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# Europe, Competing: Market Prospects, Business Needs and Technological Trends for Virtual, Smart Organisations in Europe

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## Summary

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In Lisbon, Europe set out to be the most competitive and dynamic knowledge-based economy in the world.<sup>1</sup> It is increasingly recognized that knowledge is the driving force behind economic growth. (David & Foray 2002) But knowledge that drives growth at the fastest rate has highly specific attributes:

- it is highly portable;
- it is widely accessible with even minimum ICT infrastructures (e.g. a Web browser);
- it is expressed in open, universal form so most computer systems can read it ;
- it is easily transferable from business-to-business without complex data mapping;
- it is business information that *smart* trading partners can act on to make a profit.

As knowledge acquires these attributes, it becomes “active,” fluid, actionable information, and—driven by organisations seeking enhanced competitiveness—it achieves the highest utility for those organisations that are *virtually structured* to access and act on it. Today, active, fluid business information is expressed by highly portable HTML, XML, and .Net protocols, and the primary enabling agent that makes knowledge both portable and actionable is the Internet.

“Static” information, on the other hand, is data contained in proprietary computer systems, written in antique proprietary codes, or held captive in information repositories accessible by only limited numbers of people. Static information is an expensive burden for companies, because of the high monetary and human capital costs required to convert static information to actionable information. Business organisations that traffic in active business information find they must slow down to engage with organisations that can traffic only in static information. Soon, it won’t be worth their trouble, and companies using only static information will be left behind. Static information is data expressed in such computer languages as DOS, Basic, Fortran; programs that are in pre 32-bit programs; or knowledge contained solely in people’s heads or in computers not linked to the Internet.

As knowledge and information drive growth, forward-thinking organisations are responding by future-proofing their ICT and coding platforms, and rethinking their organizational structures, information technology capabilities, and business procedures to take advantage of the immediacy of ever-current information, as it flows across global business networks through the Internet. These organisations recognize that their competitive advantage depends on positioning business-critical procedures so they can act immediately to profit from business information, whatever form it takes. Information that businesses can act on immediately can take many forms, including breaking news that affects commodity prices; electronically tendered requests for quote (RFQs) / requests for price (RFPs); call-off requests for inventory; requests for contract human

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<sup>1</sup> eEurope, Lisbon Summit March 24, 2000  
([http://trendchart.cordis.lu/Reports/html/the\\_most\\_competitive\\_economy.html](http://trendchart.cordis.lu/Reports/html/the_most_competitive_economy.html))

capital; purchase orders / retail orders; customer service requests; shipping / shipping status; and inventory logistics queries. Astute organisations also realize that to achieve their highest margins and lowest capital commitment they must automate their responses to this information, by allowing information to trigger self-correcting, critical path activities that can be monitored and managed using low-cost computer tools, like a Web browser.

## What is a Virtual Smart Organization (VSO)?

Today, the knowledge-driven economy is a global network of organisations linked over the Internet. No business organization can expect to be consistently competitive without an aggressive Internet strategy. Furthermore, to remain competitive, companies of all sizes are restructuring to be more nimble when responding to opportunities. “Old-economy,” within-the-four-walls, manufacturing and service organisations are now finding distinct competitive advantage by using less hierarchical company structures and virtual linkages to their employees, their contract labour, their access to resources, and their trading partners. In these new organizational structures, the goal is to distribute decision-making authority by *flattening* the traditional pyramidal organizational hierarchy and move from a top-down, linear, station-to-station, command-and-control structure, to an organization structured as a multi-dimensional capabilities matrix. In organisations structured as such, discrete company departments are replaced by alliances of talent and capabilities that form, dissolve, and reform to accomplish highly specific tasks. The alliances that form can be made up of individuals, teams, or technology owned by the parent company (“native” skills and capabilities) or “outsourced” labour or technology that is engaged for just the duration of the required task—whether that task is satisfying a single customer for a single SKU, or a multi-national company seeking a multi-year service contract.

