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

CAROLINE WAGNER,  
MAARTEN BOTTERMAN,  
ERIK FEIJEN, LARS SCHMIDT,  
STEVE SIMMONS,  
CHRISTIAN VAN 'T HOF,  
JONAS SVAVA IVERSON,  
LEANDER VAN LAERHOVEN

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Newtonweg 1, 2333 CP Leiden, The Netherlands  
Grafton House, 64 Maids Causeway, Cambridge CB5 8DD, United Kingdom  
Uhlandstraße 14, 10623 Berlin, Germany  
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## Preface

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This is the final report of a project conducted for the European Commission. The project, “Enabling VSOs: A Study on Market Prospects, Business Needs and Technological Trends for Virtual, Smart Organisations (VSOs) in Europe” was conducted by RAND Europe in partnership with the Danish Technology Institute (DTI) and Addico Cornix, UK, for the DG Information Society eBusiness Unit. Peter Fatelnig was the principle contact within the European Commission. The project responded to tender 82614-2002 and was conducted in 2002 and 2003.

The overall goal of the project was to determine the relationship between virtual, smart organisations, European competitiveness, and EC policies. The project set out to define what is meant by virtual, smart organisations in a European context, whether this business model would enhance European competitiveness, and if so, what the EC and other governance units could do to aid in the development of VSOs.

The project team reviewed the literature, conducted case studies, and interviewed experts and stakeholders. This report should be seen as a scoping study, defining the VSO in a European context and providing the framework within which VSOs can be assessed in the future. Interested readers will include policymakers, business people seeking new tools for competitiveness, financial and information technology managers, and policy analysts.

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For more information about RAND Europe or this document, please contact:

Maarten Botterman (Director of Information Society Programme)

E-mail: [maarten@rand.org](mailto:maarten@rand.org)

RAND Europe

Newtonweg 1

2333 CP Leiden – The Netherlands

Tel. 0031 71 5245151

Fax. 0031 71 5245191

E-mail: [reinfo@rand.org](mailto:reinfo@rand.org)



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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

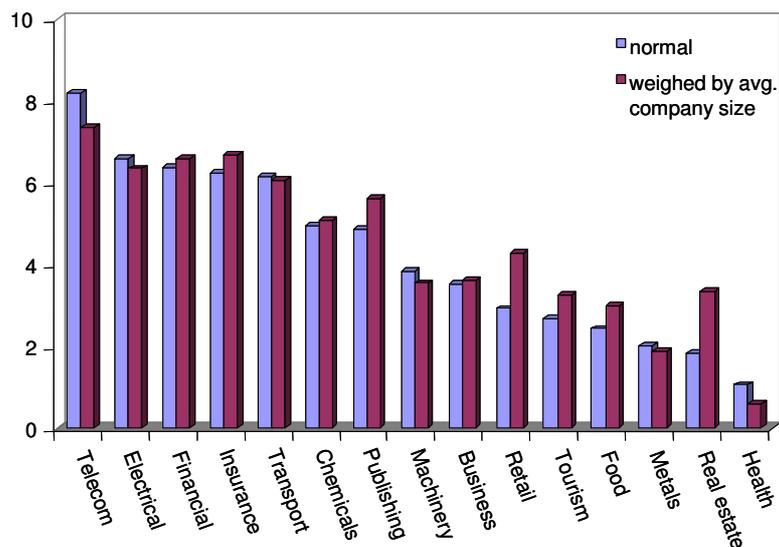
**Stage 3: Infection.** As electronic ordering increases efficiency, the virtual enterprise begins to emerge as partners introduce software that helps collaboration and inventory management along a virtual value system. Members of the value system begin to receive and ship products using an integrated, 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:

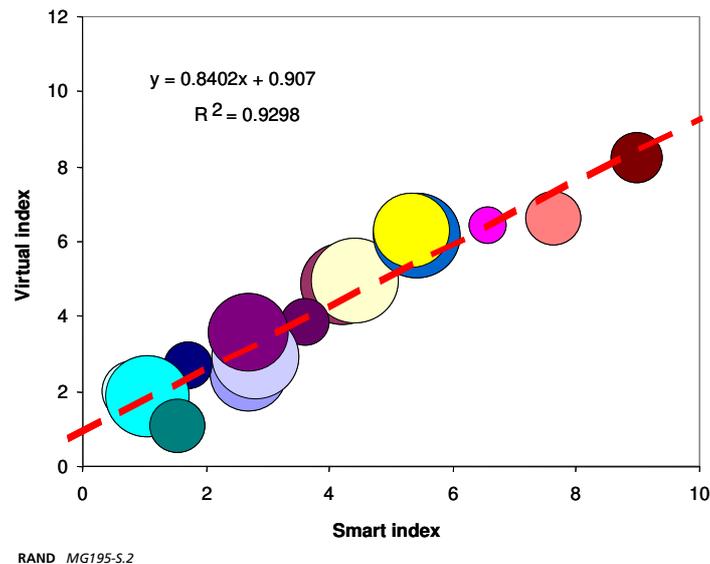
**The improvement of responsiveness and flexibility.** By adopting ICT and implementing data integration (*data sharing*) among different departments (*internal perspective*) and external partners, the VSO participants whom we interviewed said that, by adopting VSO activities, they had become more flexible 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.

This report details findings of a study on virtual, smart organisations (VSOs) in Europe. It examines the development of VSOs in Europe, with a focus on those operating at a business-to-business level. The report describes the environment (policy and business) that enables and supports VSOs. A framework for understanding VSOs in a European context is presented. Examples drawn from case studies, some conducted for this study and some drawn from literature, are placed into the framework. Recommendations for businesses seeking to enhance VSO operations, and for policymakers wanting to support them, are presented and discussed. This study presents a literature review, the results of case studies and an assessment of indicators to put VSOs into a European context.

**Organisation of this Report**

This report begins by defining VSOs (see Summary) and presenting the project methodology. In Section II, the paper discusses ICTs and networked organisation. It focuses on ways to understand VSOs as networks within the marketplace, taking advantage of ICTs. Section III presents a framework for understanding VSO market prospects, business needs and technological trends. The framework is built on a concept of a “virtual-smart continuum” that appears to characterise VSOs in Europe. This section presents examples from the case studies and literature. Section IV extends this framework into a discussion about operations and innovations, the competitiveness of VSOs and the relationship of competitiveness to technological trends and indicators. This section also discusses “enablers” of VSOs—those companies that support and enhance VSO operations in Europe. Section V presents indicators of VSOs and discusses the challenge of measuring VSO operations. The final section presents conclusions and recommendations for policy that can better support the operation of VSOs in a European context. An appendix provides a descriptions of the case studies.

