SME INTEROPERABILITY IN THE GLOBAL ECONOMY:
A DISCUSSION PAPER

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Abstract: This paper is aimed at exploring the understanding of the changes that face the lower levels of the supply chains as business moves from a global market into service with multiple highly changeable products and offerings, demanding interoperability across skills, customers and suppliers. *Copyright © 2005 IFAC*

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1. INTRODUCTION

The perspectives in this paper were derived from, and jointly agreed by the various participants in the IST NOE INTEROP (INTEROP, 2004), some 60 researchers. This Network of Excellence in Interoperability addresses 3 pillars of research consolidation, Platform, Ontologies and Enterprise modelling and methodologies.

Work package WP12 is the industrial link from this research via implementers and aided by the dissemination work package WP11, which are tasked with the dissemination of the research.
Over the past year some 4 workshops have considered the domain resulting in the basis of this paper.

Experience and knowledge are also drawn from other European initiatives. Eureka – Power (Eureka Factory), e-Power IST network of Intermediaries towards SMEs.

2. BACKGROUND

Over the last decade there has been a marked movement in the way that business conducts itself.

In the pursuance of lean ways of working across the supply chain and utilisation of so-called best practices to minimisation of waste, there has also been a move towards concentration on core competence, even to brand maintenance, and the resulting dependency on others to supply key services, so called outsourcing. An example of this type of movement is the development of the new range of diesel engines, once considered to be a market differentiator, by Peugeot and Ford as a joint collaboration (E-Power, 2002).

As regards the products and services, these are increasingly complex, using integrated technologies that cross disciplines. This increase in complexity means that there has been much more emphasis placed on project management and control at the Large Companies level.

Customers of product and services are also changing in their requirements. No longer are they satisfied to buy a car and then organise the repair and maintenance, they are looking for a complete package from purchase to replacement, through life support. This trend impacts the suppliers of components and services and is increasingly percolating down the supply chain.

The other market pressure that is also evident is the requirement to provide offerings more speedily and to customise specifications which are at least in small batches to minimise investment in inventory.

The global business and trading scenario of 'design anywhere', 'build anywhere' and 'sell anywhere' has been developing for some time. This approach is now beginning to extend to, 'support anywhere' as the product life cycle and management is considered and eventually dispose anywhere. This clinical view of the product is extending itself to business views encompassing service i.e. pay by the hour leasing where the ownership lies with the manufacturer. We also see financing moving down the supply chain as the payments are being made on use and not by order. This means that the cost of inventory is bourn by the supply chain. Similarly as the pressure mounts for shorter lead times and reaction to market pressures the need for fast reactive information flows is also needed.

The quest for seamless business, product and information flows has been sought for many years and the need for Interoperability has never been greater. However, the variety of approaches has never lessened as major industry has pursued competitive edge through restrictive ICT implementations locking into products both customer and supplier.

Just as the finance is slowing being distributed across the supply chain also is the knowledge and innovation requirements. This could also be regarded as a need for the lower members of the supply hierarchy moving up the intellectual knowledge food chain, the opposite direction to the finance flow. Failure by the supply chain to react to this opportunity/threat allows foreign competition to move into the space left (Interop, 2004).

2. BUSINESS CHALLENGE

All these movements have had the effect that Large Companies concentrate their efforts more on customer management (project management) than on the creation of the product which they rely on their suppliers and their outsourcing partners. This movement can be seen in the diagram below (Fig. 1) as the resources available address the more complex problems of product and service integration.
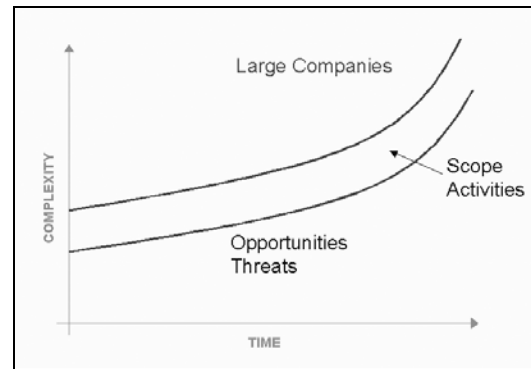

