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## **Measuring and Managing Performance in Extended Enterprises**

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### **Key words**

Performance, Measurement, Extended, Collaborative, Enterprise

## **Measuring and Managing Performance in Extended Enterprises**

### **Structured Abstract**

**Purpose of this paper:** The purpose of this research paper is to demonstrate how existing performance measurement may be adopted to measure and manage performance in extended enterprises.

**Methodology:** The paper reviews the literature in performance measurement and extended enterprises. It explains the collaborative architecture of an extended enterprise and demonstrates this architecture through a case study. A model for measuring and managing performance in extended enterprises is developed using the case study.

**Findings:** The research found that due to structural differences between traditional and extended enterprises, the systems required to measure and manage the performance of extended enterprises, whilst being based upon existing performance measurement frameworks, would be structurally and operationally different. Based on this, a model for measuring and managing performance in Extended Enterprises is proposed which includes Intrinsic and Extrinsic inter-enterprise coordinating measures.

**Research implications:** There are two limitations this research. Firstly, the evidence is based on a single case, thus further cases should be studied to establish the generalisability of the presented results. Secondly, the practical limitations of the EE performance measurement model should be established through longitudinal action research.

**Practical implications:** In practice the model proposed requires collaborating organisations to be more open and share critical performance information with one another. This will require change in practices and attitudes.

**What is original/the value of the paper:** The main contribution this paper makes is that it highlights the structural differences between traditional and collaborative enterprises and specifies performance measurement and management requirements of these collaborative organisations.

## Measuring and Managing Performance in Extended Enterprises

### 1. Introduction

With the globalisation of all the commercial and industrial activities, one of the key issues at the forefront of any chief executive's mind has been the question "*How to create and sustain competitive advantage at a global scale through collaboration*".

In this context collaboration means partnering with suppliers, customers, designers, research institutes, and so on to integrate their individual competencies to create a level of competency that is unmatched and difficult to copy and develop.

Over the last decade, concepts such as supply chain management, extended enterprises and virtual enterprises have emerged, each describing a different level or format of strategic collaboration. Out of these concepts, supply chain management has gained significant acceptance in industry whereas others, such as extended enterprises and virtual enterprises, have remained as academic concepts with no real industrial and commercial application.

It is now an accepted fact that in the 21<sup>st</sup> century, competition will be between value-chains, which efficiently and effectively integrate their competencies and resources to compete in a global economy. The European Unions research and development objectives under the 6<sup>th</sup> Framework Programme make it clear that, as yet, we do not understand how to manage a collaborative/extended enterprise.

This paper will develop the argument that our limited understanding of *how to measure and manage performance in extended and virtual enterprises* is one of the main barriers to wide scale acceptance and practical use of these concepts by industry and commerce. It will also demonstrate, through empirical evidence, that the systems required to measure and manage the performance of extended enterprises, whilst being based upon existing performance measurement frameworks and models, would be structurally and operationally different.

In tackling these issues, the paper integrates a number of existing concepts and it demonstrates that like all businesses, extended enterprises also have a common, cybernetic, structure upon which a performance measurement and management model could be developed.

In the following sections the paper will first present the methodological basis of the research presented in this paper. It will then describe the background to the research programme emphasising the relevant literature and go on to developing and validating the common cybernetic structure for extended enterprises. It will then develop and demonstrate the performance measurement model necessary to measure and manage the performance of an extended enterprise. The paper concludes with an in-depth discussion on the relative merits and limitations of the work done, emphasising the new knowledge emerging from the research.

## **2. Methodology**

From a methodological perspective this research is based on innovative constructivism (Kaplan 1998, Kasanen et al 1993). Here, the researcher starts with an observation of the limitations of the current knowledge and practices and goes on to develop innovative ideas to address these limitations either through documentation of innovative practices (Kaplan 1998) or through logical deduction from the existing literature. The researcher then collects cases, teaches and speaks about the innovation, writes articles and books, and then implements the new concept. The researcher goes through this loop (Figure 1) several times to achieve initial, intermediate and advanced implementations, which continuously informs theory (Meredith, 1993). This approach was used to develop the Balanced Score Card (Kaplan and Norton, 1992 - 1996 - 2000a -2000b).

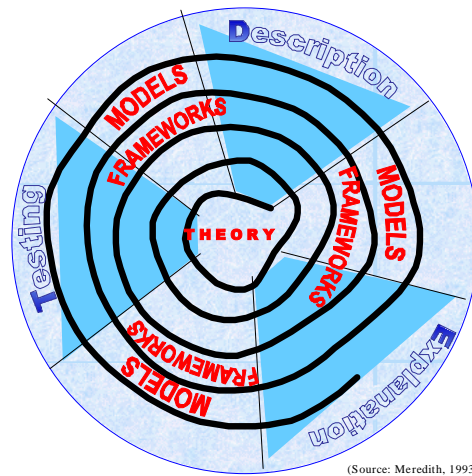


Figure 1. Meredith's research process.

The research presented in this paper can be seen as:

- An initial observation of the limitations of the current knowledge in performance measurement in the context of extended enterprises.
- An initial deduction, from literature, and explanation of a model for performance measurement and management in extended enterprises.
- Initial testing and description of the validity of this model.

The validity of the model built was tested through a single, but in depth, case study. The case data was collected through a series of semi-structured interviews and workshops with the management team of the case study organisation.

### 3. Background

The research presented in this paper has been conducted as part of a EU 5<sup>th</sup> Framework IST programme on *Advanced Methodologies and Tools for Knowledge Management within Extended Manufacturing Enterprises (K-Flow: G1RD-2001-00665)*. The authors of this paper were specifically responsible for investigating the performance measurement and management issues in extended enterprises, which is the focus of this paper.

This section first looks at the literature on performance measurement and then goes on to look at literature on extended enterprises with specific emphasis on performance measurement in extended enterprises.

### **3.1 Performance Measurement**

The background to this research extends back to the mid 1980s when the need for better-integrated performance measurement systems was identified (Johnson and Kaplan, 1987, McNair and Masconi, 1987, Kaplan, 1990, Druker, 1990 and Russell, 1992). Since then, there have been numerous publications emphasising the need for more relevant, integrated, balanced, strategic and improvement-oriented performance measurement systems.