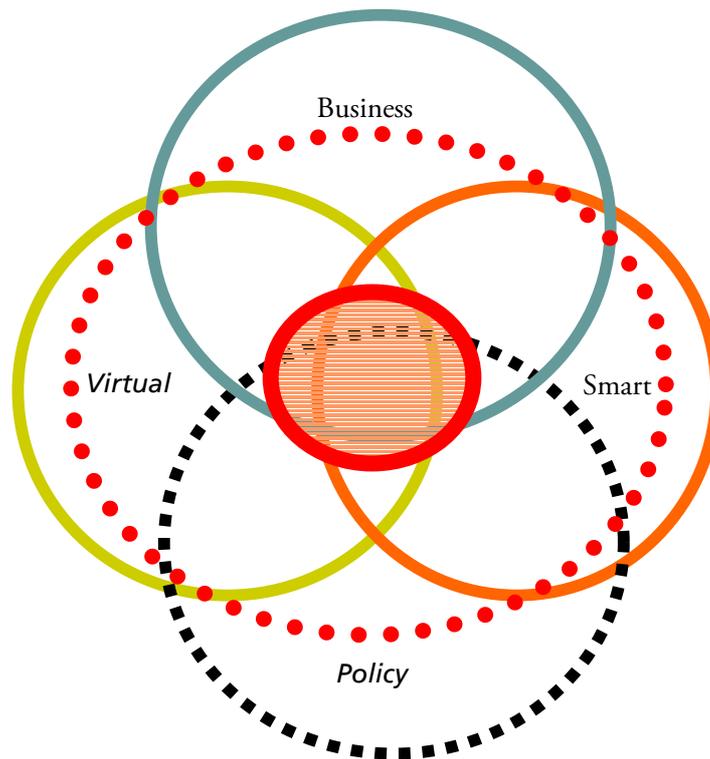
**Focus of this Study**

For the purposes of this study, we view the VSO as operating in an environment that encompasses the interests of virtual ways of doing business, smart uses of information, market forces and the policies and infrastructure provided by government. Figure 1.1 illustrates the sphere of interest and focus of this study—the intersection of virtual and smart activities with the interests of business (the market) and government. Within the inner bubble, we are examining the operations and competitive environment of business-to-business (B2B) activities.

**Defining Terms**

A virtual, smart organization is a set of business entities that link together to form linkages across traditional business lines in a collaborative network to create new products, processes, or services, and to enhance learning and market awareness. The link can be temporary, sometimes lasting a very short time, creating a single customized product or service for the marketplace. A VSO can also be a permanent entity in itself, sometimes a group of enterprises, sometimes even a single

**Figure 1.1**  
**Spheres of Interest for a Study on VSOs in Europe<sup>6</sup>**



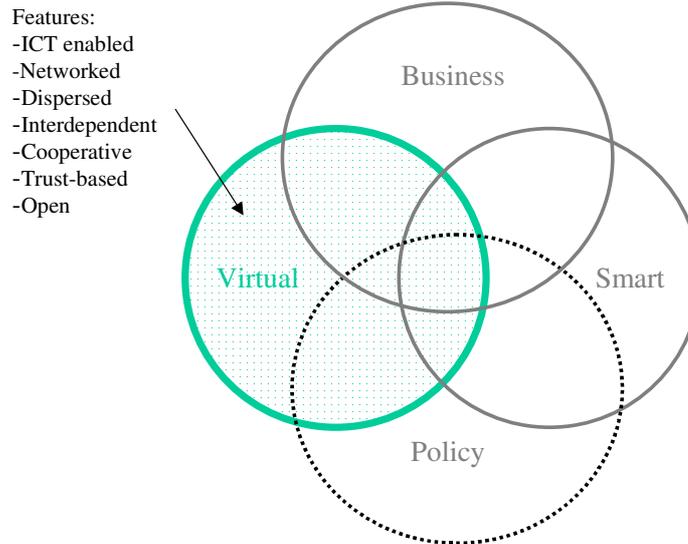
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networked enterprise. By definition, VSOs make use of information and communication technologies (ICTs) and software to lower transaction costs of networking and continuous adaptation, to increase productivity and to liberate and stimulate the power of human resources. They operate in a business environment that includes the marketplace and the set of government regulations and processes affecting business. Each of the circles in the figure is described in more detail below.

Virtual organisations are ones that operate across traditional business lines—they are not collocated into a single business entity or place. The virtual business operates along a chain or within a network of connections to “get the job done” efficiently. Sometimes this can mean links that cross very large geographic distances. Some observers talk about virtual business as inherently “global,” although we have not found all the cases we examined to be globally linked. We are focusing within this study on companies that operate in Europe, and we found that physical distance of partners is a consideration for these companies. Figure 1.2 shows the “virtual” circle and its attributes.

<sup>6</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).

**Figure 1.2**  
**Features of the Virtual Business-to-Business Entity**



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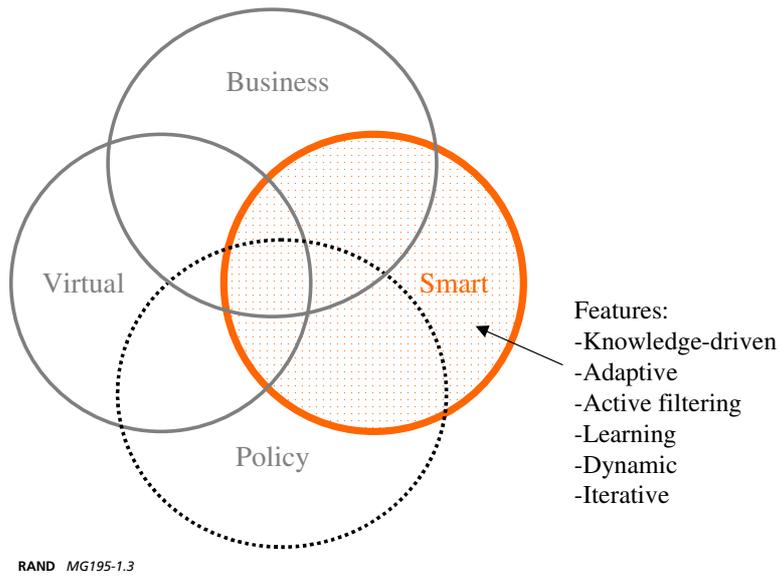
Smart organisations are ones that use information being created within the virtual value system to enhance operations. Thus, these entities have the features shown in Figure 1.2. It is not necessary for a business to be virtual in order to be smart, even though this study focuses on the cases where both features occur. The features of being a knowledge-driven, learning organization has often been linked to the conduct of research and development. R&D is being more broadly defined within e-commerce to mean the process of learning and iterating on that knowledge to become more competitive.