Organizing, cataloguing, cost-allocating, and offering ready access to the individuals, teams, and technology available to accomplish a business task—no matter the location of the resource, inside or outside an organization’s four walls—can best be done by recasting old-economy organisations as “virtual” organisations that affiliate, assemble, and dissolve resource alliances in “smart” ways that focus on accomplishing discrete business goals. These organisations, called Virtual Smart Organisations, or VSOs, are the focus of this report, and our research shows they can be borne, grown, encouraged, and measured using a variety of metrics and practices explained herein. Though VSOs are “smart” insofar as they allow the business demands to drive the assembly of resource alliances, they can be “virtual” in multiple ways:

- **ICT.** VSOs use information and communications technology (ICT)—principally the Internet or company extranets—to link resources and allow teams to collaborate.
- **Human Capital Structures.** VSOs catalogue and advertise human resource capabilities (or technology capabilities that may be brought to bear on a business problem) so any member of a capabilities continuum can view and select from talent pools—native or outsourced—through human capital management (HCM) software, from such companies like SAS and SAP.
- **Empowering Middle Management.** VSOs can link their internal human resources to human resources and technologies outside the company that can be contracted for specific business tasks, principally through pre-approved vendor registries or by allowing middle management the power to authorize cost-justified alliances or contract labour.
- **Enabling Collaboration.** VSOs can enable collaboration among matrix team members through decision-support software, expert systems, self-learning embedded procedures,

mentoring software, and critical path management, so learning curves are increasingly flattened.

- **Data-Base Structures.** VSOs use hosted software solutions, accessed over the Internet which rely on “single authoritative database” models that avoid the time and cost required to rationalize and synchronize multiple databases.
- **Customer Experience.** VSOs can use technology to create highly personal “one-to-one” customer experiences (even in B2B environments, when the customer is another company or a sister division within a large company) through customer relationship management (CRM) software that accesses a transparent historical record of the enterprise’s efforts on behalf of the customer.

**VSOs: A real-world example.** VSOs are not abstract entities imagined by academics; indeed, many exist today with model organisations in Europe, some of which are cited in this report. One real-world example of a NL-based VSO is a company, JDS Uniphase (JDSU). JDSU uses commercially available off-the-shelf software (COTS) to operate a global, drop-ship management system put in place to manufacture and market JDSU’s fibre-optics components. Using a “software extension” created and implemented by ClearOrbit,<sup>2</sup> JDSU has become a VSO by “accessorizing” its Oracle ERP (version 11i) to allow JDSU to manage and seamlessly collaborate in real time with global contract manufactures, suppliers and their suppliers (see sidebar *Case Study: A Real World VSO*). When a business customer calls JDSU with an order, JDSU is able to “commit to fulfil,” *even though it does not have the product in physical inventory nor own title to the product*. Using virtual linkages, and the diffusion of its own authoritative ERP data over the internet, JDSU refers its suppliers to pre-existing product specifications (“smart” practices) and determines which of its contract manufacturers is best prepared to fulfil the order. JDSU assumes no labour carrying costs, no inventory carrying costs, and no long contractual obligations. It *composes a virtual alliance of capabilities and products in response to an order*, and, if need be, that alliance can be dissolved with no consequence when the demand is satisfied or no longer exists.

## Is a VSO More Competitive Than a Non-VSO?

It is our conclusion that VSOs are more competitive than non-VSOs. Indeed, we expect that many more European companies will take on VSO features over time for the following reasons:

- **Labour.** Model VSOs have human capital structures that demand task-specific, cost-allocation for labour. Human capital that is not actively working to increase margins or volume is reassigned or relieved. For non-VSOs, the capital commitment of carrying labour that is not cost-allocated drives down margins, as it drags on growth and needlessly consumes unrecoverable capital. Since labour costs represent one of the chief costs of production, the VSOs’ flexibility to expand and contract a labour force in response to contracted tasks makes them more competitive than non-VSOs. EU business organisations have a cultural tradition of long-term commitment to labour and labour unions. VSOs represent a serious challenge to this culture, as organisations with high labour costs and long-term labour contract commitments are now competing in a *global* marketplace with companies who can recruit contract labour that is strictly cost-allocated, flexible, and comparatively low-cost. This labour structure allows that

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<sup>2</sup> A company based in Austin, Texas

competitor to deliver products at a lower cost and price, even when the expense of shipping long distances is factored in.