In terms of frameworks and models, the SMART model (Cross and Lynch 1988-1989) and the Performance Measurement Questionnaire (Dixon et al 1990) were developed in the late 80s. In the 90s the Balanced Scorecard (Kaplan and Norton, 1996) made a significant impact by creating a simple, but effective, framework for performance measurement. During the 90s, the European Business Excellence Model (EFQM, 1998) also made a significant impact on what measures companies used and what they did with these measures. The EPSRC funded research on Integrated Performance Measurement Systems tested the feasibility of developing an auditable reference model from three different view points - Structures (Bititci and Carrie 1998), Information (Kehoe and Little 1998) and People Behaviour (Burns and Backhouse, 1998). This work built upon the Balanced Scorecard and EFQM Models, using the Viable Systems Structure (Beer, 1985) and resulted in the development of the Integrated Performance Measurement Systems Reference Model.

Other research programmes, and to a certain extent consultancy organisations, also developed approaches, procedures and guidelines for developing and designing effective performance measurement systems (Doumeingts et al, 1995, Krause 1999). The Performance Measurement Workbook (Neely et al 1996) and more recently the Performance Prism (Neely and Adams, 2001) encapsulates the contents of the previous models. Both of these are now widely published and used.

There have been several other initiatives for developing and defining performance measures for various business areas and processes, including performance measures

for production planning and control (Kochhar et al 1996, Oliver Wight inc 1993), performance measures for the product development process (Oliver 1996, O'Donnell and Duffy 2002), performance measurement for Human Resources (Kelly & Gennard 2001, Gibb 2002) performance measurement for service management (Wilson 2000, Fitzgerald et al 1991), and so on.

All this work has led to significant developments in the field of performance measurement and management but from a single enterprise point of view. An important finding of this research is that ***none of the above works consider performance measurement from an extended enterprise perspective.*** However, they do provide a platform to inform further research into performance measurement in extended enterprises. Common themes emerging from the literature on performance measurement relevant to this research are:

Performance measurement systems should:

- be balanced - i.e. the requirements of various stakeholders (shareholders, customers, employees, society, environment) need to be included (Kaplan and Norton 1996, Dixon et al 1990, Russel 1992, EFQM 1998, Bititci 1998, Neely 2001)
- be integrated - i.e. relationships between various measures need to be understood (Dixon et al 1990, Russel 1992, Suwignjo et al 2000, Neely et al 1996).
- inform strategy - i.e. not be driven by strategy but provide an input to strategy (Bititci 1998 and 2000, Neely and Adams 2001)
- deploy strategy - i.e. propagate and translate strategic objectives throughout the organisation to the critical parts of the organisation (Kaplan and Norton 2000a and 2000b, Bititci et al 1997 and 2000, Neely et al 1996).
- focus on business processes that deliver value (EFQM 1998, Bititci et al 1997, Neely and Adams 2001)
- be specific to business units (Kaplan and Norton 2000a and 2000b, Neely et al 1996, Bititci et al 1997)

- include competencies - i.e. capabilities and competencies that determine how value is created and sustained (Kaplan and Norton 2000a and 2000b, Neely and Adams 2001)
- include stakeholder contribution - i.e. the role of the stakeholders and the contribution they can make to the success and failure of a business (Neely and Adams 2001)

### **3.2 Extended Enterprises**

According to Browne et al (1995) the EE concept is close to what Christopher (1992) calls "Co-makership", "a long-term relationship with a limited number of suppliers on the base of mutual confidence". This co-makership allows the partners to work together on engineering the value of their product, besides developing simplified means of ordering and invoicing which improve quality and reduce costs for all parties (Childe, 1998).

Childe (1998) defines an extended enterprise as "*a conceptual business unit or system that consists of a purchasing company and suppliers who collaborate closely in such a way as to maximise the returns to each partner*".

From the literature on extended enterprises the following pertinent points have been extracted as being of relevance to the research presented in this paper:

- External forces, such as economical situations, social values, political constraints and available technology, affect strategic aspects of the extended enterprise (O'Neill and Sackett 1994 and Martinez et al. 2001).
- The extended enterprise is a philosophy where member organisations (EE Actors) strategically combine their core competencies and capabilities to create a unique competency. A facet of this approach is the development of products and services that best fit the physical and intellectual characteristic of the individual markets (Martinez et al. 2001, Kochhar and Zhang 2002).
- In extended enterprises people across a number of organisations participate in the decision-making process. This demands knowledge integration. It also means a



deep change in the power structures in the organisations concerned. Therefore, the improvement in education levels and the development of stronger civic attitudes, increased participation and improved communications are prerequisites for effective operation of extended enterprises (O'Neill and Sackett 1994).

- In an extended enterprise each company is self-organised, while the extended enterprise imposes a federal structure for communication and synchronisation between individual enterprises (Martinez et al. 2001).
- The Extended Enterprise is a knowledge-based organisation that uses the distributed intellectual strengths of its members, suppliers and customers. Knowledge and trust are key resources in an extended enterprise (O'Neill and Sackett 1994).
- The Extended Enterprise business strategy formulation is an incremental process; planning, implementation, evaluation and revision represent small steps, done almost simultaneously (Martinez et al. 2001, Lillehagen and Karlsen 2001).
- Senior management's main strategic role is setting purpose, promoting change and defining generic procedures. Moreover, management is deeply involved in tactical and operational decisions. The managerial hierarchy is flat and decision-making is widely distributed (O'Neill and Sackett 1994, Ip-Shing et al 2000).
- For an Extended Enterprise, the operations strategy is a natural outcome of the business strategy. Operations is seen as a specialised form of service, where the integration of competencies of all those involved in the operations process achieves economies of scope (Eneroth and Malm 2001, Lillehagen and Karlsen 2001).
- The operations of extended enterprises needs to be carefully coordinated and synchronised as it is a process within a single enterprise. This will involve multi-skilled and multi-cultural people working in different enterprises. The use of appropriate planning and coordination systems and tools, supporting communication facilities, that will enable the team members to share information and to synchronise the activities, are also critical prerequisites (O'Neill and Sackett 1994).
- It is also essential that learning (i.e. new knowledge) is shared across the extended enterprise (Coscia 2002, Preiss 1999).

The literature review led the researchers to develop a particular understanding of an extended enterprise and its difference from a supply chain. In the context of this research a supply chain is a customer-supplier chain of individual enterprises, each operating as an individual enterprise trying to maximise its own corporate goals, thus sub-optimising the overall performance. Whereas an extended enterprise is a chain of enterprises, which essentially behave as a single enterprise trying to maximise the corporate goals of the extended enterprise, thus optimising the performance of each individual enterprise. This difference is illustrated in Figure 2.