Several European projects in successive Framework Programmes have studied aspects of virtual and/or smart organisation(s). The Commission publication “New methods of work and electronic commerce”<sup>7</sup> lists more than 50 projects that have focussed on smart organisations alone. Smart organisations are defined by the European Commission as “knowledge driven, adaptive and learning as well as agile in their ability to create and exploit the opportunities of an internet networked economy and are keystones of the shift from industrial to the digital era. These organisations are virtual in concept, highly flexible, dynamic and capable of leveraging the power of network technologies to meet customer demands for high value-added products and services in a global market.” Figure 1.3 shows key features of smart organisations.

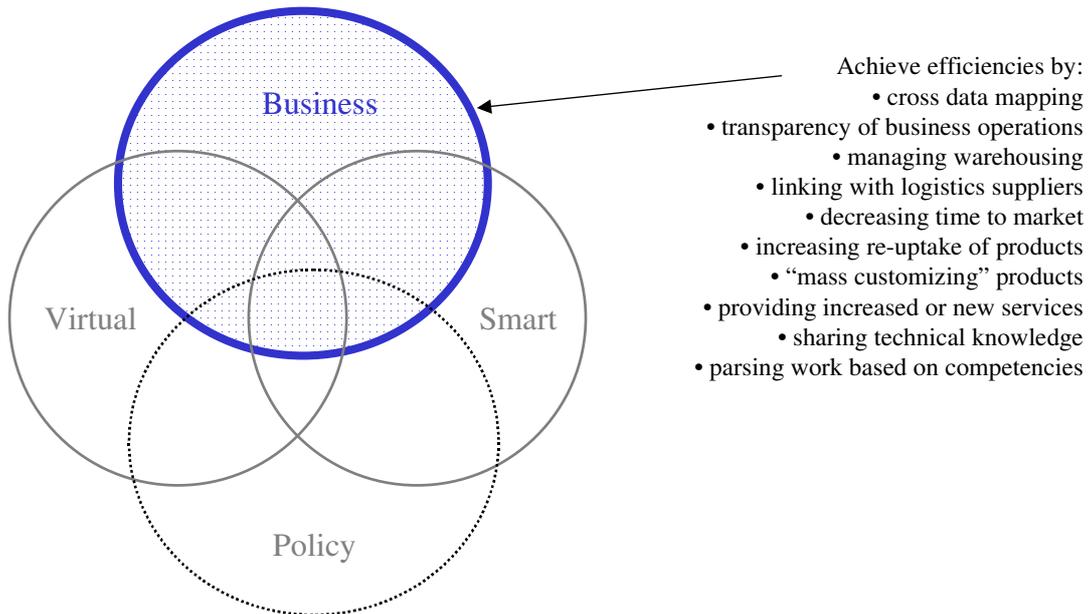
The business environment is very large and diverse, and the “market” is even more broad and amorphous in its defining structure and borders. In order to focus this study, attention is paid to the business-to-business activities emerging within the VSO environment. Certainly, there are many interesting applications of virtual sales of music and software through the Internet, and other applications of consumer ordering using the World Wide Web. Nevertheless, these applications are on the periphery of the study presented here. The question of how businesses are working together across traditional business lines to innovate and create new business services are

<sup>7</sup> European Commission, Directorate General Information Society (2001), “New Methods of Work and Electronic Commerce. Overview of Activities.” December 2001

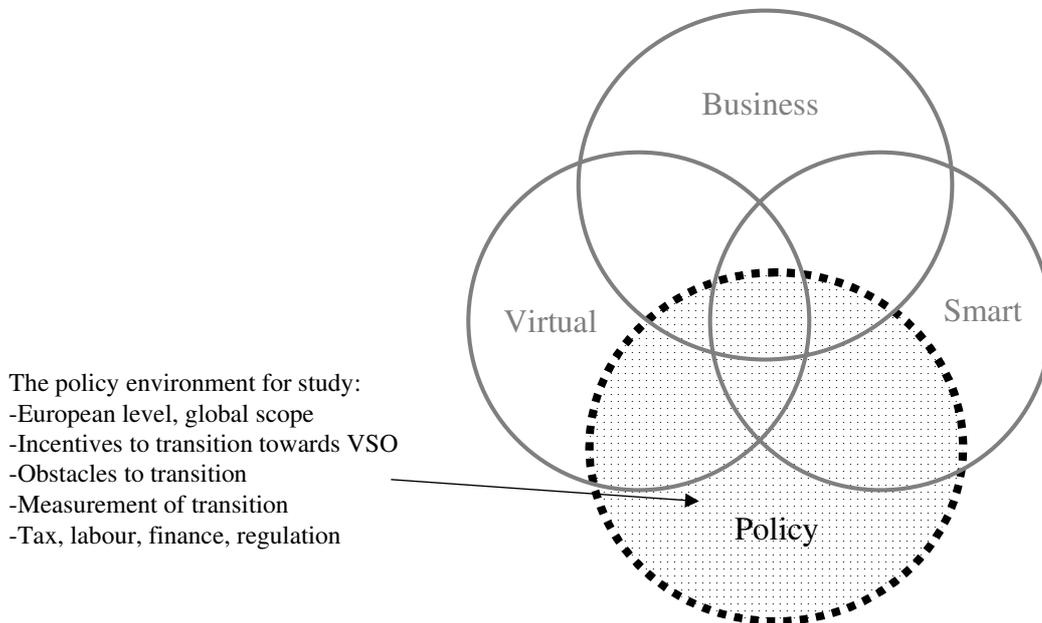
**Figure 1.3**  
**Features of the Smart Business Entity**



**Figure 1.4**  
**Features of the Business-to-Business Activities Discussed in this Report**



**Figure 1.5**  
**The Focus on Policy within a European Context**



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of the focus of this study. Figure 1.4 shows some of the business-to-business features that are part of the focus of this study.

