✓, please give brief example
(1) **Formally documenting** value streams (e.g. supply chain process, NPD process)	✓	
(2) **Continuous optimisation** of value streams	✓	
(3) Joint analysis **across functions** to decide whether alliance should be used	✓	
(4) Joint analysis **across firms** to decide whether alliance should be used	×	
(5) Using an **analysis template** for alliance decision making	×	
(6) **Regular review** of alliance decisions for long-term tasks	✓	
(7) **Coordinating** internal & alliance operations to improve their compatibility	×	
(8) **Resource allocation** for internal & alliance operations	✓	(Who are responsible?)
(9) Existence of **focal point** for collecting, assessing, and supporting proposals for internal & alliance operations	✓	(Who is the focal point?)
(10) Gaining **stakeholders'** support for internal & alliance operations	×	
(11) Designing **competency protection**	×	
(12) **Capturing** knowledge from experience of internal & alliance operations	×	
(13) **Creating** knowledge for internal & alliance operations	×	
(14) **Educating** staff	✓	

Many thanks for your help!
Please write your name and address, including e-mail and telephone number, so that we can send you the results of our analysis.

Name: _____ Email: _____
Tele no.: _____

Address:

Professor A. K. Kochhar
Head of the School of Engineering & Applied Science
Aston University

Y. Zhang
Researcher
Aston University

Further Questions for Company G

1. Please tick (✓) the **alliances** in which your company has **experience.**
If ticked (✓), please briefly describe the alliance **background, reasons, & what** (e.g. expertise, market knowledge, financial resource) you are seeking from your partner, & your partner is seeking from you.

	✓	If ✓, background, reasons, & what sought
(1) **Supply chain** partnerships		
(2) Collaboration/alliance with **customers**		
(3) Partnerships for **developing new products** (with competitors, R&D institutions, etc.)		
(4) **Manufacturing** partnerships (e.g. achieving scale economies, reducing labour costs, etc.)		
(5) Partnerships for **entering new geographic areas** (e.g. entering Japanese market, entering Chinese market, etc.)		
(6) Partnerships for **entering a new industry**		
(7) Alliances for **learning** from partners (e.g. management expertise, product technologies, etc.)		
(8) Others:		

2. Our last interview has identified the following practices which are/aren't carried out in your company. Please **confirm**, and also give brief **example** for each practice carried out (✓).

		If ✓, please give brief example
(1) **Formally documenting** value streams (e.g. supply chain process, NPD process)	✓	
(2) **Continuous optimisation** of value streams	✓	
(3) Joint analysis **across functions** to decide whether alliance should be used	✓	
(4) Joint analysis **across firms** to decide whether alliance should be used	×	
(5) Using an **analysis template** for alliance decision making	✓	
(6) **Regular review** of alliance decisions for long-term tasks	✓	
(7) **Coordinating** internal & alliance operations to improve their compatibility	✓	
(8) **Resource allocation** for internal & alliance operations	✓	(Who are responsible?)
(9) Existence of **focal point** for collecting, assessing, and supporting proposals for internal & alliance operations	×	
(10) Gaining **stakeholders'** support for internal & alliance operations	×	
(11) Designing **competency protection**	✓	
(12) **Capturing** knowledge from experience of internal & alliance operations	✓	
(13) **Creating** knowledge for internal & alliance operations	✓	
(14) **Educating** staff	×	

Many thanks for your help!
Please write your name and address, including e-mail and telephone number, so that we can send you the results of our analysis.

Name: _____ Email: _____

Tele no.: _____

Address:

Professor A. K. Kochhar
Head of the School of Engineering & Applied Science
Aston University

Y. Zhang
Researcher
Aston University

Appendix 3 Alliance Performance Measurement System

(Areas of) Measures	In/pro/out	Balanced Scorecard Dimension	Perspective	Stage	Objective /Subjective	Alliance Specific
Measures assessing "alliance parties' resource contributions"						
Whether alliance parties' resource contributions complement each other	**Input** (*resource input*)	Internal	Alliance perspective	**Formation**; **Operation** (*resource input*)	Objective; Subjective	✓
Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives	**Input** (*resource input*)	Internal	Alliance perspective	**Formation**; **Operation** (*resource input*)	Objective; Subjective	✓
Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)	**Input** (*resource input*)	Internal	Alliance perspective	**Formation**; **Operation** (*resource input*)	Objective; Subjective	×
Whether alliance parties have actually contributed the resources they have agreed to contribute	**Process** (*inputting resources*)	Internal	Alliance perspective	**Operation** (*inputting resources*)	Objective; Subjective	✓
Measures assessing "alliance parties' dependency"						
Our dependency on our partners	**Input**; **Output** (*initial & evolved dependency*)	Financial; Customer; Learning & growth; Internal	Own perspective	**Formation**; **Operation** (*initial & evolved dependency*)	Objective	✓