Fig. 1. Diagram of complexity

But what impact does this have on the Supply Chain and particularly SMEs? In contrast, the majority of the SMEs that contribute to Europe's GDP (Gross Domestic Product) have not moved much from their provide-to-order status. Basically this would appear to be the lack of justification. Although the power of back office equipment has increased significantly for lower cost, the application software has not followed this trend. In fact the software is more expensive than it was to implement and the knowledge required appears to be outside the normal SME scope. This means that the SME has to place a high degree of trust into the IT supplier to the extent that a mistake could disastrously impact his business. Also, the Large Companies sometimes contractually dictate the information interfaces and where an SME has multiple customers this has a prohibitive demand on their scarce resources (PLCS).

Consequently there are gaps opening up between Large Companies and SMEs. There can be opportunities for SMEs to provide added value services or it is a threat that companies outside Europe will fill the gaps and then there will be a barrier between the SME and its former customers. Eventually, this will lead to the demise of the company or it will have find alternative niche markets but this could be too late.
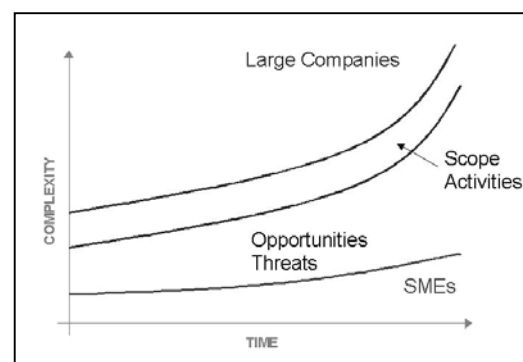

Fig. 2. Complexity relative to SMEs.

3. UNDERSTANDING THE DOMAIN

Interoperability exists in many dimensions. Between departments, companies, across the multiple skills, engineering, commercial, production and legal. This involves many cultures and indigenous processes and terminologies. Fig. 3 shows the multiple interfaces across which Interoperability must exist within an organisation that wishes to play the Global Game.
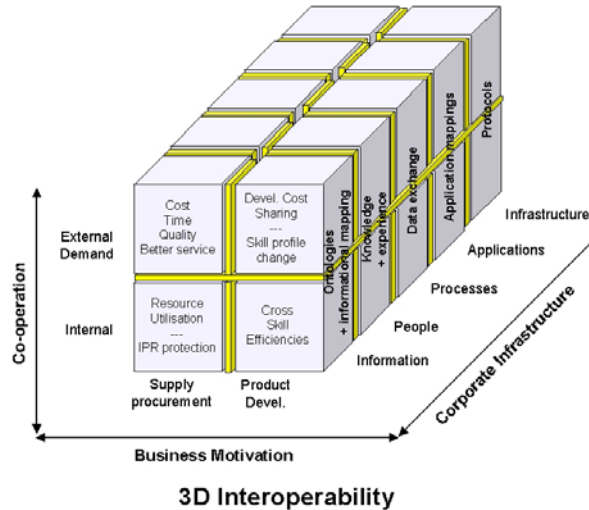

Fig. 3. 3D Interoperability (Doumeingts, Piddington, 2004)

To counter the opening of this gap some companies have joined together to create trading clusters where they can act as large companies whilst maintaining their own identity and competitive edge. By inter-operating they can achieve buying advantages and can also offer the accumulation of their services. For example, if a machinist, a fabricator, a constructor, a transport and an IT company joined together they could offer an order delivered to the customer for a sub assembly of a product such as a car or washing machine in a faster time than if they acted independently. Of course this entails a lot of analysis and co-ordination of processes across the business, re organisation, as well as co-ordinated communications with their variety of customer systems. The diagram below shows the lines of communication that must inter-operate to be successful.
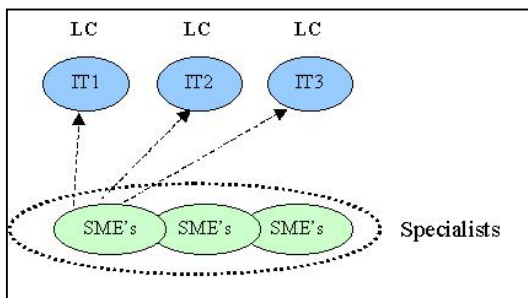