The circle shown in Figure 1.5 indicates that policy plays a role in VSO operations. The policy implications of these shifts in business operations are significant. Tax systems, regulatory structures, contract law, and labour training all affect the ability of a company to invest in ICTs, to shift business processes, to hire and train staff, to trade goods, and so on. These factors need to be re-examined in light of the emergence of network operations within VSOs. In addition, impact on groups that will be disaffected by changes in the industrial structure will need to be considered. For example, new training schemes may be needed to help mitigate short term transitions in labour and skill demand. Changes in the financial and accounting system that supports and enables business may also be needed. Rights of ownership under contract law – when companies take possession of goods and become responsible for them—are also factors that will need additional research.

In addition, the fact that the VSO is enabled by the information infrastructure requires policy attention. The infrastructure and its capacities will need careful scrutiny to examine the extent to which it is adequate to handle additional applications of B2B networking in the future. Comparisons with other countries, and perhaps negotiations to reconcile differences in regulations or use of hardware or standards may be needed. Examinations of the questions of use of spectrum, wireless access, and synchronisation of information flows may also be required. Thus, this study considers the policy environment within which businesses operate as a core part of the inquiry.



The trends towards forming links across non-traditional business spaces is part of the evolution of organizational design and management leading toward less hierarchical forms of organization. This transition is taking place in many sectors—not just in business—and the resulting entities are often referred to as “network-organisations.” (Cloutier et al. 2001) They are characterised by few set routines and a lot of self-organizing processes. They are enabled but not caused by ICTs. The causative factors are not clear but are more likely to lie in the growing complexity of structures, ones which force organisations to become as complex as the environments in which they work: In order to deal in this environment, rigid hierarchies must become more flexible and shift towards the adaptivity of self-organizing networks as the global business environment itself becomes more complex.

Organisations both large and small increasingly find they have much to gain from introducing collaborative networking within their own institutions, crossing the boundaries of intra-organisational structures. Currently, large organisations have a tendency to concentrate on their core business and to cooperate with relatively small sets of preferred suppliers and subcontractors (sometimes called B2B: business to business). This cooperation is continuously improved with a variety of electronic collaborative methods. Often, this kind of cooperation might be dubbed a “strategic alliance” rather than “virtual, smart organisation.” There is a fine line between the two that needs to be made clear. An alliance is usually made for some duration and is based on contracts. A VSO is temporary or can be easily reformed, is linked using ICT, and is often based on less formal methods of obligation than a strategic alliance.

The terms such as “virtual” and “smart” describe emerging activities that network businesses. They are part of an emerging business model, one that will eventually be imitated in some form by most businesses. Thus, the early adopters are innovators who are demonstrating new ways to do business. Both “virtual” and “smart” involve the use of information and communications technology (ICT) to enhance competitiveness. By virtue of adroit use of ICT, the virtual organization forges temporary links among the otherwise independent entities that add value to an economic system (such as the supply chain of a large manufacturer). These virtual links arise and dissolve as needed to reduce transaction costs, increase efficiency and respond more quickly to the needs of customers and initiatives of rivals. The “smart” part of the process involves the use of the information emerging from the virtual processes to add value to planning and innovation, and allowing quick response to the marketplace.

Some organisations exhibit characteristics of virtual networks. Other exhibit smart characteristics without virtual links. The business entities combining the two processes are a small subset of all businesses operating within Europe. These business entities can be said to be early adopters and market leaders. These units are tapping into and taking advantage of the possibilities of networking offered by ICTs to reform and reconstruct the way they operate. VSOs seem to be able to benefit from the new possibilities emerging by excellence. Innovative in nature, they do help move business to the new model by setting new standards. Like the first teleworkers, the VSOs seem to show the way for European business towards being more competitive in the global,

networked knowledge society. As with many innovations, acting as a VSO is now a comparable advantage to businesses, but is expected to soon become a prerequisite for sustainable business. Ultimately, VSO type activities can be expected to be part of business for most organisations.

Virtual business operations emerge from a tradition that includes agile and lean manufacturing processes, as well as the set of activities in the 1970s described as the “quality” movement. (Prince and Kay 2003) Virtual businesses enable the extension of the agile and lean concepts to different stages of production within the virtual value system. Smart activities emerge from a tradition of firms focusing on adding value through research and development. (Matheson and Matheson 1998) These firms initially focused on innovating and adding value by conducting applied research and market analysis. These firms have also evolved into research consortia and design groups that now incorporate many features of virtual organization and knowledge management. (Skyrme 2001)