Our partners' dependency on us	**Input**; **Output** (*initial & evolved dependency*)	Financial; Customer; Learning & growth; Internal	Own perspective	**Formation**; **Operation** (*initial & evolved dependency*)	Objective	✓
Compatibility among alliance parties' objectives	**Input**; **Output** (*initial & evolved compatibility*)	Financial; Customer; Learning & growth; Internal	Alliance perspective	**Formation**; **Operation** (*initial & evolved compatibility*)	Objective; Subjective	✓
Our risks due to the alliance	**Input**; **Output** (*initial & evolved risk*)	Financial; Customer; Learning & growth; Internal	Own perspective	**Formation**; **Operation** (*initial & evolved risk*)	Objective; Subjective	✓
Our partners' risks due to the alliance	**Input**; **Output** (*initial & evolved risk*)	Financial; Customer; Learning & growth; Internal	Own perspective	**Formation**; **Operation** (*initial & evolved risk*)	Objective; Subjective	✓
Measures assessing "alliance objectives"						
The alliance objectives create a mutually acceptable win-win situation	**Output** (*output from achieving the objectives*)	Financial; Customer; Learning & growth	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*output from achieving the objectives*)	Objective; Subjective	✓
Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)	**Output** (*benefits*)	Financial; Customer; Learning & growth	Own perspective	**Formation**; **Operation**; **Dissolution** (*benefits*)	Subjective	×
Whether the alliance objectives are achievable (such as feasibility report)	**Input**; **Process** (*feasibility of achieving the objectives via the input & process*)	Internal	Alliance perspective	**Formation**; **Operation** (*feasibility of achieving the objectives via the input & process*)	Objective; Subjective	×
Measures assessing alliance objective achievement (e.g. net profit/sales)	**Output** (*alliance achievement, thus partner benefits*)	Financial; Customer; Learning & growth	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*alliance achievement, thus partner benefits*)	Objective; Subjective	×

Measures assessing "resource protection"						
Whether our company's resources have been put under effective protection	**Input**; **Process** (*our resource input & process for protection*)	Internal	Own perspective	**Formation**; **Operation**; **Dissolution** (*our resource input & process for protection*)	Objective; Subjective	✓
Whether our company's resources under protection have been damaged	**Output** (*outcome of protection*)	Financial; Customer; Learning & growth	Own perspective	**Operation**; **Dissolution** (*outcome of protection*)	Objective; Subjective	✓
Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance	**Output** (*outcome of protection*)	Financial; Customer; Learning & growth	Own perspective	**Operation**; **Dissolution** (*outcome of protection*)	Objective; Subjective	✓
Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred	**Input**; **Process** (*our partners' resource input & process for acquisition*)	Internal	Own perspective	**Formation**; **Operation**; **Dissolution** (*our partners' resource input & process for acquisition*)	Objective; Subjective	✓
Measures assessing "alliance geographic location"						
Whether the alliance geographic location helps achieve alliance objectives	**Input** (*location*)	Internal	Alliance perspective	**Formation**; **Operation** (*location*)	Objective; Subjective	×
Whether the alliance geographic location helps protect our company's resources	**Input** (*location*)	Internal	Own perspective	**Formation**; **Operation** (*location*)	Objective; Subjective	✓

Measures assessing "alliance managers"						
Alliance managers' characteristics, such as their expertise	**Input** (*managers*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*managers*)	Objective; Subjective	× ✓
Whether alliance managers have effectively conducted their responsibilities	**Process**; **Output** (*managers' behaviours & outcomes*)	Financial; Customer; Learning & growth; Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*managers' behaviours & outcomes*)	Objective; Subjective	× ✓
Measures assessing "task allocation among alliance parties"						
Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)	**Process** (*task allocation*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*task allocation*)	Objective	✓
Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)	**Output** (*resource protection outcomes of task allocation*)	Financial; Customer; Learning & growth	Own perspective	**Formation**; **Operation**; **Dissolution** (*resource protection outcomes of task allocation*)	Objective; Subjective	✓
Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)	**Output** (*benefit achievement outcomes of task allocation*)	Financial; Customer; Learning & growth	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*benefit achievement outcomes of task allocation*)	Objective; Subjective	✓