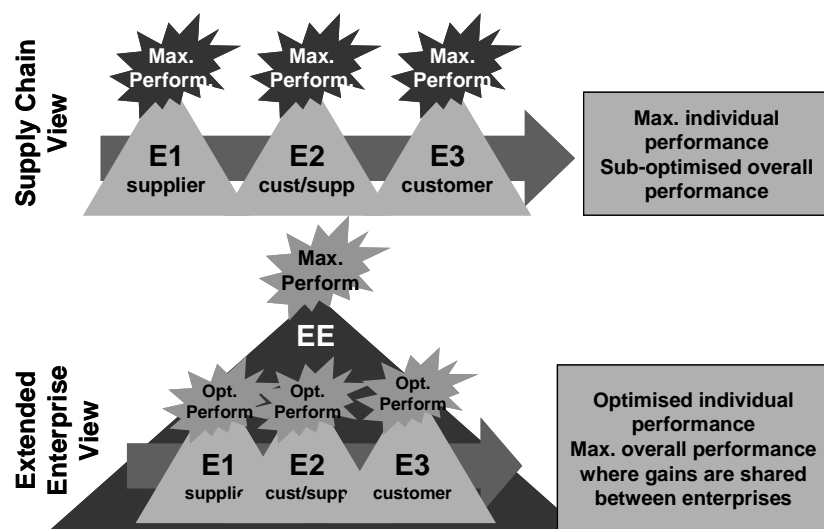


Figure 2. Extended enterprise v. supply chain

Based on the literature and the above difference between the supply chain and extended enterprise this research adopted the following definition for extended enterprise: ***Extended Enterprise is a knowledge-based organisation which uses the distributed capabilities, competencies and intellectual strengths of its members to gain competitive advantage to maximise the performance of the overall extended enterprise.***

### **3.3 Performance Measurement in Extended Enterprises**

In order to identify the most appropriate performance measurement system for extended enterprises, a review of performance measurement systems in Supply Chains, Extended Enterprises and Virtual Enterprises were conducted.

Gunasekaran et al (2001) propose a series of performance metrics for performance evaluation of supply chains. The measures and metrics are arranged in three levels (strategic, tactical and operational) and along the five elements of an integrated supply chain: Plan performance, source performance, production performance, deliver performance and customer satisfaction. This is rather similar to the hierarchical performance measurement structure used within version 5 of SCOR model (Supply Chain Operations Reference model - [www.supply-chain.org](http://www.supply-chain.org)) which views a supply chain as six key processes (Plan, Source, Make, Deliver, Return and Enablers) and presents a set of performance measures which can be broken down from the entire supply chain (Level) down in to individual processes (Level 2) and into specific activities within each process (Level 3).

Beamon (1999) proposes an alternative framework, comprising of three types of performance measures: resource measure, output measures and flexibility measures. She argues that supply chain performance measurement system must contain at least one individual measure from each of the identified types.

Kochhar and Zhang (2002) in studying the performance measurement systems of virtual enterprises identified that each individual enterprise has its own performance measurement system part of which relates to its activities related to the virtual enterprise, which tends to be coordinating type measures to ensure that the necessary level of coordination and synchronisation is achieved between individual enterprises.

In fact all four works (Gunasekaran et al 2001, SCOR v5, Beamon 1999, and Kochhar and Zhang 2002) propose a range a performance measures that may be appropriate in supply chains, extended enterprises and virtual enterprises. Closer study of these works reveal that the majority of the measures proposed are not any different from measures traditionally used in a single enterprise, but they are organised in a fashion to correspond to the supply chain (i.e. plan, source, make, deliver, etc). The exception to this is the works by Gunasekaran et al (2001 and Kochhar and Zhang (2002) who

identified the need for *Supply Chain Partnership Measures* and *Coordinating Measures* respectively.

This background study into performance measurement in extended enterprises concluded that:

- Extended Enterprise is a knowledge-based organisation, which uses the distributed capabilities, competencies and intellectual strengths of its members to gain competitive advantage to maximise the performance of the overall extended enterprise.
- None of the current strategic models and frameworks for performance measurement, such as Balanced Scorecard, Performance Prism, IPMS, Smart Pyramid etc consider performance measurement and management from an extended enterprise perspective.
- Other works into performance measurement in supply chains, extended enterprises and virtual enterprises specify a range of performance measures, which should be used in managing supply chains and virtual organisations but fail to integrate these within a strategic performance measurement framework.
- Inter-enterprise coordinating (or partnership) measures are essential to ensure that various partners within an extended enterprise coordinate effectively and efficiently to ensure that the performance of the extended enterprise is maximised.
- None of the current strategic models and frameworks for performance measurement (such as balanced scorecard, performance prism, IPMS and so on) explicitly considers the need for inter-enterprise coordinating measures.

#### **4. The Collaborative Architecture of an Extended Enterprise**

Earlier, the paper identified that performance measurement should be specific to business units (Kaplan and Norton 2000a and 2000b, Neely et al 1996, Bititci et al 1997).

In their work into developing a generic architecture for an integrated performance measurement system Bititci and Carrie (1998) adopted Beer's (1985) viable systems model and identified a cybernetic structure for a business (see also Bititci and Turner 1999).

In essence, this work has described the competitive structure of any business that needs to be managed. This structure, which is illustrated in Figure 3b, may be summarised as:

- The business exists to create wealth for its shareholder (or satisfy expectations of its key stakeholders).
- It achieves this by operating one or more business units that need to remain competitive in their selected markets to satisfy the needs of the business. Here a Business Unit is defined as ***the logical part of the business, which exists to service a particular market sector with specific competitive requirements.*** Business Units may be product oriented or market oriented. In a product-oriented business unit, it is the design characteristic of the product or product group that determines how the product competes in that market sector. In a market-oriented business unit the same product may be subjected to different competitive pressures in different markets.
- Each business unit competes by operating a number of value-add (operate) processes supported by the support processes. The efficiency and effectiveness of these processes determines the competitiveness of the business units.
- The efficiency and effectiveness of each business process is determined by the combined performance of its critical activities.