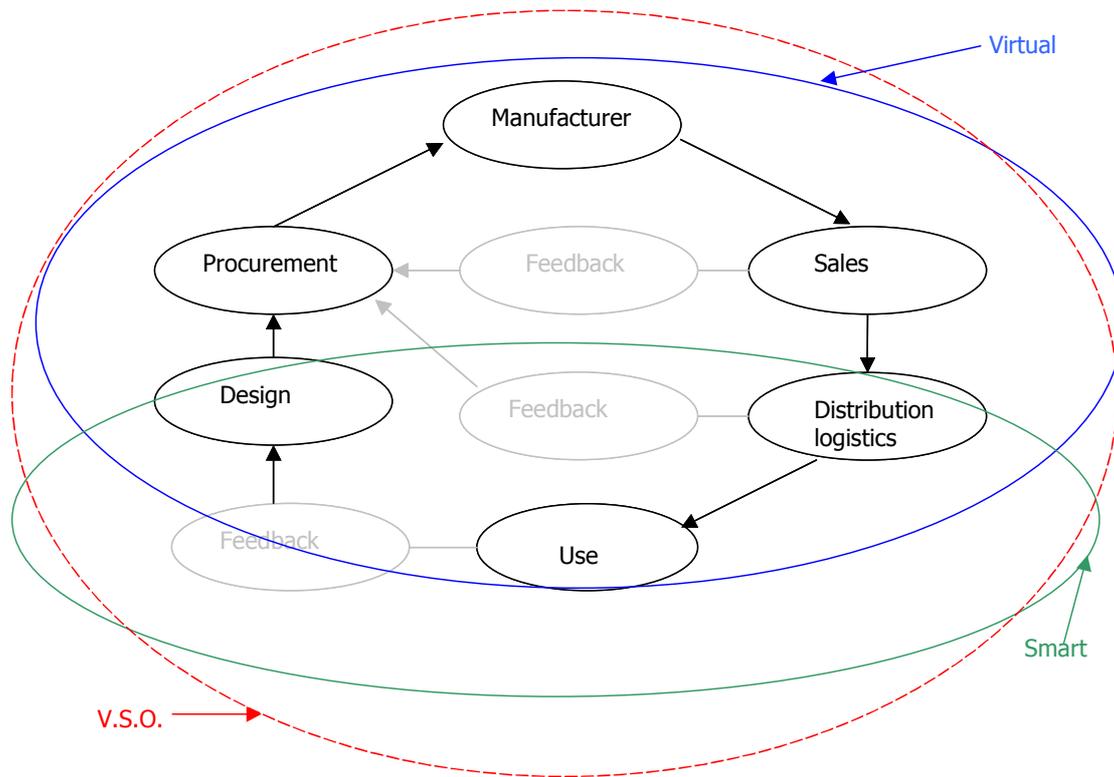
Network theory suggests that as ICTs are adopted and new links are established, the entities being linked must adapt their internal structure to the new information and operating environment. Indeed, building upon the virtual links, the “smart” organisation uses the information from this supply system within its own internal operation, iterates on this information and responds back to the virtual organisation. In this way, the “smart” organization can appropriate extra value developed within the supply system as a result of the virtual links. It can use this value to provide new products and services to customers more quickly and at lower cost than traditional rivals. This might be envisioned as an arc connecting across companies in a virtual value system, and loops from the arc extending down into companies that make “smart” use of information derived from the value system. (See Figure 2.1)

A number of studies have been conducted that focus on different aspects of the application of ICTs to business. Litan and Rivlin (2001) consider the impact of the Internet on different sectors and cite three distinct economic impacts of the use of ICT: decreasing cost of transactions; increasing the ease of management; and moving the economy closer to the model of perfect competition. According to Feldman (2003), businesses use the Internet to lower purchasing costs, reduce inventories, lower cycle times and allow for lower sales and marketing costs. These benefits provide the incentives for companies seeking to gain a competitive edge to use ICT to create virtual linkages that may lower costs or help to deliver products to the market.

Figure 2.1 begins to illustrate the complexity of the relationships within the VSO. This figure lists the principle components of the value system—the same components that would have appeared in a more traditional supply chain list—but it places them and links them in a way that suggests that the components are no longer in a chain, but in a complex, dynamic network of interactions. Complex dynamics is facilitated by a series of feedback loops within the system. These feedback functions are part of what makes the system smart. The nature of the information exchange, how it changes the functions of participants in the VSO network (for better or for worse), and what this information contributes to competitiveness are important features of VSOs being discussed in this study.

Sambamurthy, Bharadwaj and Grover (2003) argue that the transition has a number of implications for firm organisation. They say that information technology, investments, and capabilities influence firm performance through three significant organisational capabilities: 1) agility, 2) digital options, and 3) entrepreneurial alertness. Strategic processes in turn aid 1) capability-building, 2) entrepreneurial action, and 3) co-evolutionary adaptation. This third concept of co-evolution is one that emerges within the network literature as a feature that is found in many complex systems. As once-unique entities begin to interact, they reshape each other at an increasingly fast pace, often increasing the rate of change.

**Figure 2.1**  
**Generalised Supply System, Virtual, Smart, and Combined**



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At its best, VSOs operate in a realm that has been called “networked innovation.” This is where innovative ideas emerge from the complementary capabilities of different group participants, using ICTs to tap into new ideas. In fact, in the literature, it has been noted that geographic distribution encourages innovation and engenders new knowledge creation at a rate that is not experienced in close collaboration. (Cowan and Jonard 2003) Strong ties and close collaboration may result in rich communications among collaborators, but, research shows that, eventually, close collaborators begin to think alike and share a common outlook. Collaborators at a distance – across geographic space or functionally different – can be assumed to have different points of view and different experiences. As a result, collaborators can at times challenge the status quo or bring complementary capabilities that would not have been available within the firm. These collaborations are more likely to result in innovative research and create intriguing outcomes. Companies that want to distinguish themselves by differentiating their product may find that networks create greater innovation than working alone.

### A Guide to Related Studies

The following bullets summarise other studies that may be of interest.

- **DEEDS** (<http://www.deeds-ist.org/HTML/home.htm>) ensures an open Forum of European executive policy makers (Policy Group) stimulating, discussing, exchanging and monitoring public policies related to the major issues of the digital economy, focusing on the uptake of electronic business practices by SMEs.