Fig. 4. Diagram of clustered companies

Both forms of collaboration are referred to as Supply Chain, but one is hierarchical (a contractual leader exists and is contract driven across the collaboration) and the other peer to peer (management decisions are part of the management of the cluster). These mainly relate to decisional processes and management style that take place in the collaboration organisation (Eureka-Power, 2004).

4. NEED TO CO-OPERATE

It is clear that in the light of competition from China, the Pacific Rim and the US, Europe must work co-operatively in a flexible and knowledgeable way. Europe cannot afford to fight the battle through individual initiatives, but must pool information and work collaboratively to achieve success. Nowhere is this more important than in Engineering and Manufacturing where there is a major skill shortage, especially in those applications of e-technologies where European SMEs lag behind their competitors and where wide differences exist within Europe itself.

It is also evident that European industry must place itself in the added value parts of the lifecycle as it will never be able to complete against those operations that chase cheap labour. The implications are that the tradition supply chain companies must move from 'make as instructed' to design contributions aimed at cost reduction or quicker time to market. Once again to offer these services the smaller companies will have to collaborate to provide the range of capabilities that will be necessary to provide these new customer services.

5. HURDLES TO BE CROSSED

Clearly, in this new world of business, there is a need to co-operate and in different ways. It can be as a supplier to multiple customers each wanting similar information but in different ways. Of course the SME must retain its own infrastructure and ways of working and not be constrained by customer demands. This protects its competitive edge of being able to rapidly react to changing circumstances and not incurs the overheads of Large Companies.

However, this does then present a major hurdle where multiple supply chains compete for resources and the interoperability within the IT layer comes at a very high and varied cost.

The diagram below attempts to illustrate this complex relationship where the SME organisation is a node in interacting and competing supply chains and as a consequence faces a much more complex environment.
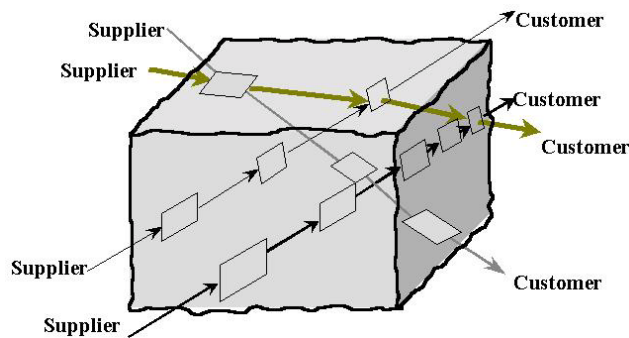
Fig. 5. Competing Supply Chains (Jaekel, 2003)

Resulting from the above environment some factors can be identified that need in depth consideration and further research.

Among others, some of these factors could be:

5.1 The wide diversity in software product objectives and approaches

Most software applications are developed as an assistance to a particular skill e.g. CAD aimed at the design function or ERP targeted at the procurement and control functions. Interoperability at this level across collaborations, is carried out in different time frames depending upon the function and the transfer of information is also across diverse systems.

5.2 The expense of developing integrated systems

Integration has always been expensive and today's products are only affordable by the large companies. Policies are need to be developed that SME can use and probably are highly dependant upon standard ontologies.

5.3 The continuity born of new computer and Web technologies

The adoption of new systems usually occurs in large companies with the investment in a new product. Most SMEs have a continuous business and need to be able to adopt incremental change not versions.