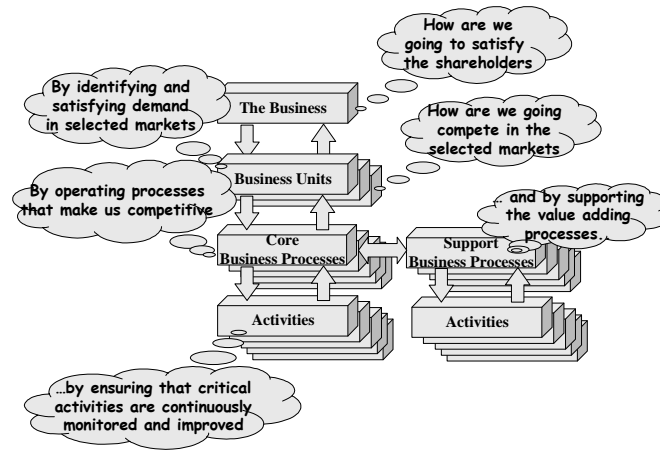


Figure 3. The competitive structure of a business.

Earlier, the paper also identified that performance measurement systems should focus on business processes that deliver value (EFQM 1998, Bititci et al 1997, Neely and Adams 2001). But in an extended enterprise these value-adding processes of each enterprise need to be joined end-to-end in a coordinated and synchronised manner. In short, they need to behave as a single process end to end as depicted in Figure 4 below. This concept is also strongly supported by other authors, such as Eloranta (1999) and Hammer (2001).

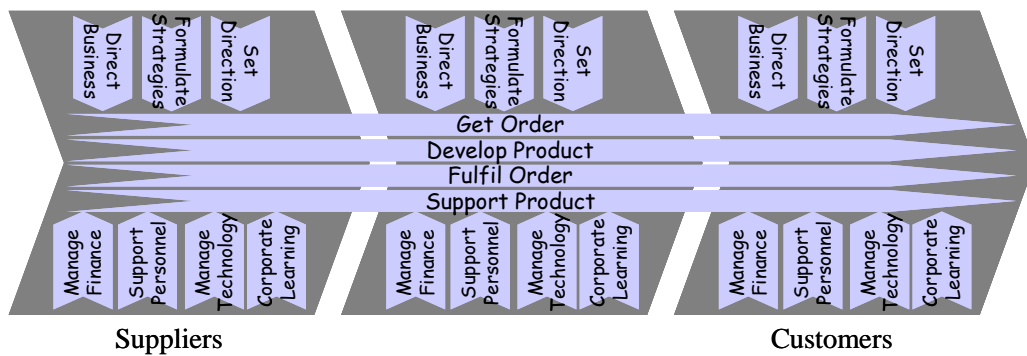


Figure 4. The extended business processes.

In fact, Figure 4 simplifies the complexity of the environment within which an extended enterprise operates. According to the competitive business structure presented in Figure 3, business units should be the main unit of analysis for managing the performance of

extended enterprises. Although, at a superficial level, collaboration between firms may appear to take place at enterprise level, it is our hypothesis that;

1. In reality, collaboration takes place at business unit level.
2. In complex organisations, which may have several business units, each business unit may be part of a different collaborative system. Figure 5 illustrates this concept where enterprise E1 has three business units (BU1, BU2 and BU3). Each business unit is part of a different extended enterprise - depicted by arrows with different patterns.

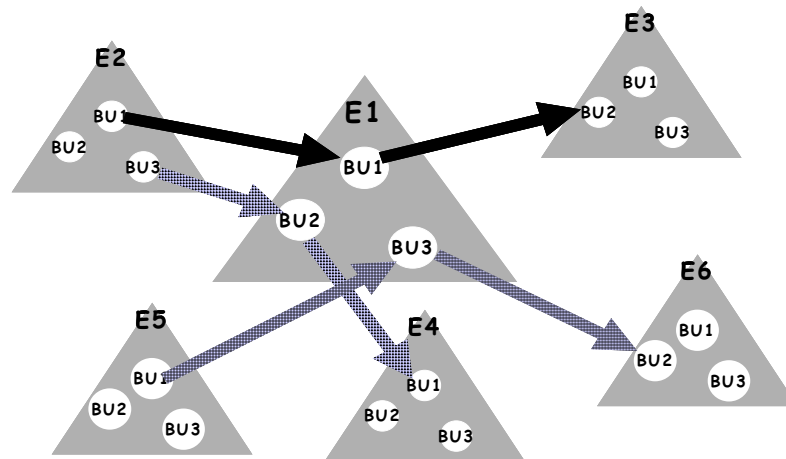


Figure 5. Architecture of extended enterprises.

Within the architecture presented in Figure 5, any one extended enterprise has to ensure that the operate processes are extended across the enterprises within that extended enterprise, i.e. the extended business process model (Figure 4) arises at business unit level.

Figure 6 illustrates the business process architecture of two separate extended enterprises comprising of five individual enterprises. This architecture is further explained below:

- All enterprises have two business units, with the exception of Enterprise 2, which has three business units.

- Business units 1.1 (Business Unit of Enterprise 1), 2.1 and 3.1 are joined together with extended operate processes to form the Extended Enterprise 1.
- Similarly, business units 5.1, 2.3 and 4.2 are joined together with extended operate processes to form the Extended Enterprise 2.
- Enterprise 2 is playing a role in two different extended enterprises and is supporting two sets of extended operate processes.
- The performance measurement literature suggests that each enterprise deploys its strategic objectives to its business units and internal business processes - illustrated by arrows in Figure 6.
- If we are to treat the extended enterprise as a single competitive entity under its own right as the extended enterprise literature suggests, then each extended enterprise should have clearly defined strategic and performance objectives and that these need to be deployed to its business units and extended processes.
- Because the strategy of each business unit is deployed from two different sources, i.e. enterprise and extended enterprise, there is a potential source of conflict that needs to be managed.