- **Capital.** Model VSOs carry no or little inventory. By using sophisticated ERP systems that use the Internet to traffic in real-time inventory information, a VSO can market something it does not possess nor have title to. With the Internet and COTS software, VSOs achieve transparency to their trading partners' inventory and commit to fulfil with confidence because they are assured virtual availability. Reducing inventory reduces the capital required to carry inventory, freeing the capital for investment in innovation, dispersal as dividends, or allowing the company to carry less debt, thereby favourably affecting the VSOs' debt-to-share or debt-to-value ratios. Non-VSOs with high capital costs and inventory management costs will have to charge more for their products or have lower margins for a competitively priced product, thereby making them less competitive.
- **Flexible Corporate Structures.** In response to rapidly breaking business opportunities (e.g. the manufacture and shipment of power transformers into an area hit by floods, or the shipment of building materials into a war zone under reconstruction), model VSOs are naturally more competitive because they can compose, dissolve, and recompose teams or technology capabilities with relative ease.

## Will VSOs Contribute to EU Competitiveness?

It is our conclusion that VSOs will contribute to EU competitiveness, with a caveat on the culture of labour. VSO models are today variously embodied by companies engaging in global drop-ship management; virtual marketplaces; Internet-based information repositories/information portals, and task- or job-specific alliances of allied trading partners that quickly form in response to a business demand. Underlying the formation of these VSOs are three key factors:

- **Data Portability.** The inherent portability of business information, as it flows across geographic boundaries over the Internet using common protocols;
- **Open Bidding.** The ease with which a company can tender open-bid contracts and RFPs (based on product specifications) to any subcontractor that can meet specifications, no matter where that subcontractor exists geographically;
- **Lowest Cost Labour.** Labour in developing counties is so inexpensive and shipping so efficient and relatively affordable that they makes the distance and cost of global shipping less of a factor.

Though it has real human costs that are already affecting EU labour pools, the global portability of business information has enabled VSOs to follow low-cost labour to its cheapest location. Further, information portability allows VSOs to pit suppliers against one another in ways that would have been impossible before the Internet. Today, enterprising VSOs in and out of the EU are vigorously and favourably competing against *all* EU companies (VSOs and non-VSOs). For the EU to achieve global competitiveness, it should consider incorporating VSO principles, if only because competitors have embraced those principles and, as we have concluded, they are using them to achieve lower labour costs, higher margins, lower inventory, lower capital costs, and a business agility that allows them to respond to breaking opportunities faster than non-VSOs.

## Should VSOs Be Stimulated? If Yes, How?

Yes, VSOs should be stimulated, in these five ways:

- **Connectivity.** Persistent, pervasive, high-quality, low-cost, broadband Internet connectivity is an imperative to growing VSOs. Government can play a role through tax incentives or direct subsidy to making the Internet widely available and increase broadband access;
- **Modelling.** In multiple sectors of the economy, non-VSO companies should be provided with tutorial-form models, seminars, testimonials, and case studies of how successful VSOs operate, with business-process road maps provided so non-VSOs can begin making transitions to VSO practices.
- **Increased Equity Values.** The supply chain has been an early leader in VSO modelling because of the rewards in *equity values* that companies realize when they are not carrying inventory costs on their books. When this concept was first recognized, software makers responded with a plethora of tools to enable virtual supply chains. Through publicity in business periodicals, EU organisations need to become aware of the correlation between VSO best practices and the enduring economic well-being and higher values of companies that practice them, as measured by increased profit margins, increased P&E ratios, lower debt-to-value ratios, lower debt-to-share ratios, and higher cash-to-share ratios (See sidebar: *Measuring VSOs*.)
- **Labour.** Long-term, even lifetime, commitment of employment to an employee or union members may be contrary to VSO practices. In model VSOs, labour is cost-allocated for every hour it is carried on the organization's books. VSOs may need freedom from traditional labour practices to expand, contract, or outsource their labour pools in response to actual demand. Restricting organizations by requiring that they carry dormant or non-cost-allocated labour may enable the competition to sprint past them. If VSOs competed only with companies that had similar labour commitments (e.g. competition only within the EU), this problem would not be so evident, as the capital commitments of labour among competitors would achieve parity. But VSOs *compete globally*, so the problem of high-cost labour or long-term commitment to labour will continue to be an issue.
- **Tax Policy.** Since VSOs depend on virtual inventory to drive down costs, tax policy requires flexibility. As products move toward delivery, their titles can virtually change hands dozens of times, as they pass from station to station along the value chain. But these titles may be held (or pass through) each station for only an instant. Taxing each "owner" would frustrate this fluid movement of products. Similarly, taxes on Internet connectivity, Wi-Fi, RFID, and similar connectivity methods should be removed, mitigated, or used as incentives to move companies into pervasive, persistent, broadband connectivity. (That said, on an overwhelming basis, the participants in an opinion poll conducted for this report did not see significant barriers to VSO formation existing within labour or tax laws. More than 95 percent said "no" to the existence of barriers.)

## Can VSOs Be Identified and Measured?

VSOs can be measured in three categories:

1. Whether they exist at all;

2. To what extent are they committed to VSO best practices across their various organizational sectors;
3. If they are gaining competitive advantage through VSO practices.

Few if any standard metric systems have been developed to determine whether VSOs exist and to what degree VSOs practices are being adopted, though there are indicators to watch for, e.g. the implementation of collaborative and/or hosted software solutions; the diminishment of labour commitments; and the existence of human capital structures (with supporting software) that encourage the composition of collaborative teams to accomplish specific business tasks. But as we examine the best way to measure VSOs, bear in mind that VSOs are not emerging because they are intellectually interesting. VSOs are emerging because they are competing and the imperative exists for many companies is to convert to VSO status.

Whether an organization has become a VSO or is the process of implementing VSO practices can be indicated by:

- The organization's cultural willingness and corporate ability to commit capital to software that enables VSO practices (e.g. collaborative software, decision-support software, mentoring software, CRM software, HCM software);
- The organization's willingness to publish product specifications and manage outsourced contracts and labour to produce products or services;
- The organization's willingness to index its labour loads to actual work, and increase / reduce labour loads as demand spikes / subsides;
- The rate than an organization has adopted and embraced software that enables it to search for and contract outsource labour;
- The organization's ability to integrally use the Internet to respond to tenders or business opportunities;
- The organization's ability to catalogue and afford access to the full range of its capabilities, inside and outside the company's "four walls."

Since a VSO posture is a organizational and strategic response designed by forward-thinking management to counter the business advantage of competitors, the metrics for success of a VSO are the same metrics of success for any business, and they can be observed when comparing VSOs to non-VSOs, or when comparing one VSO to another:

- Optimised profit margins;
- Low / no inventory costs;
- Cost-allocated labour;
- Advantageous P&E ratios;
- Low debt-to-value ratios;
- Low debt-to-share ratios;
- High cash-to-share ratios;
- Sustainable profit;
- Quarter-on-quarter growth.

### Case Study: A Globally Competitive, European-based VSO

JDS Uniphase, the global fiber-optics components maker, with offices in The Netherlands, uses commercially available off-the-shelf software (COTS) to operate a global, drop-ship management system put in place to manufacture and market its fiber-optics components. Using a software extension created and implemented by ClearOrbit, JDSU has become a VSO by “accessorizing” its Oracle ERP (a Web-hosted version 11i) to allow it to manage and seamlessly collaborate in real time with global contract manufactures, suppliers and their suppliers. When a business customer calls in an order to JDSU, JDSU is able to “commit to fulfil,” even though it does not have the product in physical inventory nor own title to the product. Using virtual linkages, and the diffusion of its own authoritative ERP data over the internet, JDSU refers its suppliers to published product specs (“smart” practices) and determines which of its contract manufacturers is best prepared to fulfil the order. JDSU assumes no labour carrying costs, no inventory carrying costs, and no long contractual obligations. It composes a virtual alliance of capabilities and products in response to an order, and, if need be, that alliance can be dissolved with no consequence when the demand is satisfied or dries up.