- **BEEP** Best eEurope Practices. The BEEP project is concerned with analysing and exploiting good practices (cases) in four main domains of the eEurope initiative: Work & Skills, Digital SME, Social Inclusion and Regional Development. The aim of the project is to serve as a learning platform, exchanging important lessons learned in e-policy and testing new methodologies to do so. The core of the project is an online knowledge base ([www.beepknowledgesystem.org](http://www.beepknowledgesystem.org)), which contains over 300 e-practices from across Europe, both private and public sectors and both large and small organisations. Unique to this knowledge base is the conceptual structure, which makes case studies easily retrievable and comparable and serves a broad spectrum of analytic tools.
- The **INKASS** project addresses the area that is at the intersection of Knowledge Management and Electronic Commerce. This area refers to the trade of explicit and implicit knowledge for specific needs at an inter-organisational level, addressing the opportunities and risks found in the purchase and selling of knowledge at the business-to-business environment. The INKASS project aims at the development of an Internet-based marketplace of knowledge assets that will be targeted at European SMEs and their knowledge needs in the areas of professional services for business management and engineering. The project result will be a total solution for knowledge trading, which integrates both technological and non-technical elements (business models, roles, processes and revenue models).
- The **WISER** Project Science is turning to e-science. An increasing part of on-line scientific communication and research is not (or only incomplete) visible in traditional S&T indicators. The objective of this research is to explore the possibilities and problems in developing a new generation of Web based S&T indicators. Web indicators should produce information about visibility and connectivity of research centres forming a common EU research area; innovations and new research fronts reached by e-science; about equal rights access and participation on e-science gender and regional. The main products will a Web-portal about Web indicators and a proposal for an additional chapter for the next ERSTI report. Quantitative measurements of Web activities based on advanced informetric methods will be combined with qualitative case studies about changing ways of knowledge production and traditional S&T indicators.
- **KITS** (Knowledge and Information Transfer System) is a project to increase the effective use of advanced E-commerce technologies and methodologies by SMEs involved, at different stages, in value system relationships. The project will address this through two lines of activity. Researching and analysing the current use of E-commerce technology by SMEs engaged in value system relationships, their role(s) and economic relationships in extended value systems and between SMEs in dynamic networks. Second, Identifying such SMEs and bringing them into a Community of Interest (COI) spanning four regional clusters. The COI will concentrate on benchmarking the SMEs' use of E-commerce technology and developing strategies to enable them to progress to more advanced technology, so that they can reap greater business benefit. These and other related studies are summarised in the appendix. The methodology used for this study involved examining the literature on business-to-business electronic interactions. This included reports by the European Commission, academic literature and business literature. We also examined network theory for any insights it could give us on networked business. Then we choose companies within Europe to examine more closely. This was difficult because we wanted to examine the virtual *value supply system* rather than a single company. However, we found that at this point in the development of VSOs, it is necessary to enter the system at a single point, and it was most efficient to do this through the traditional business structure. So we contacted business people in

companies that reported part of their operations as being virtual or smart. We also examined some virtual companies operating in North America and in Asia as comparisons. Finally, we conducted a survey of experts to assess the usefulness of our framework and its applicability to European VSOs.

- **SIBIS** (Statistical Indicators Benchmarking the Information Society) is a project in the "Information Society Programme" of the European Commission (IST-2000-26276) that was running from January 2001 to September 2003. SIBIS has taken up the challenge of developing innovative information society indicators to take account of the rapidly changing nature of modern societies and to enable the benchmarking of progress in EU Member States. These indicators have been tested and piloted in representative surveys in all EU member states, 10 Acceding and Candidate countries, Switzerland and the USA. The SIBIS project is closely related to the eEurope and eEurope+ initiatives of the European Union and contributes to measuring the progress of eEurope actions in the above countries.

Some other related studies sponsored by the European Commission can be found by following this link: [http://www.europa.eu.int/information\\_society/topics/ebusiness/ecommerce/9ebu](http://www.europa.eu.int/information_society/topics/ebusiness/ecommerce/9ebu)



## A Framework for Understanding Virtual, Smart Organisations in a European Context

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VSOs operating in Europe display patterns that allow us to build a framework for understanding them. The framework includes four parts: 1) initiation -- how a VSO starts up as a new business, or how an existing business decides to become a virtual operation, 2) incorporation - how existing businesses make the transition to and incorporate VSO features, 3) operations and innovation - how VSO features aid competitiveness and how this is measured at the level of the firm, and 4) benchmarking – who are the winners and losers and how the benefits can be measured at a social level. Each of these parts of the framework will be discussed along with examples from case studies.

Business-to-business *enablers* are not covered extensively in this report. We will discuss their role in aiding some companies to become more virtual. Enablers include companies that provide software systems, such as SAP, to allow warehouse management systems (see box). Other types of enablers are third party logistics companies such as TNT, ones that help move products between companies along the virtual supply system. They are the muscles that hold together the bones of the VSO and which allow the linked entities to work in tandem.

### Initiating or Transitioning a B2B in a VSO Environment

Within the European VSO environment are two types of B2B companies:

1. product and service providers, and within this, there are i) new economy companies like I-Know-Law that have emerged with ICT supply chain or knowledge management capabilities as native to their company culture and ii) old economy companies, like Phillips, ABN Amro Bank, or Siemens, that have upgraded their ICT supply chain management capabilities to compete more effectively; and
2. B2B enablers, and within this, there are i) companies that sell or service the ICT supply chain management capabilities, and ii) companies that serve as logistics managers, whether it is data management (such as SAP) or the movement of goods (such as TNT).

Some of these units are wholly owned by the core company while others are outsourced to service providers. (Lau and Wong 2001) They can include Internet-based product design and manufacturing systems for one-of-a-kind products or highly customised output. Within the subset of activities that constitute manufacturing, two major markets are identified, and both appear to be rapidly changing. (Noonan and Wallace 2003) These are the original equipment manufacturers (OEMs), ones that build their own end-user products, and contract manufacturers that offer a structured network of suppliers. Emerging within the marketplace, however, appear to be a third type of manufacturer: that is the complementor or company that focuses on a core competency to the exclusion of other activities. (Noonan and Wallace 2003)

### What does Business-to-Business Mean within the VSO Environment?

“B2B” is the umbrella term for the data exchange and data viewing protocols that enable the computers of disparate enterprises to communicate. It includes functions such as cross data mapping systems (collaborative software), which is done so that data can be exchanged and/or made transparent among suppliers, assemblers and delivery to cut inventory, reduce costs, and increase speed of delivery. The data mapping activity is especially important and most widely used when the communication between firms is triggered by ordering or delivery events and then viewed across platforms.

Firms are able to do this because they implement inventory disposition data transparency. They have made digital (“codified”) all the information about their inventory – this is called categorical display of inventory disposition. All the suppliers to a particular company can use this technology to “see” what is needed at a production table; suppliers anticipate what their client is going to need in terms of orders – called “load balancing.”

Categorical display of inventory disposition is the competitive factor for these companies. For example, U.S.’s Dell establishes a standard for needed parts and they “publish” it on their website to their suppliers using software called Enterprise Resource Planning (ERP) -software that tracks inventory. ERP is proprietary software made by companies like SAP. Each manufacturer will buy off-the-shelf software and then have the ERP customized to their specifications. Warehouse management systems (WMS) are the engines that monitor the inventory data in a way that is complementary and interactive with the ERP.