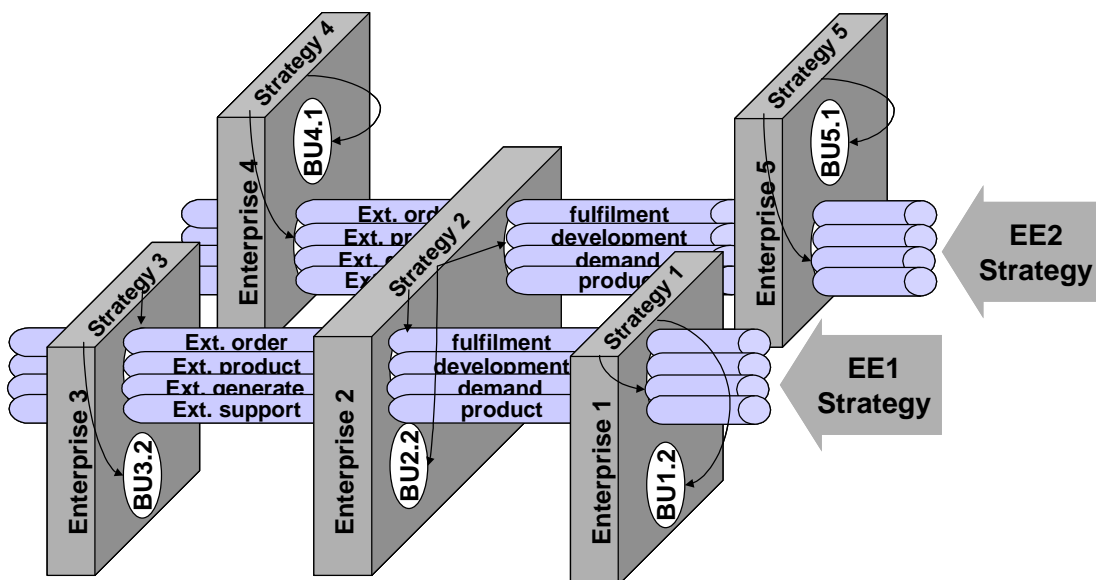


Figure 6. The collaborative architecture of extended enterprises.



Based on this new insight we have extended our hypothesis as follows:

3. A meta-level manage process is required that links the strategy and performance objectives to ensure that any potential conflicts between enterprise objectives and the objectives of the extended enterprise are managed and, if possible, eliminated.
4. A new performance measurement framework needs to be developed to facilitate this meta-manage process by modifying the existing performance measurement frameworks to accommodate the architecture of the extended enterprise.

## 5. CASE STUDY: Daks Simpson Limited

So far this paper demonstrates, through literature, that an extended enterprise is structurally different and more complex compared to a single enterprise. It also concluded that a strategic framework for measuring and managing performance in extended enterprises does not exist. The purpose of this case study is two fold. First, it demonstrates the validity of the collaborative architecture developed, above, for extended enterprises. Then, the case study is used to develop a conceptual framework for measuring and managing performance in extended enterprises.

The case data presented in this section was collected through a series of semi-structured interviews and workshops with the management team of the case study organisation.

Daks Simpson is an apparel manufacturer specialising in ladies' and gents' suits, jackets and trousers. The manufacturing facilities are based in Scotland with product design based in London. The products are sold in a global market. Daks is a globally recognised brand name with a significance presence in the Far-East market, particularly in Japan.

In practice, Daks has two business units, these are:

- **Brand Business**, which specialises in the design, manufacture and sales of products under the Daks brand. These products are tailored garments produced to high specifications in limited quantities. Typically, a gent's suit may sell at £400 -

£600 in one of Daks' stores or through one of their retailers, such as Fraser, Slater or Harrods in the UK and through Nordstrom in the US.

- **Contract Business** which specialises in the design, manufacture and sales of products either under customers own labels, such as the St Michael label for Marks and Spencer, or for corporate wear under a customers name such as Bank of Scotland. Compared to the garments produced for the Daks brand, these are much simpler products sold in larger volumes. These are mass-produced rather than tailored in contrast to the Daks product range.

Table 2 below illustrates the nature of the extended enterprise for each one of the business units. The empirical data presented in this Table confirms the existence of two different extended enterprises (or collaborative systems) within one enterprise.

	<b>Suppliers</b>	<b>Daks Simpson</b>	<b>Customers</b>	<b>Overall Value Proposition</b>
<b>Daks Business</b>	<p>Fashion designers and design houses.</p> <p>Innovation in materials and new designs in materials (i.e. patterns)</p> <p>Flexibility of supply, quality of materials.</p> <p>Flexibility of supply, quality of products.</p> <p>Flexibility of supply</p>	<p>Designer-led product design with emphasis on style, look and feel. Garments can be customised to individual customers requirements.</p> <p>Complete new product ranges for every season.</p> <p>High variety low volume manufacturing in manufacturing cells - small tailoring units responsible for complete manufacture of a garment</p> <p>A significant accessories business, such as belts, ties, shirts, jackets, caps, etc., designed by Daks and manufactured by subcontractors.</p> <p>High degrees of uncertainty and complexity requiring frequent changes to production schedules</p>	<p>Fraser, Slater, Harrods, Nordstrom, Daks shops, etc</p>	<p>Brand Managers/ Product Image</p>
<b>Contract Business</b>	<p>Customers influenced by fashion, influencing product style and specification.</p> <p>Cost of materials and manufacturing methods</p> <p>Reliability and continuity of supply. Price.</p> <p>Reliability and continuity of supply</p>	<p>Customer led product development in volume designs with emphasis on minimising the work content.</p> <p>New product introductions fairly rare - mostly minor modifications to existing designs.</p> <p>Low variety and high volume manufacturing in manufacturing lines.</p> <p>No accessories business</p> <p>Low uncertainty and complexity makes planning and scheduling simpler requiring little or no changes to schedules</p>	<p>Marks and Spencer, Bank of Scotland, etc</p>	<p>Price Minimisers/ Value for money</p>

Table 2. The collaborative structure of Daks Simpson Limited.

Further analysis of the Daks' "Order Fulfilment" and "Product Development" processes illustrate that the overall picture is quite complex, as shown in Figures 8 and 9. Here, for both Extended Business Units, the two processes have been mapped in their extended forms to illustrate the value chain of each extended process, whilst the details of the processes internal to Daks have been suppressed. Figure 8 shows that the two extended processes have enterprises/organisations that are both specific and common to both processes. For example, cloth suppliers, such as Arthur Bell, Nobles, Moon, etc., have a role to play in both the Product Development process and the Order fulfilment process. Whereas catwalks are specifically part of the extended product development process, the equipment suppliers and subcontractors are specifically part of the extended order fulfilment process.