5.4 The compatibility with legacy applications

Applications create data. This legacy data must interoperate with the new system and the old systems that are not being replaced. As the newer systems seem to generate more sophisticated information the interface has to 'Create information?'

5.5 The low degree of integration of the e-processes with the remaining processes

Most e–Processes are centred upon the commercial or the transfer of information upon request. More integrated system approach is needed that recognised the life cycle of information across business and collaborative projects.

5.6 The low appreciation for interoperability impact in architectures and platforms by high-level decision makers

The majority of SMEs concentrate upon the capability on which the business was founded. This is unlikely to be IT infrastructures and a deep understanding of BPR. Awareness has therefore to be part of any improvement in the situation to generate ownership by all levels of the organisation.

5.7 The concept of the 'perception of risk', very usual among SMEs. In this concept, we include the risk of choosing a wrong architecture, the cost perception, etc.

There is a common belief that SMEs will not spend money. This is not true, but they do need to know what they are risking. Change needs to be coupled with business risk and models need developing that integrate the change scenarios with the monetary risk that is involved.

5.8 Competitive edge

Recognition of the unique selling feature of the business and the relationships to business objectives and performance is not well understood and without this it is difficult to understand what can be shared and what needs to be protected.

5.9 Shared Data environments

SMEs need to trust a third party to supply the service to the collaborative project perhaps with interoperable conversions and mapping achieved by middleware. But there must also be assurances that a path is not being provided to competitors via a collaborator.

5.10 Valuing information

How is IPR shared and identified in a collaborative service or product? There have to be algorithms that indicate this and then legal frameworks can p be generated along lines already investigated in Europe – e Legal for example.

5.11 Culture

Culture is really the main issue. It has to be changed in line with experience already made with TQM. This is the involvement of all levels of the organisation in understanding their role, their contribution and the dependency on their fellow workers be they mangers or operatives. To approach an SME the following have to be taken into consideration and addressed before the technology.

5.12 No time to Think

The SME tends to be at the bottom of the supply chain in a very reactive and demanding regime. This is of course one aspect of the competitiveness. However, as much time is spent on day-to-day problem solving there is little time available for strategic planning of the future business.

5.13 Don't have the skills

Most SMEs have built their businesses upon the exploitation of a set of core skills. e.g. machining with very few if any other staff not involved with added value profit generating tasks. As a consequence it is very difficult to assess the business impact demanded by new technologies such as IT aimed at the infrastructure improvements. This lack of trusted skill prevents optimum adoption of these type of improvements. As we are well aware the choice of a wrong piece of IT can seriously affect the viability of a company.

5.14 Can't evaluate risk

Most large companies have carried out systematic analysis of the business processes and there is an understanding of the impact of change across functional areas. This is not true for the SME. Few have perceived the need to formalise the identification of business objectives and the means to achieve these objectives. Without an holistic view of a company it is difficult to access risk and the consequential impact of change leading to unplanned surprises that can be, in the limit, fatal to the business.

5. CONCLUSIONS ON SMES AND INTEROPERABILITY

The nature of SMEs is that they spend so much of their time concentrating on survival and creating revenue that little effort is expended in looking to the future and searching new ways of working although these could provide new routes to increase profits. However, they do provide a major source of employment and a major contribution to GDP.

With the advent of e-technologies that offer such improvements they are generally outside of the core skill set of SMEs. This leads to a poor take up of these business technologies or at least an incomplete use. Regional government officials have realised this and have created several facilities charged with introducing these necessary enablers to businesses in the region.

However, these SMEs are financially supported by the Regions. Unfortunately the Regions forget that there are funds at the National and European level to support such activities, so sometimes the support to SMEs can be restrictive.

Based on the previous description we reach the following conclusions for SMEs:

- They have difficulties to find on the adapted tools, particularly ERP tools,

- They are more focusing on the technical problems than on organisational or semantic topics: Enterprise Modelling is poorly used,

- The investments are very high and it is not easy to demonstrate the ROI,

- There is no adapted methodology to facilitate the introduction of new IT solutions particularly the Interoperability technology.

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