Added to this package is the supply chain optimisation software that automates the predictive inventory balancing. WMS tells you how many widgets you have in the factory. Supply chain optimisation looks for the trigger threshold to draw down existing inventory and to order new inventory. This allows companies to carry less (or no) inventory, reducing capital costs and the need for warehousing.

Indeed, as a number of sources note, a variety of market mechanisms have emerged to address the various issues pertaining to B2B. (Mahadevan 2003) It remains unclear in the literature as to the key characteristics of these market mechanisms, and it is unclear what factors drive the choice of one market mechanism over another. Questions such as the number of linkages within a B2B that is optimal, (degree of fragmentation), how to specify assets when seeking a partner, the complexity of product design or description, and value assessment for parts of the process all become important and complex parts of the B2B environment. (Kreng and Chang 2003)

The set of companies emerging as VSOs in the marketplace appears to be a small set within Europe. In our study, we examined the activities of two small companies that started business as “virtual” companies. I-Know-Law and Global Recycle. The first company is a micro-business operating in the Netherlands; it leverages juridical knowledge through a virtual network using an online knowledge database. Jurists can access this database for models to aid in the preparation of juridical documents. Global Recycle is a micro-business operating in Scotland. It acts as a virtual Web-based “middle man” connecting buyers with suppliers of scrap metal. It is not clear if either of these companies are “smart” in the sense that we are using here: whether they are applying ICT to help manage responses to market information. The firms are so small that all the “smartness” is retained by the employees. These two are the only firms we interviewed for this project that began business as a VSO. Other businesses were transitioning from more traditional businesses to VSOs.

Old-economy companies seeking to improve their activities to gain efficiencies from virtual operations or smart information processing are more common than the start-up companies. In this category, we found that a large range of manufacturing and service companies are taking different approaches to virtual, smart operations. To a great extent, companies reported that they

initiated virtual links or smart operations for one of three reasons: 1) internal communications were viewed to be poor and inefficient; 2) the competitive landscape meant that the company had to provide their service either more quickly or at a more competitive price, or both, and 3) another company approached them to link up, and these links required increasing electronic codification of processes or services.

A third method of making this transition is one of buying up or merging with a company that is already operating in a virtual network. We found several examples of this from a scan of firms in North America and Asia, but our case studies provided us with one example as well. Oestergaard Auto sells spare parts to independent Danish mechanics. Some years ago they invented a Web-based system (*the auto-club*) where mechanics could order spare-parts. As mechanics did not have computers and Internet access, Oestergaard supplied this. A few years later it was discovered that the system could be used for more than just selling spare-parts. It was possible to implement a simple ERP system. The customers could use this system to keep track of customers and financial information. Thus Oestergaard still sells auto spare-parts, but another major part of the business is the provision and development of Web-based applications that is used by their customers.

Once the “initiation” decision is made, the companies we examined appear to shift processes and adapt to new methods of operating along a continuum of technology adoption and reorganisation, illustrated in Table 3.1. This process will be explained in more detail below.

## **Incorporation - The Phases Towards Becoming Virtual**

Table 3.1 describes the phases along which a company might move, in theory, as it becomes part of a virtual supply system. In practice, companies take on different parts of this process as needed, in order to work with other companies. Often this phased process takes place along a “step and assimilate” model in which the firm adopts a new technology or practice and then makes internal shifts and changes to operations, capital and labour before making the next step towards horizontal operation.

### **Stage 1: Isolation**

The first stage of this transition (viewed from a networking perspective) can be called “isolation” because the company is not well linked with suppliers or clients. The company may already have some “smart” features in that they conduct research and development, or attempt to learn quickly from the marketplace. These smart companies are often the ones that are ready to seek more efficient operations through external links or internal reform, precisely because they have stayed on top of changes in the market.

In this stage, companies are organized functionally along traditional lines of vertically-integrated corporate organisation, with a low degree of networked integration and non-leveraged Web capabilities. The characteristics of firms at this level might include:

- Functional (“silo” or “stove-piped”) strategies
- Traditional supply chain processes
- Hierarchical information and knowledge systems
- Measurements not aligned with company objectives.

In a traditional command-and-control manufacturing company, inventory is held on a just-in-case basis, with stores holding inventory for as much as six months or more in advance. Capital is tied up in long-term contracts, and labour is similarly contracted on a long-term basis with little

**Table 3.1**  
**Broad Characteristics of VSOs at Transition Stages**

Business Function	Isolation (Stage 1):	Initiation (Stage 2):	Infection (Stage 3)	Integration (Stage 4):
Inventory	18 month inventory; varied to meet many possible needs; inventory carried on "just-in-case" basis. Excess latency in the supply chain; supply chain is an archipelago of static data islands.	Data is gathered to prepare for predictive inventory management. Aim to collapse cycle time from valid purchase order to transferring title to new owner. Reduce cost of capital through lessening carry costs/carry days.	System chain execution becomes proceduralised so it can be managed by exception or through variance reporting. Attention shifts to who holds title and when title is transferred across the supply system.	Just-in-time inventory; electronically tagged; highly specific or customized. Title is passed from manufacturer to consumer even though supply chain logistics providers handle inventory on behalf of the manufacturer, on a "touch and go" basis, as inventory skips through the supply chain.
Capital	Capital is tied up in buying inventory to hold/prepare to sell; and in raw materials with long cycle times before sale. Carrying costs to borrow or commit this capital are high. Tying up capital adds layers onto bank relationships that move slowly.	Capital starts to be freed from carrying latent inventory; can be reallocated to purchasing software. Software can advance the cause of inventory visibility into "native (on site) inventory and across <i>networked</i> supply chains.	Vendor Owned Inventory and Supplier Owned Inventory are viewed as the <i>best practice</i> . Companies that don't use this model are at a competitive disadvantage.	Inventory is "borrowed" by SCE (supply chain execution / logistics providers / freight forwarders / third party logistics providers) until sold, and all parties have with capital concerns can view inventory at all times to see its disposition, and get authoritative / audit-level assurance as to where their products are until sold
Labour	High-priced, geographically inflexible labour. Rote processes are treated as highly skilled labour. High management intervention requirements. High legacy salary / contract costs; pension and benefits costs	Move toward codification and automation of basic processes: basic tasks are proceduralised and hence can be done by lower cost personnel; move away from higher skills required; high pension and benefits costs. Free labour from geographical restrictions so it can seek low labours costs.	Short-term contracts for workers; outsourcing of peripheral, non-core operations; some risk-sharing with labour force. Labour costs may be indexed to volume so if volume drops labour costs can drop with it.	Labour costs indexed to volume; performance is matrixed; full shared risks/rewards between owners and workers; labour and production can move to low labour cost areas. Products are produced by "manufacturer" publishing product specs and allowing outsourcers to bid/compete on the work. Manufacturing process is a "matrix" that reaches out to resources, each competing for the cheapest offering.
Software	Static Web page (electronic brochure); Boxed software; on-site "client-side" servers; high license costs; onsite IT staff; costly upgrades; requirements for data bridging to other dissimilar / disparate systems.	Business processes start to move "off paper" into ICT applications, where data can be captured without re-entry. Interactive website; Internet ordering; Predictive software to help manage processes. Move toward ASP deployment of software, rather than client side boxes. Move away from on-site IT requirements. Parley "free" IT infrastructure of the internet to be the corporate IT infrastructure	Single-entry business model, where any data entered into any aspect of corporate systems (or system linked to corporate system) is integrated (automatically routed to proper data fields anywhere in the system) Electronic ordering; inventory tracking; SKU-based processes; Web, internet, linked to internal software management	Companies move to a universal data protocol to engage in business. All business processes handled through open-standard Web-based protocols, through robust ASPs. all processes and data "transparent" /fully visible through any Web-accessible computer.
Protocols	Word; Excel; HTML	XML	Internet; Web	SQL; SKU; dot.net; fully interactive at all levels
>> Pressures: lower costs of creating product; reduce time needed to deliver products >>>				