Figure 9 illustrates a much simpler picture for the Extended Contract Business Unit; this is not a surprise as this is a much simpler business unit where product variety is low and volumes are high with relatively low product development activity. Although this is a much simpler extended business unit, structurally it demonstrates the same characteristics as the Extended Daks Business Unit.

However, further analysis (not illustrated in Figures 8 and 9) also revealed that the organisations common to both extended processes are split internally. For example, in the case of the extended Daks Business Unit, in one of the cloth suppliers (Nobles) there is a team of people who work closely with the designers in Daks on product development whilst another team in Nobles is working closely with the order fulfilment team in Daks. Furthermore, the product development and the order fulfilment teams in Nobles are in continuous communication with their counterparts in Daks but they rarely communicate with each other within Nobles. Our research established that this was a common occurrence in all those suppliers and customer who are involved in both order fulfilment and product development processes. That is the extended business processes seems to be better integrated horizontally, i.e. between enterprises, then vertically, i.e. between processes within the same enterprise.

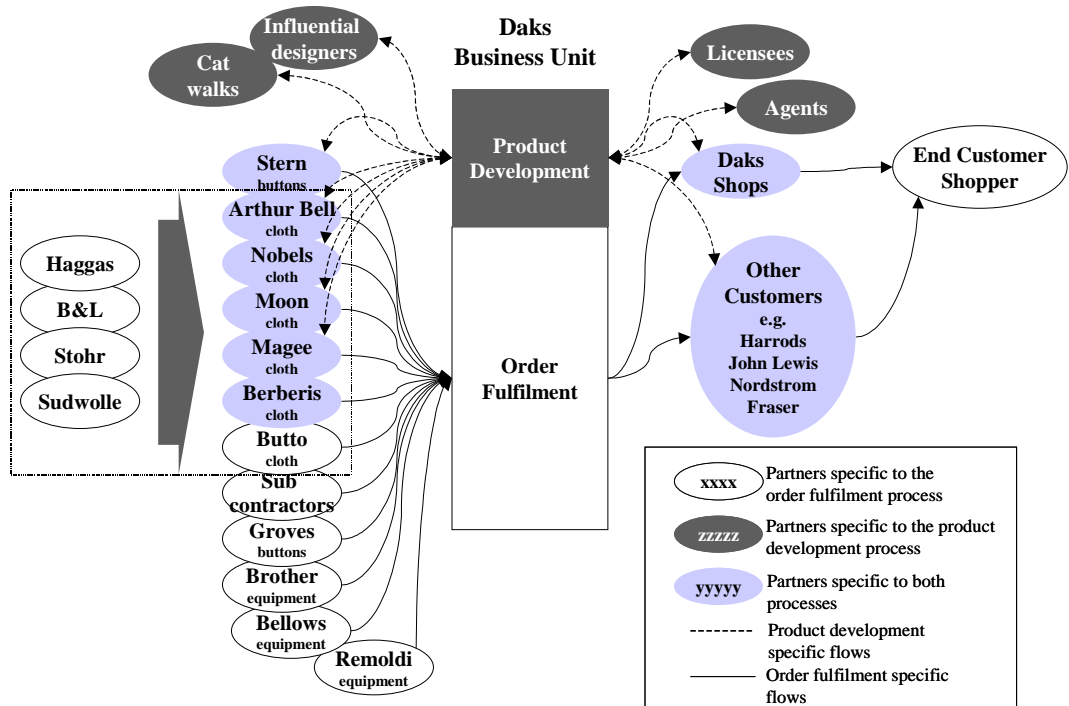


Figure 8. The configuration of the extended business processes in the extended Daks business.

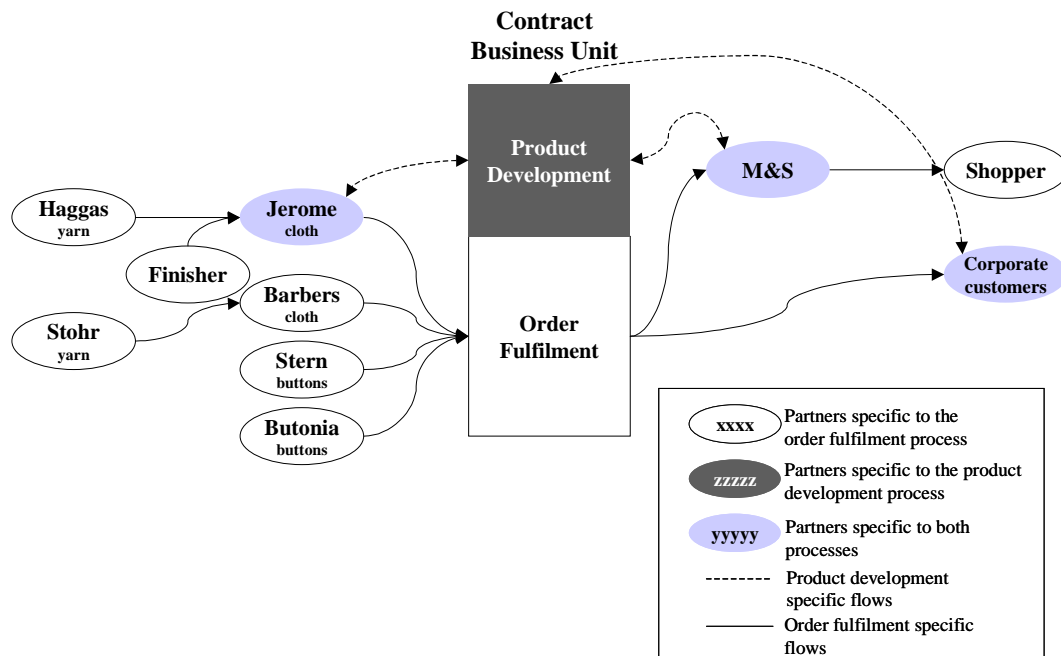


Figure 9. The configuration of the extended business processes in the extended Contract business.

From this case study we can conclude that:

- The two extended business units are exclusive.
- The two extended business processes are exclusive.
- Although some organisations may be common to both extended business processes, the internal split within these organisations is such that the two processes remain exclusive.
- There is a continuous flow of information and knowledge between enterprises along each one of the extended processes.
- However, the flow of information and knowledge between the two extended processes is intermittent.