Whether task allocation avoids task duplication	**Process** (*task allocation*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*task allocation*)	Objective	×
Measures assessing "cross-partner teams"						
Whether each cross-partner team has its clear purpose	**Process** (*setting clear purpose*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*setting clear purpose*)	Objective; Subjective	×
Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)	**Output** (*outcomes of achieving team purpose*)	Financial; Customer; Learning & growth	Alliance perspective	**Formation; Operation; Dissolution** (*outcomes of achieving team purpose*)	Objective; Subjective	×
Cross-partner team members' characteristics, such as their expertise	**Input** (*human resource input into the team*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*human resource input into the team*)	Objective; Subjective	× ✓
Whether team members can effectively communicate with each other	**Input; Process** (*communication facility input & human behaviour for effective communication*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*communication facility input & human behaviour for effective communication*)	Objective; Subjective	× ✓
Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)	**Output** (*resource protection outcomes of cross-partner teams*)	Financial; Customer; Learning & growth	Own perspective	**Formation; Operation; Dissolution** (*resource protection outcomes of cross-partner teams*)	Objective; Subjective	✓
Measures assessing "alliance decision making"						
Whether key alliance decisions are made with alliance parties' consensus	**Process** (*deciding via consensus*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*deciding via consensus*)	Objective	✓

Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support	**Process** (*deciding via effective communication with stakeholders*)	Financial; Customer; Internal	Alliance perspective	**Formation; Operation; Dissolution** (*deciding via effective communication with stakeholders*)	Objective; Subjective	✓
Measures assessing "alliance assets sharing"						
Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets	**Process** (*distinguishing own assets from alliance assets*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*distinguishing own assets from alliance assets*)	Objective	✓
Whether alliance assets can be fairly shared among alliance parties according to resource contributions	**Process** (*fairly sharing alliance assets*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*fairly sharing alliance assets*)	Objective	✓
Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us	**Output** (*outcome from alliance asset distribution*)	Financial; Customer; Learning & growth	Own perspective	**Formation; Operation; Dissolution; Post-dissolution** (*outcome from alliance asset distribution*)	Subjective	✓
Measures assessing "partners' post-dissolution activities"						
Whether our competition risks caused by our partners' post-dissolution activities have been minimised	**Output** (*competition outcome of the alliance*)	Financial; Customer; Learning & growth	Own perspective	**Formation; Operation; Dissolution; Post-dissolution** (*competition outcome of the alliance*)	Subjective	✓
Measures assessing "alliance parties' operational conflicts"						

Alliance parties' operational conflicts with the alliance	**Input**; **Output** (*initial & evolved conflicts*)	Financial; Customer; Learning & growth; Internal	Alliance perspective	**Formation**; **Operation** (*initial & evolved conflicts*)	Objective; Subjective	✓
Alliance parties' operational conflicts with each other	**Input**; **Output** (*initial & evolved conflicts*)	Financial; Customer; Learning & growth; Internal	Alliance perspective	**Formation**; **Operation** (*initial & evolved conflicts*)	Objective; Subjective	✓
Measures assessing "trust among alliance parties"						
Whether alliance parties are comfortable with their partners' performance	**Output** (*outcome of partners' performance*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*outcome of partners' performance*)	Subjective	✓
Alliance parties' commitment to the alliance	**Process** (*parties' behaviour*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*parties' behaviour*)	Subjective	✓
Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)	**Process** (*parties' dishonest behaviour*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*parties' dishonest behaviour*)	Objective; Subjective	✓
How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)	**Process** (*parties' interpretation*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*parties' interpretation*)	Subjective	✓
Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them	**Process** (*parties' interpretation*)	Internal	Alliance perspective	**Formation**; **Operation**; **Dissolution** (*parties' interpretation*)	Subjective	✓

Whether open communication exists among alliance parties	**Process** (*open communicating*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*open communicating*)	Subjective	✓
Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks	**Process** (*parties' behaviour*)	Internal	Alliance perspective	**Formation; Operation; Dissolution** (*parties' behaviour*)	Subjective	✓
Measures assessing "alliance supporters"						
Whether sufficient supporters of the alliance exist on the side of each alliance party	**Input** (*human resource input*)	Internal	Alliance perspective	**Formation; Operation** (*human resource input*)	Subjective	✓
Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions	**Input; Process; Output** (*human resource input, behaviour, and outcome*)	Internal	Alliance perspective	**Formation; Operation** (*human resource input, behaviour, and outcome*)	Subjective	✓