In the first stage of this effort, six key contract manufacturers around the world are interacting directly with JDSU Oracle ERP via real-time Web pages and Web services. By using COTS collaborative software, JDSU’s manufacturers and suppliers have real-time, seamless, transparent access to JDSU’s Oracle ERP. But JDSU retains complete visibility and control over the disposition of inventory during the staging and shipment processes at supplier locations, including the printing of shipping documents, commercial invoices and barcode labels, with all of the necessary customer information printed in JDSU’s format, using JDSU’s ERP data. JDSU collaborates in real time with its trading partners, without having to construct a unique, independent data model or engage in any costly custom code or data mapping. JDSU simply interacts with data where it resides, at any point in the supply and demand chains, at any time and from anywhere on the globe. Suppliers print JDSU-compliant package labels and drop ship directly to customers, yet JDSU remains the brand the customers see and the single point of customer contact.

“Typically, the goal of virtual collaboration is visibility to purchase orders across disparate systems,” said ClearOrbit’s Tom Dziarsk. “But ClearOrbit has advanced that model dramatically. At JDSU, ClearOrbit works with the Oracle ERP system to track and manage the entire drop ship order process, in real-time, across disparate ERP systems, while enabling JDSU to present itself to the customer and perform as the sole product manufacturer. It is truly a virtual smart organization.”

Contractors flourish where skilled labour is cheapest; JDSU is able to offer the best price (and realize the highest margins) on commodity items due to three factors: Its specifications are superior; it nimbly responds with speed and availability when a customer calls seeking a product; it can access the cheapest skilled labour available at that time, reducing product costs in a commodity market. Trading partner who wish to be part of this VSO must subscribe to JDSU’s advanced data protocols, or install software to bridge to those protocols. All linkages are hosted and accessed using low-cost browsers over the Internet.

## Research Results

In order to better understand business-to-business VSO operations in Europe, this project synthesized the outcomes of a literature review, a data analysis, expert opinion, and case studies of European companies. In an opinion poll conducted to support this project, a nearly unanimous count (93 percent) responded positively to the idea that implementing virtual, smart technologies “will make European companies more competitive.” Whether this is true or not, the perception

among the experts surveyed is that VSOs are a significant shift in the competitive operation of business, and one that offers great potential benefit to European competitiveness.

Castells (1996) has argued that the new informational paradigm is characterised by the network organisation. What is important in wealth creation are not “structures” (institutions such as corporations that concentrate power and knowledge) but *networks* that constitute the “new social morphology of our societies” that distribute power and knowledge. Rigid hierarchies devolve to become more complex and non-linear in their operations. Units within businesses take on more responsibility, acting more like self-organizing entities. Castells suggests that network structures substantially modify the operation, creation, outcomes, and uses of knowledge – a feature that we have observed in our case studies of European companies. The opinion poll supports this, with the vast majority (86 percent) reporting that *flexibility* is the greatest benefit offered by VSO operations. Additionally, VSO practices tend to collapse the sales cycle, shortening the time between customer contact and fulfilment, and generally accelerating the pace of business. Among experts polled for this study, more than 75 percent saw the ability to be “more responsive to customer inquiries” as a major benefit of VSOs.

Effective use of ICTs by networked businesses has been shown to reduce transaction costs and increase efficiency. (Litan and Rivlan 2001) They enable codification and embedding of knowledge, as well as promotion of learning. (Balconi 2003) They liberate and stimulate human resources, allowing staff to move away from rote tasks and towards the things only people can do: innovate by creatively solving problems and seeking new solutions. Those polled for this report did not see the need for staffing being significantly reduced by VSO operations (64 percent said “no” to this). However, they did agree that this shift enables businesses to respond more quickly to the changing needs of the marketplace (78 percent). And, more than 80 percent expect that VSO operations will enable European companies to be more innovative.