This case study strongly supports the architecture proposed in Figure 7 and it suggests that, in developing collaborative systems, attention needs to be paid to:

1. Flow of information and knowledge along each extended business unit
2. Flow of information and knowledge between two different extended units
3. Flow of information and knowledge along each extended process
4. Flow of information and knowledge between two different extended processes

## 6. Measuring and Managing Performance in Extended Enterprises: A Model

Based on the architecture of the extended enterprise as presented in Section 4 of this paper the research team developed the Extended Enterprise Performance Measurement Model, which is illustrated in Figure 10.

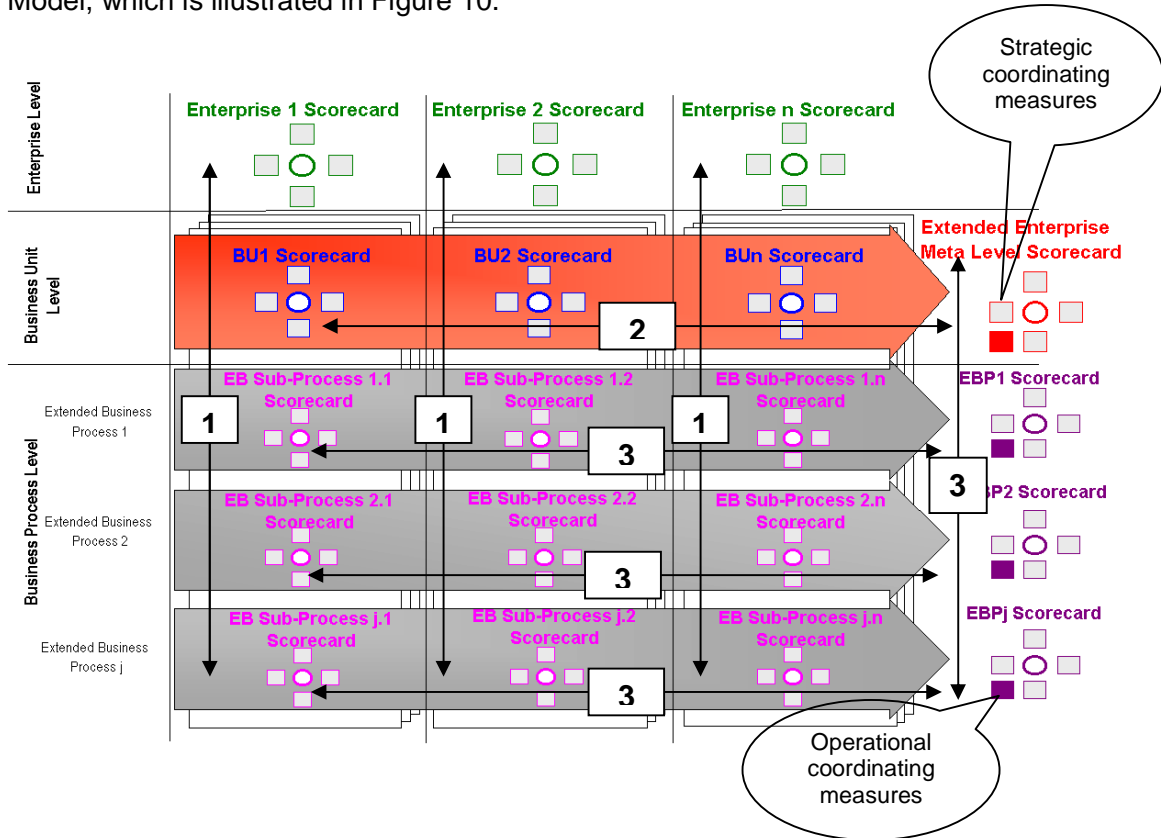


Figure 10. The extended enterprise performance measurement model.

In Figure 10 the extended enterprise consists of a number of enterprises (three in this case), which are collaborating. The readers should note that the extended enterprise emerges at the business unit level by linking the business units of number of different enterprises. The extended enterprise then comprises a number of extended business processes. Each extended business process is the integration of the business processes of individual enterprises.

The Extended Enterprise Performance Measurement Model (EPPMM) comprises of a series of scorecards. These are:

- Enterprise Scorecards, which are specific to each enterprise collaborating in the extended enterprise. Essentially, these are conventional strategic scorecards.
- Business Unit Scorecard, corresponding to the collaborating business unit of an enterprise.
- Business Process Scorecards (EB Sub-Process Scorecard), these are operational scorecards internal to each enterprise.
- Extended Enterprise or Meta Level Scorecard, which includes strategic inter-enterprise coordinating measures
- Extended Business Process Scorecards (EBP Scorecard), which includes operational inter-enterprise coordinating measures

In managing the performance of each enterprise the management team will be required to deploy the strategic objectives of the enterprise to its own business units and business processes (deployment path 1 in Figure 10).

The strategic objectives of extended enterprise will also be deployed to the business units, which make up the extended enterprise (deployment path 2). This will be consolidated with the objectives received from the enterprise and deployed through path 1 to individual business processes.

Similarly, the strategic objectives of the extended enterprise would be deployed to its extended business processes and then to the sub-processes (i.e. part of the process that is specific to an enterprise), as illustrated in deployment path 3.

This presents a complex structure for performance measurement and management in extended enterprises. In order to understand the consequences and practicality of such a structure the research team applied this measurement model in the Extended Contract business of Daks Simpson Plc. The results are as illustrated in Figure 11.