Appendix 4 Case Study Analysis Template

	A	B	C	D	E	F	G
Module 1 – VME Metabolism and Its Switcher	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Continuous optimisation of value streams towards lean operation							
(2) Joint analysis across functions							
(3) Joint analysis across firms							
(4) Regular review of EI decisions for long-term tasks							
Module 2 – EI Management Function	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Ensuring value stream optimisation							
(2) Improving EI compatibility							
(3) Internal resource allocation for EI							
(4) Gaining stakeholders' support for EI							
(5) Designing competency protection							
(6) Evaluating EI performance							
(7) EI knowledge management							
Module 3 – VME Performance Measurement	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Performance measurement for externalised operations							
(2) Performance measurement for internalised operations							
Assessment issues for external operations							
M3.1 alliance parties' resource contributions							
Whether alliance parties' resource contributions complement each other							
Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives							
Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)							
Whether alliance parties have actually contributed the resources they have agreed to contribute							
M3.2 alliance parties' dependency							
Our dependency on our partners							
Our partners' dependency on us							
Compatibility among alliance parties' objectives							
Our risks due to the alliance							
Our partners' risks due to the alliance							
M3.3 alliance objectives							
The alliance objectives create a mutually acceptable win-win situation							
Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)							
Whether the alliance objectives are achievable (such as feasibility report)							
Measures assessing alliance objective achievement (e.g. net profit/sales)							

M3.4 resource protection							
Whether our company's resources have been put under effective protection							
Whether our company's resources under protection have been damaged							
Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance							
Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred							
M3.5 alliance geographic location							
Whether the alliance geographic location helps achieve alliance objectives							
Whether the alliance geographic location helps protect our company's resources							
M3.6 alliance managers							
Alliance managers' characteristics, such as their expertise							
Whether alliance managers have effectively conducted their responsibilities							
M3.7 task allocation among alliance parties							
Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)							
Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)							
Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)							
Whether task allocation avoids task duplication							
M3.8 cross-partner teams							
Whether each cross-partner team has its clear purpose							
Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)							
Cross-partner team members' characteristics, such as their expertise							
Whether team members can effectively communicate with each other							
Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)							
M3.9 alliance decision making							
Whether key alliance decisions are made with alliance parties' consensus							
Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support							

M3.10 alliance assets sharing							
Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets							
Whether alliance assets can be fairly shared among alliance parties according to resource contributions							
Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us							
M3.11 partners' post-dissolution activities							
Whether our competition risks caused by our partners' post-dissolution activities have been minimised							
M3.12 alliance parties' operational conflicts							
Alliance parties' operational conflicts with the alliance							
Alliance parties' operational conflicts with each other							
M3.13 trust among alliance parties							
Whether alliance parties are comfortable with their partners' performance							
Alliance parties' commitment to the alliance							
Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)							
How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)							
Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them							
Whether open communication exists among alliance parties							
Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks							
M3.14 alliance supporters							
Whether sufficient supporters of the alliance exist on the side of each alliance party							
Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions							

Appendix 5 Case Study Analysis – By Location

(NR-Not relevant; O-Objection)

	China					UK	
	A	B	C	D	E	F	G
Module 1 – VME Metabolism and Its Switcher	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Continuous optimisation of value streams towards lean operation	×	×	×	×	×	✓	✓
(2) Joint analysis across functions	✓	✓	✓	✓	✓	✓	✓
(3) Joint analysis across firms	×	×	×	×	×	×	×
(4) Regular review of EI decisions for long-term tasks	✓	✓	✓	✓	✓	✓	✓
Module 2 – EI Management Function	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Ensuring value stream optimisation	×	×	×	×	×	✓	✓
(2) Improving EI compatibility	✓	✓	✓	✓	✓	×	✓
(3) Internal resource allocation for EI	✓	✓	✓	✓	✓	✓	✓
(4) Gaining stakeholders' support for EI	✓	✓	✓	✓	✓	×	×
(5) Designing competency protection	✓	✓	✓	×	✓	✓	✓
(6) Evaluating EI performance	✓	✓	✓	✓	✓	✓	✓
(7) EI knowledge management	×	×	×	×	×	×	×
Module 3 – VME Performance Measurement	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Performance measurement for external operations	✓	✓	✓	✓	✓	✓	✓
(2) Performance measurement for internal operations	✓	✓	✓	✓	✓	✓	✓
Assessment issues for external operations							
M3.1 alliance parties' resource contributions							
Whether alliance parties' resource contributions complement each other	✓	✓	✓	✓	✓	✓	✓
Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives	✓	✓	✓	✓	✓	✓	✓
Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)	✓	✓	✓	✓	✓	✓	✓
Whether alliance parties have actually contributed the resources they have agreed to contribute	✓	✓	✓	✓	✓	✓	× (NR)
M3.2 alliance parties' dependency							
Our dependency on our partners	✓	✓	✓	✓	✓	×	✓
Our partners' dependency on us	×	✓	✓	✓	✓	×	✓
Compatibility among alliance parties' objectives	×	×	×	✓	×	×	✓
Our risks due to the alliance	✓	✓	✓	✓	✓	✓	✓
Our partners' risks due to the alliance	×	✓	×	✓	×	×	✓
M3.3 alliance objectives							
The alliance objectives create a mutually acceptable win-win situation	✓	✓	✓	✓	✓	✓	✓
Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)	✓	✓	✓	✓	✓	✓	✓
Whether the alliance objectives are achievable (such as feasibility report)	✓	✓	✓	✓	✓	✓	✓
Measures assessing alliance objective achievement (e.g. net profit/sales)	✓	✓	✓	✓	✓	✓	✓