The virtual features of the business enterprises we examined are fairly easy to identify. In these cases, companies that pre-dated the virtual business model continue to exist as stand-alone entities, but ones that linking along a virtual, digital value system to produce or fulfil a product. This link creates a virtual enterprise that can be temporary or permanent.

## Phases Towards Virtual Operations

Among the European companies we studied that have begun the transition from a traditional to a virtual business model, we identified four stages towards becoming a virtual operation.

**Stage 1: Isolation.** Traditional within-the-four-walls firms operate as independent organisations. Margins show room for dramatic improvement, due to capital costs of carrying inventory and labour that is not cost-allocated. Cross-functional integration is manually implemented, often through paper-based exchanges; human capital does not have access to an electronic repository or expert system. Websites serve as an “electronic brochure.” Within the firm, there is little in the way of cross-functional or reflexive learning.

**Stage 2: Initiation.** The first steps towards electronic linkages are made by processing client orders through email or the Web, replacing paper. This enables more automation in the ordering process. The automated orders can enable some internal learning and efficiency. Employee, contractor, and technology capabilities are electronically catalogued.

**Table S.1**  
**Stages Towards a VSO**

	<b>Isolation Stage 1</b>	<b>Initiation Stage 2</b>	<b>Infection Stage 3</b>	<b>Integration Stage 4</b>
Inventory	Just-in-case	Predictive inventory management	System chain execution	Just-in-time, customised
Capital	Sunk costs	Free latent capital	Vendor owned inventory	Share, networked ownership of all input
Labour	Inflexible, contract-based, costly	Automate basic tasks	Short-term contracting, outsourcing	Labour costs indexed to volume
Software	Paper-based, or Web is an "electronic brochure"	Interactive website, internet ordering	Single entry, data, SKU based	Universal data protocols, processes through Web
Protocols	HTML; text	XML	SQL, XML	SQL, XML; .Net

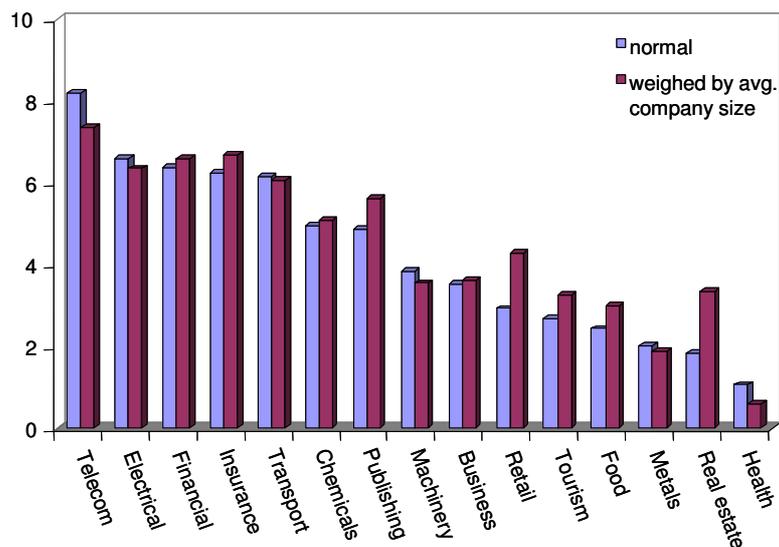
**Stage 3: Infection.** As electronic ordering increases efficiency, the virtual enterprise begins to emerge as partners introduce software that helps collaboration and inventory management along a virtual value system. Members of the value system begin to receive and ship products using an integrated, automated management process. This frees up capital and it also frees labour from rote tasks so that companies can assess the marketplace more effectively and focus internally on innovation.

**Stage 4: Integration.** The enterprise has integrated all manufacturing or service delivery through Web-based protocols that enable shared design, continuous bidding, delivery tracking, and lowest-cost inventory management, or service monitoring. The enterprise better anticipates product, service and labour needs and is able to seek temporary market advantages through innovation.