<p><b>Jerome</b>  <u>Strategic objectives:</u>                  Maximize s/holder interest  <u>Scorecard:</u>                  RoNA EVA                  Turnover Profit                  Asset turns</p>	<p><b>DAKS Simpson Plc</b>  <u>Strategic objectives:</u>                  Maximize s/holder interest  <u>Scorecard:</u>                  RoNA EVA                  Turnover Profit                  Asset turns</p>	<p><b>Retailer</b>  <u>Strategic objectives:</u>                  Maximize s/holder interest  <u>Scorecard:</u>                  RoI EVA                  Turnover Profit                  Asset turns</p>	
<p><b>Jerome (Std. product BU)</b>                  Value proposition: Price minimiser  <u>Objective:</u>                  1. Cost effectiveness through efficient and effective design, manufacturing and logistics operations.                  2. Product quality and reliability  <u>BU1 Scorecard</u>                  Profit share Profitability                  Turnover Operating expenses                  Return to Manufacture</p>	<p><b>DAKS (Contract BU)</b>                  Value proposition: Price minimiser  <u>Objective:</u>                  1. Cost effectiveness through efficient and effective design, manufacturing and logistics operations.                  2. Product quality and reliability  <u>BU2 Scorecard</u>                  Profit share Profitability                  Turnover Operating expenses                  Return to Manufacture</p>	<p><b>Retailer (value BU)</b>                  Value proposition: Simplifier  <u>Objective:</u>                  1. Hassle free and reliable shopping experience                  2. Well priced &amp; robust products  <u>BU3 Scorecard</u>                  Profit share Profitability                  Turnover Op. expenses                  Customer complaints</p>	<p><b>Extended Contract Business</b>                  Value proposition: Price minimiser,  <u>Strategic objectives:</u>                  1. Cost effectiveness through efficient and effective design, manufacturing and logistics operations.                  2. Product quality and reliability  <u>EE Scorecard</u>                  Profit Customer satisfaction                  Turnover Price index                  Market share Total operating expenses                  RoNA/RoI Asset turns                  Number of inter-partner strategic conflicts</p>
<p><b>Sub-process 1.1 Scorecard</b>                  Delivery performance                  Fill rates TSCM cost                  Lead times CoGS                  Responsiveness RTM proc. cost                  Up-side flexibility CtCT                  Value added productivity                  Local inventory days of supply</p>	<p><b>Sub-process 1.2 Scorecard</b>                  Delivery performance                  Fill rates TSCM cost                  Lead times CoGS                  Responsiveness RTM proc. cost                  Up-side flexibility CtCT                  Value added productivity                  Local inventory days of supply</p>	<p><b>Sub-process 1.3 Scorecard</b>                  Availability and shortages                  Display capacity                  Fulfilment cost                  Return processing cost                  Local cash to cash cycle time                  Local Inventory days of supply</p>	<p><b>Extended Order Fulfillment Process</b>  <u>Scorecard</u>                  Delivery performance Cost of goods sold                  COGS Fill rates                  Total fulfilment cost Lead times                  Value added productivity Up-side flexibility                  Responsiveness Return processing cost                  Inventory days of supply Cash to cash time(CtCT)</p>
<p><b>Sub-process 2.1 Scorecard</b>                  Local PD expenses as % of revenue                  Local % New product revenue                  % new prods that meets local goals                  Post release design changes                  % Component standardisation</p>	<p><b>Sub-process 2.2 Scorecard</b>                  Local PD expenses as % of revenue                  Local % New product revenue                  % new prods that meets local goals                  Post release design changes                  % Component standardisation</p>	<p><b>Sub-process 2.3 Scorecard</b>                  Local PD expenses as % of revenue                  Local % New product revenue                  % new prods that meets local goals</p>	<p><b>Extended Product Development Process</b>  <u>Scorecard</u>                  PD expenses as % of revenue                  PD effectiveness index                  % New product revenue                  % New products that meets goals                  Post release design changes                  % Component standardisation</p>

Figure 11. Performance measurement in the Daks' extended contract business



## **7. Discussion and Conclusions**

### **7.1 Research Results and Lessons**

This paper started with the argument that our limited understanding of how to measure and manage performance in extended enterprises is one of the main barriers to wide scale acceptance and practical use of the concept by industry and commerce.

The literature demonstrated that, although there is useful information on how Extended Enterprises should approach their business and operations strategy, planning and control, performance measurement and so on, the guidance given remains either at a very operational level (e.g. lists of performance measures that could be used in extended enterprises) or at a very generic level (e.g. under business strategy the compatibility of members are discussed) without providing a strategic framework on how the performance and strategy of an external enterprise could be or should be managed.

The research, having developed a model for the collaborative architecture of the extended enterprise (Figure 6), demonstrated through a single case study, that an Extended Enterprise is structurally different than a single enterprise. That is:

- Extended Enterprises functions at business unit level by connecting the business units of number of different enterprises.
- In an Extended Enterprise the business units are interdependent. In a single enterprise that has several business units, the business units are mutually exclusive, i.e. operationally they do not depend on one another and they are viable operations in their own right. In an extended enterprise the picture is quite different, here the business units are depended upon each other, i.e. each business unit has to operate in strategic and operational synchrony with the other business units in the extended enterprise.
- The Extended Enterprise comprises a number of Extended Operate Processes.
- A meta-level manage process is required to manage the performance of the extended enterprise. This process would need to closely integrate with the manage processes of each enterprise.

The research concluded that, due to the above structural differences, the systems required to measure and manage the performance of extended enterprises, whilst being based upon existing performance measurement frameworks and models, would be structurally and operationally different.

Based on the above conclusion, a model for measuring and managing performance in Extended Enterprises is proposed (Figure 10). The practical application of this model in the Daks case study (Figure 11) led to the conclusions that, although complicated, it is possible to create a performance measurement framework to facilitate integrated management of the extended enterprise, participating enterprises and their business units and business processes. And that this framework leads to development of coordinating measures that are:

- Intrinsic as a result of deployment, e.g. profit measures along the Extended Enterprise or lead-time measures along the order fulfilment process relate to inter-partner lead-time measures proposed by Kochhar and Zhang (2002).
- Extrinsic, such as "number of inter-partner strategic conflicts" (Kochhar and Zhang 2002), which require to be consciously designed into the measurement system.

## **7.2 Limitations and Further Research**

The key limitations of the research described in this paper are:

- The empirical evidence presented is based on a single case; further cases need to be studied to establish the generalisability of the above results.
- The practical application of the EE performance measurement model was a paper base exercise. To establish its practical limitations and usability an action research project of longitudinal nature is required.

During the research, the question whether Daks case study represented a typical Extended Enterprise was considered. As demonstrated earlier in this paper, there are various definitions of Extended Enterprise and there is indeed some confusion between Supply Chains, Extended Enterprises, Virtual Organisations and Collaborative Enterprises. In this paper our definition of an extended enterprise was based around business processes that extend across a number of organisations. In this context we are

confidant that Daks case study represents a typical extended enterprise, as demonstrated earlier the extended processes are better integrated horizontally then vertically.

The research teams appreciates that the findings presented in this paper are at the early stages of Meredith's (1993) research process, and the results should be seen as:

- An initial observation of the limitations of the current knowledge in performance measurement in the context of extended enterprises.
- An initial deduction, from literature, and explanation of a model for performance measurement and management in extended enterprises.
- Initial testing and description of the validity of this model.

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