M3.4 resource protection							
Whether our company's resources have been put under effective protection	✓	✓	✓	×	✓	✓	✓
Whether our company's resources under protection have been damaged	✓	✓	×	×	×	×	×
Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance	✓	✓	×	×	×	✓	✓
Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred	×	×	×	×	×	×	×
M3.5 alliance geographic location							
Whether the alliance geographic location helps achieve alliance objectives	✓	✓	✓	✓	✓	✓	✓
Whether the alliance geographic location helps protect our company's resources	×	×	×	×	×	✓	✓
M3.6 alliance managers							
Alliance managers' characteristics, such as their expertise	×	×	×	×	✓	✓	✓
Whether alliance managers have effectively conducted their responsibilities	×	✓	✓	✓	✓	✓	✓
M3.7 task allocation among alliance parties							
Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)	✓	✓	✓	✓	✓	✓	✓
Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)	✓	✓	×	× (NR)	✓	✓	✓
Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)	✓	✓	✓	✓	✓	✓	✓
Whether task allocation avoids task duplication	✓	✓	✓	✓	✓	✓	× (O)
M3.8 cross-partner teams							
Whether each cross-partner team has its clear purpose	✓	✓	✓	✓	✓	✓	✓
Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)	✓	✓	✓	✓	✓	✓	×
Cross-partner team members' characteristics, such as their expertise	×	×	✓	✓	×	✓	✓
Whether team members can effectively communicate with each other	✓	×	×	×	×	✓	✓
Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)	×	×	×	× (NR)	✓	✓	✓
M3.9 alliance decision making							
Whether key alliance decisions are made with alliance parties' consensus	✓	✓	✓	✓	✓	✓	✓
Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support	✓	✓	✓	✓	✓	✓	✓

M3.10 alliance assets sharing							
Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets	× (NR)	× (NR)	✓	× (NR)	✓	× (NR)	✓
Whether alliance assets can be fairly shared among alliance parties according to resource contributions	× (NR)	× (NR)	✓	× (NR)	✓	× (NR)	✓
Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us	× (NR)	× (NR)	×	× (NR)	✓	× (NR)	✓
M3.11 partners' post-dissolution activities							
Whether our competition risks caused by our partners' post-dissolution activities have been minimised	✓	✓	×	✓	✓	✓	✓
M3.12 alliance parties' operational conflicts							
Alliance parties' operational conflicts with the alliance	×	×	✓	✓	×	✓	✓
Alliance parties' operational conflicts with each other	×	×	✓	✓	×	✓	✓
M3.13 trust among alliance parties							
Whether alliance parties are comfortable with their partners' performance	✓	✓	✓	✓	✓	✓	✓
Alliance parties' commitment to the alliance	✓	✓	✓	✓	✓	✓	✓
Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)	✓	✓	✓	✓	✓	✓	✓
How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)	×	×	✓	✓	×	✓	✓
Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them	×	×	×	×	×	✓	×
Whether open communication exists among alliance parties	✓	✓	×	×	✓	✓	×
Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks	✓	✓	×	×	✓	✓	×
M3.14 alliance supporters							
Whether sufficient supporters of the alliance exist on the side of each alliance party	✓	✓	✓	✓	✓	✓	✓
Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions	✓	✓	✓	✓	✓	✓	✓

Appendix 6 Case Study Analysis – By Size

(NR-Not relevant; O-Objection)