Most of the enterprises contacted for this study are in the second or third stage on the growth path towards a VSO. This may indicate that the firms are still evolving into VSOs. It also suggests that perhaps the companies see little advantage to moving into full virtual operations, or, that structural and cultural obstacles hinder it. It may also mean that firms need to catch up in the "smartness" of their operations before they can become fully virtual. (Table S.1 summarizes important characteristics of firms in the four stages.)

This is an evolving landscape: At each step in the external process of implementing virtual business practices, we find that a company must assimilate practices and increase their internal "smartness" in handling information. Thus, we suggest that the process is a "step-and-assimilate" model. As new products or processes are implemented, many parts of the network must adjust to the change. Thus, the move through the stages is not smooth, nor even assured. Some companies had reached a point in stage 2 or 3 where they did not see additional incentives to make changes in the near future. Other reported plans to implement features of the next stage of VSOs.

**Figure S.1**  
**VSO Activities, in Practice<sup>3</sup>**



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## Findings About VSO Operations

In a series of case studies, we interviewed businesses that have reported some VSO-related operations. Based on the case studies,<sup>4</sup> and complemented with a number of interviews, we conclude that VSOs are focusing initially on using ICT for more efficient operating procedures. Although some organisations appear to lead the field in adopting virtual strategies, companies that have reached the most advanced stages of VSO operations (*stage 4*) are still not common in the marketplace. At each step in the external process of linking, we find that a VSO must assimilate practices and increase their internal “smartness” in handling information. It is also clear that different aspects of VSO operations are applicable in different business environments. Among the most intriguing findings from this project are:

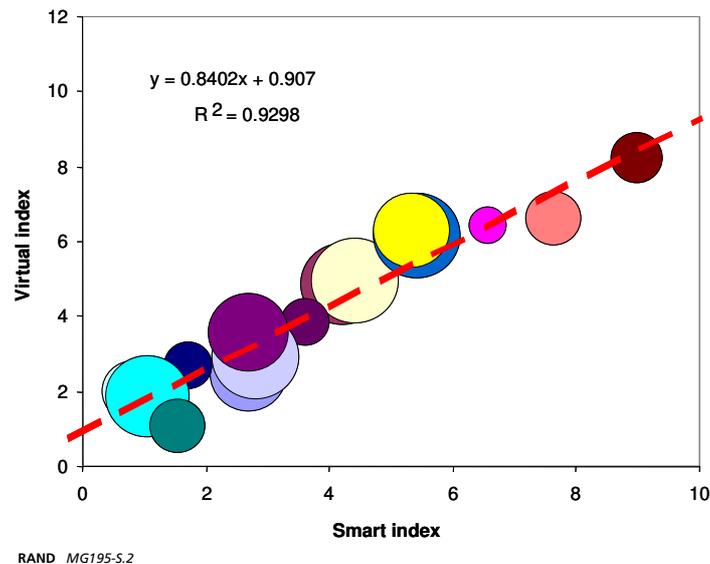
**The improvement of responsiveness and flexibility.** By adopting ICT and implementing data integration (*data sharing*) among different departments (*internal perspective*) and external partners, the VSO participants whom we interviewed said that, by adopting VSO activities, they had become more flexible and responsive to market inquiries. Important aspects of this process that were reported include:

- Greater emphasis on codifying communication and information exchange;
- An increase in sharing product development supported by ICTs;
- More efficient inventory management along the virtual value system.

<sup>3</sup> The *virtual* index is defined as an equally weighted mean of scores on the following dimensions: Intranet usage, Internet website, Online selling of goods, Order triggers an electronic process, SCM use, Exchange documents with suppliers, Extranet use, LAN usage, EDI usage, Number of IT-maintenance people (per 1000). Scores for these indicators are mapped on a 1-10 scale. The original scores lie between 1-100 and must be interpreted as “% of enterprises (from a sector, size-class or country)” to which the issue in the question is applicable. The *smart* index is identically constructed as the virtual index. The score is based on the following dimensions: Online order automatically processed, Online channels index, Collaboration index, Use of CRM, Use of KM. Source: E-business Watch Data (June 2002), [http://www.ebusiness-watch.org/marketwatch/database/survey\\_info.htm](http://www.ebusiness-watch.org/marketwatch/database/survey_info.htm).

<sup>4</sup> Many of the case studies were identified using the BEEP Knowledge Base. See <http://www.beepknowledgesystem.org>.

**Figure S.2**  
**Smart Activities, as a Function of Virtual Operations**



**Reduction of transaction costs.** By implementing management changes, software and communications technologies and encouraging networking among manufacturing companies, suppliers and clients, the corporate representatives with whom we spoke said they have clearly seen that it is possible to reduce held inventory and lower transaction costs. As data-interchange between suppliers, manufacturing companies and customers takes place on the Internet, the need for human intervention is increasingly reduced.

**Building a knowledge base.** The above-described benefits are based on the immediate information transaction processes between the partners, but smart companies can track this data and use it for learning purposes. For example with the codified data provided by using ICTs, companies can quickly analyse: What types of inquiries are received from clients? What is the clients' satisfaction level? What types of new services and knowledge resources can we offer? How can we quickly address client problems?

**Improving customer focus.** Analysis of the cases suggests that European firms concentrate their ICTs investments first on inventory management and downstream links (towards clients). This implies a strong *customer service* focus, a tool generally seen as sustaining competition relative to cost effectiveness strategies. This customer focus is often called "one-to-one," because the model VSO leaves the impression with the customer that all the resources of a company are focused just on that customer in a one-to-one relationship. Several of the firms that have completed downstream integration reported that they have plans to implement upstream integration in the near future. Within the European context, we find that companies take some steps in common. These include:

- automating supply and delivery;
- outsourcing as many tasks as possible;
- shifting to more contract or temporary labour;
- tendering for new supplier relationships on a frequent basis;
- allowing the customer to customise products and services;
- contacting customers continuously;
- linking across the Internet for many business functions.

In a pattern similar to the findings of other studies,<sup>5</sup> we find that larger companies appear to be able to adopt features of virtual operations more quickly and more effectively than small and medium-sized companies. (SMEs) (EES 2003; Cagliano and Spin 2002) SMEs face some initial costs and the implementation or lock-in of standard software when making ICT and software decisions. Lock-in would appear to have greater consequence for a small company that can only choose a few strategic links when compared to many links possible for the large firm. That said, however, in the opinion poll conducted for this study, the participants did not see software lock-ins as keeping SMEs out of VSO operations (96 percent of respondents).

## The Role of Government

Governments can help facilitate VSO business methods. Assistance can be offered directly with aid to software implementation, management changes, and labour training. Assistance can also be offered indirectly by creating the conditions for favourable business practices. Participants in our poll had very clear ideas about the ways in which government can help with VSO formation and implementation. These ideas emerged from the case studies, as well:

- Explore ways to implement VSO-friendly legislative frameworks (87 percent);
- Make more research and development outcomes available to business, particularly SMEs (85 percent);
- Demonstrate “best practice” in supply chain management and promote flexible software, such as open-source and XML (76 percent);
- Enable extranet implementation and wider involvement of supply-chain participations, including end-users (76 percent).

Other recommendations that emerged from the literature and case studies include:

- Create or help foster the creation of “entry software” for small and medium-sized businesses to aid joining virtual supply system;
- Facilitate tax changes that will aid paperless transfer of goods and services;
- Examine regulatory burdens on logistics suppliers in Europe;
- Review labour laws that may inhibit flexibility in workforce.

Future research can profitably focus on the entry problems of businesses that start up using the VSO business model (rather than transition from an old economy model), since we only found two of these companies within our overview. In addition, more research into how companies become “smart” may be warranted, since this feature of operations does not come through as clearly as virtual activities. The role of indirect policies on VSOs (tax, cost of capital, trade, and labour policies) also need further assessment and scrutiny. The issue of how labour is managed is an important issue that may need further attention as more companies transition towards a VSO business model.

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<sup>5</sup> Reality Bites: The second annual report on e-business in the UK, Confederation of British Industry, 2002.