	Small		Medium		Large		
	A	E	D	F	B	C	G
Module 1 – VME Metabolism and Its Switcher	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Continuous optimisation of value streams towards lean operation	×	×	×	✓	×	×	✓
(2) Joint analysis across functions	✓	✓	✓	✓	✓	✓	✓
(3) Joint analysis across firms	×	×	×	×	×	×	×
(4) Regular review of EI decisions for long-term tasks	✓	✓	✓	✓	✓	✓	✓
Module 2 – EI Management Function	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Ensuring value stream optimisation	×	×	×	✓	×	×	✓
(2) Improving EI compatibility	✓	✓	✓	×	✓	✓	✓
(3) Internal resource allocation for EI	✓	✓	✓	✓	✓	✓	✓
(4) Gaining stakeholders' support for EI	✓	✓	✓	×	✓	✓	×
(5) Designing competency protection	✓	✓	×	✓	✓	✓	✓
(6) Evaluating EI performance	✓	✓	✓	✓	✓	✓	✓
(7) EI knowledge management	×	×	×	×	×	×	×
Module 3 – VME Performance Measurement	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Performance measurement for external operations	✓	✓	✓	✓	✓	✓	✓
(2) Performance measurement for internal operations	✓	✓	✓	✓	✓	✓	✓
Assessment issues for external operations							
M3.1 alliance parties' resource contributions							
Whether alliance parties' resource contributions complement each other	✓	✓	✓	✓	✓	✓	✓
Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives	✓	✓	✓	✓	✓	✓	✓
Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)	✓	✓	✓	✓	✓	✓	✓
Whether alliance parties have actually contributed the resources they have agreed to contribute	✓	✓	✓	✓	✓	✓	× (NR)
M3.2 alliance parties' dependency							
Our dependency on our partners	✓	✓	✓	×	✓	✓	✓
Our partners' dependency on us	×	✓	✓	×	✓	✓	✓
Compatibility among alliance parties' objectives	×	×	✓	×	×	×	✓
Our risks due to the alliance	✓	✓	✓	✓	✓	✓	✓
Our partners' risks due to the alliance	×	×	✓	×	✓	×	✓
M3.3 alliance objectives							
The alliance objectives create a mutually acceptable win-win situation	✓	✓	✓	✓	✓	✓	✓
Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)	✓	✓	✓	✓	✓	✓	✓
Whether the alliance objectives are achievable (such as feasibility report)	✓	✓	✓	✓	✓	✓	✓
Measures assessing alliance objective achievement (e.g. net profit/sales)	✓	✓	✓	✓	✓	✓	✓

M3.4 resource protection							
Whether our company's resources have been put under effective protection	✓	✓	×	✓	✓	✓	✓
Whether our company's resources under protection have been damaged	✓	×	×	×	✓	×	×
Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance	✓	×	×	✓	✓	×	✓
Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred	×	×	×	×	×	×	×
M3.5 alliance geographic location							
Whether the alliance geographic location helps achieve alliance objectives	✓	✓	✓	✓	✓	✓	✓
Whether the alliance geographic location helps protect our company's resources	×	×	×	✓	×	×	✓
M3.6 alliance managers							
Alliance managers' characteristics, such as their expertise	×	✓	×	✓	×	×	✓
Whether alliance managers have effectively conducted their responsibilities	×	✓	✓	✓	✓	✓	✓
M3.7 task allocation among alliance parties							
Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)	✓	✓	✓	✓	✓	✓	✓
Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)	✓	✓	× (NR)	✓	✓	×	✓
Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)	✓	✓	✓	✓	✓	✓	✓
Whether task allocation avoids task duplication	✓	✓	✓	✓	✓	✓	× (O)
M3.8 cross-partner teams							
Whether each cross-partner team has its clear purpose	✓	✓	✓	✓	✓	✓	✓
Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)	✓	✓	✓	✓	✓	✓	×
Cross-partner team members' characteristics, such as their expertise	×	×	✓	✓	×	✓	✓
Whether team members can effectively communicate with each other	✓	×	×	✓	×	×	✓
Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)	×	✓	× (NR)	✓	×	×	✓
M3.9 alliance decision making							
Whether key alliance decisions are made with alliance parties' consensus	✓	✓	✓	✓	✓	✓	✓
Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support	✓	✓	✓	✓	✓	✓	✓
M3.10 alliance assets sharing							
Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets	× (NR)	✓	× (NR)	× (NR)	× (NR)	✓	✓

Whether alliance assets can be fairly shared among alliance parties according to resource contributions	× (NR)	✓	× (NR)	× (NR)	× (NR)	✓	✓
Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us	× (NR)	✓	× (NR)	× (NR)	× (NR)	×	✓
M3.11 partners' post-dissolution activities							
Whether our competition risks caused by our partners' post-dissolution activities have been minimised	✓	✓	✓	✓	✓	×	✓
M3.12 alliance parties' operational conflicts							
Alliance parties' operational conflicts with the alliance	×	×	✓	✓	×	✓	✓
Alliance parties' operational conflicts with each other	×	×	✓	✓	×	✓	✓
M3.13 trust among alliance parties							
Whether alliance parties are comfortable with their partners' performance	✓	✓	✓	✓	✓	✓	✓
Alliance parties' commitment to the alliance	✓	✓	✓	✓	✓	✓	✓
Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)	✓	✓	✓	✓	✓	✓	✓
How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)	×	×	✓	✓	×	✓	✓
Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them	×	×	×	✓	×	×	×
Whether open communication exists among alliance parties	✓	✓	×	✓	✓	×	×
Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks	✓	✓	×	✓	✓	×	×
M3.14 alliance supporters							
Whether sufficient supporters of the alliance exist on the side of each alliance party	✓	✓	✓	✓	✓	✓	✓
Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions	✓	✓	✓	✓	✓	✓	✓

Appendix 7 Case Study Analysis – By Market Scope

(NR-Not relevant; O-Objection)

	National			Regional		Global	
	B	C	E	A	D	F	G
Module 1 – VME Metabolism and Its Switcher	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Continuous optimisation of value streams towards lean operation	×	×	×	×	×	✓	✓
(2) Joint analysis across functions	✓	✓	✓	✓	✓	✓	✓
(3) Joint analysis across firms	×	×	×	×	×	×	×
(4) Regular review of EI decisions for long-term tasks	✓	✓	✓	✓	✓	✓	✓
Module 2 – EI Management Function	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Ensuring value stream optimisation	×	×	×	×	×	✓	✓
(2) Improving EI compatibility	✓	✓	✓	✓	✓	×	✓
(3) Internal resource allocation for EI	✓	✓	✓	✓	✓	✓	✓
(4) Gaining stakeholders' support for EI	✓	✓	✓	✓	✓	×	×
(5) Designing competency protection	✓	✓	✓	✓	×	✓	✓
(6) Evaluating EI performance	✓	✓	✓	✓	✓	✓	✓
(7) EI knowledge management	×	×	×	×	×	×	×
Module 3 – VME Performance Measurement	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓	×/✓
(1) Performance measurement for external operations	✓	✓	✓	✓	✓	✓	✓
(2) Performance measurement for internal operations	✓	✓	✓	✓	✓	✓	✓
Assessment issues for external operations							
M3.1 alliance parties' resource contributions							
Whether alliance parties' resource contributions complement each other	✓	✓	✓	✓	✓	✓	✓
Whether the total of alliance parties' resource contributions is enough for achieving the alliance objectives	✓	✓	✓	✓	✓	✓	✓
Measures assessing alliance parties' resource contributions (e.g. the technical measures assessing the product technology contributed)	✓	✓	✓	✓	✓	✓	✓
Whether alliance parties have actually contributed the resources they have agreed to contribute	✓	✓	✓	✓	✓	✓	× (NR)
M3.2 alliance parties' dependency							
Our dependency on our partners	✓	✓	✓	✓	✓	×	✓
Our partners' dependency on us	✓	✓	✓	×	✓	×	✓
Compatibility among alliance parties' objectives	×	×	×	×	✓	×	✓
Our risks due to the alliance	✓	✓	✓	✓	✓	✓	✓
Our partners' risks due to the alliance	✓	×	×	×	✓	×	✓
M3.3 alliance objectives							
The alliance objectives create a mutually acceptable win-win situation	✓	✓	✓	✓	✓	✓	✓
Measures assessing our company's benefits through the alliance (e.g. the technical measures assessing the product technology enhanced)	✓	✓	✓	✓	✓	✓	✓
Whether the alliance objectives are achievable (such as feasibility report)	✓	✓	✓	✓	✓	✓	✓

Measures assessing alliance objective achievement (e.g. net profit/sales)	✓	✓	✓	✓	✓	✓	✓
M3.4 resource protection							
Whether our company's resources have been put under effective protection	✓	✓	✓	✓	×	✓	✓
Whether our company's resources under protection have been damaged	✓	×	×	✓	×	×	×
Whether our partners' or other companies' resources similar to ours under protection have been improved/generated through the alliance	✓	×	×	✓	×	✓	✓
Whether our partners set up facilities (*such as a factory, a team, etc.*) for their own use (*without our permission*), in which our resources under protection can be used/generated/transferred	×	×	×	×	×	×	×
M3.5 alliance geographic location							
Whether the alliance geographic location helps achieve alliance objectives	✓	✓	✓	✓	✓	✓	✓
Whether the alliance geographic location helps protect our company's resources	×	×	×	×	×	✓	✓
M3.6 alliance managers							
Alliance managers' characteristics, such as their expertise	×	×	✓	×	×	✓	✓
Whether alliance managers have effectively conducted their responsibilities	✓	✓	✓	×	✓	✓	✓
M3.7 task allocation among alliance parties							
Whether tasks have been allocated to the most suitable alliance parties (*i.e. whether the alliance parties have the most suitable resources for the tasks allocated to them*)	✓	✓	✓	✓	✓	✓	✓
Task allocation won't damage our resources (*e.g. our company will do a key working procedure to ensure that our relevant skills won't be lost, which might happen if we do not perform the working procedure for a long time*)	✓	×	✓	✓	× (NR)	✓	✓
Whether task allocation helps alliance parties achieve benefits (*e.g. our company will do a key working procedure to improve relevant skills*)	✓	✓	✓	✓	✓	✓	✓
Whether task allocation avoids task duplication	✓	✓	✓	✓	✓	✓	× (O)
M3.8 cross-partner teams							
Whether each cross-partner team has its clear purpose	✓	✓	✓	✓	✓	✓	✓
Measures assessing team purpose achievement (e.g. the number of new technologies produced by the team)	✓	✓	✓	✓	✓	✓	×
Cross-partner team members' characteristics, such as their expertise	×	✓	×	×	✓	✓	✓
Whether team members can effectively communicate with each other	×	×	×	✓	×	✓	✓
Cross-partner teams won't undermine our company's resources (e.g. knowledge leakage)	×	×	✓	×	× (NR)	✓	✓
M3.9 alliance decision making							
Whether key alliance decisions are made with alliance parties' consensus	✓	✓	✓	✓	✓	✓	✓
Whether key alliance decisions are effectively communicated to stakeholders (e.g. parent companies) & have their support	✓	✓	✓	✓	✓	✓	✓

M3.10 alliance assets sharing							
Whether alliance parties' assets involved in the alliance have been clearly distinguished from the alliance assets	× (NR)	✓	✓	× (NR)	× (NR)	× (NR)	✓
Whether alliance assets can be fairly shared among alliance parties according to resource contributions	× (NR)	✓	✓	× (NR)	× (NR)	× (NR)	✓
Our partners' shares of the alliance assets (e.g. ownership of the products produced by the alliance) won't help them/other companies compete with us	× (NR)	×	✓	× (NR)	× (NR)	× (NR)	✓
M3.11 partners' post-dissolution activities							
Whether our competition risks caused by our partners' post-dissolution activities have been minimised	✓	×	✓	✓	✓	✓	✓
M3.12 alliance parties' operational conflicts							
Alliance parties' operational conflicts with the alliance	×	✓	×	×	✓	✓	✓
Alliance parties' operational conflicts with each other	×	✓	×	×	✓	✓	✓
M3.13 trust among alliance parties							
Whether alliance parties are comfortable with their partners' performance	✓	✓	✓	✓	✓	✓	✓
Alliance parties' commitment to the alliance	✓	✓	✓	✓	✓	✓	✓
Alliance parties' dishonest behaviour (e.g. behaviour breaching business morality)	✓	✓	✓	✓	✓	✓	✓
How alliance parties' interpret the cause of the gaps between their expectations and the results (*whether they interpret it as caused by us, e.g. we didn't commit, or they interpret it as caused by some uncontrollable factors, such as market factor*)	×	✓	×	×	✓	✓	✓
Whether alliance parties' interpretation of partners' cultural behaviours negatively influences the trust among them	×	×	×	×	×	✓	×
Whether open communication exists among alliance parties	✓	×	✓	✓	×	✓	×
Whether alliance parties act willingly on their partners' behalf (*e.g. actively taking measures to protect partners' core competencies*), especially when such actions expose themselves to risks	✓	×	✓	✓	×	✓	×
M3.14 alliance supporters							
Whether sufficient supporters of the alliance exist on the side of each alliance party	✓	✓	✓	✓	✓	✓	✓
Whether the alliance supporter(s) on the side of an alliance party can strongly influence the alliance party's decisions	✓	✓	✓	✓	✓	✓	✓

Appendix 8 Case Study Feedback Questionnaire

Part 1: Completeness of the Reference Model

If the answer to any of the following questions is "Yes", please give details:

(1) Are there any practice(s) that are missing from the feedback, but could improve the effectiveness of the decision making regarding whether external or internal operations should be used for a certain task?
[Yes/No] .....
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(2) Are there any practice(s) that are missing from the feedback, but could help manage external & internal operations to improve their holistic performance?
[Yes/No] .....
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Part 2: Representation of Current Process

At the end of each feedback, there is a **box**. Please cross (✗) this box if you think that the information you gave in this research has been wrongly interpreted.

Part 3: Additional Feedback

If there are any other suggestions or comments that you wish to make about the feedback or the project in general, please add them here:

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