new training. The Internet and the Web are replacing paper, but only in a passive sense. Since our study aimed to examine virtual, smart organisations, we did not interview any companies that are currently in stage 1. Often, however, the problems experienced at stage 1 induce change and move companies along the virtual-smart continuum. As one businessman put it:

“Our three companies had been working together for several years. We were really close and trusted each other, but sometimes had problems in communicating and synchronising our activities due to poor use of communications and planning tools. This caused delays in executing orders...” [EES p. 39]

### Stage 2: Initiation

Stage 2, “initiation,” is when companies have begun to initiate the processes of internal and external interfaces. In this stage, companies are organized functionally, with a high degree of integration and non-leveraged Web capabilities, some electronic links to customers and to suppliers. These companies operate with functionally focused e-Business solutions. Some characteristics of these firms include:

- integration of some functional information to decrease inventory and improve efficiency;
- documented processes are followed;
- leaders are trained in supply chain management and people who provide data are trained in ICT use;
- rote functions are codified and digitised to some extent;
- electronic systems are connected and generally provide accurate information about what is needed and where;
- key measurements are used departmentally.

We found that the process often begins on the downstream side, with companies more often linking electronically with their customers, seeking to improve service provision. One such company is Rationel Windows, producing high-quality windows for Danish and International markets. Rationel Windows had always been traditionally organized until 4-5 years ago (much like Rockwool, another case study). With the implementation of a MS-business solution/Navision the company started integrating with customers in the design process: All production takes place using Just-in-Time principles. This has been done via data-sharing with suppliers and it is feasible that suppliers within the next few years will have total responsibility for all raw-material stock management at Rationel.

Similarly, Bonfiglioli Group Spa in Italy specializes in the production of power transmission engines. The company has successfully implemented a virtual B2B environment (*Mosaico*) to enhance customer satisfaction and integrate their order processing systems. This has been successful according to corporate representatives. However, the company still needs to integrate upstream suppliers into their system in order to become truly virtual. This is a future plan. “*Currently we are focusing our efforts to integrate our suppliers with our systems as well. This is just a matter of months, not years,*” according to a Bonfiglioli executive.

As companies like Rationel Windows and Bonfiglioli create horizontal links, they find that the new methods of operating also require new approaches to capital, labour and information management. These are the points of assimilation that take place as the company adopts new technologies and reorganizes internal processes. In an example provided by SAP of their own users, Fisherwerke implemented a full supply chain management system in response to two factors: 1) priced-based competition, and 2) the desire of the company to retain manufacturing close to its research functions in Germany. The supply chain management has been implemented

internally and has improved planning, reduced costs of manufacturing and, according to the firm, improved customer service. They lowered inventory, increased automation, and moved labour off rote work. They have not yet extended their activities to upstream ordering, nor to downstream customer contact. [SAP website]

### Stage 3: Infection

Stage 3 might be termed the point of “infection,” where a firm has made enough change in internal operations to be at a point of “no return.” A process of internal integration and limited external integration has begun. In this stage, companies are cross-functionally organized and have some electronic integration with suppliers and customers. These companies operate with integrated systems within the enterprise, with limited external supply system integration. Often, technologies introduced in stage 2, once assimilated, make other types of changes imperative. For example, as one executive noted:

“Once we started linking the systems together we found that changes were needed in each company’s business processes.... For instance, several clients might order the same component and therefore complete visibility was too revealing for some of the supply chain members. So we revised the way the components were categorised.” [EES 36]

The firms at this stage are characterised by:

- integration of information from the whole supply chain to plan product movement from supplier to customer;
- Sophisticated processes involving all affected organisations;
- highly capable systems providing supply chain information to affected departments;
- codifying all rote activities, and most of them digitised as well.

An Italian textile VSO moved into stage 3 when they identified a number of inefficiencies in production and lack of standardisation with suppliers and clients. The three firms involved introduced ink-jet technology to allow them to print directly onto fabric. As they digitised this part of the process, the firms found that they also needed to digitise other parts of the production chain. As each step improved and change was assimilated, the partners re-engineered and digitised most parts of their production process. An extranet was developed that allowed the re-design of selling and the order management processes. [EES p. 31]

Konkraft Manufacturers has made a transition that characterises them as a stage 3 company. This is a virtual network of five European companies collaborating on designing and manufacturing kitchens. The five firms have created a horizontally-integrated network. They have an intranet and they use the Internet and the Web to allow rapid communication, data exchange and common storage of data. The design processes are shared electronically between the members. Each firm markets the jointly created products. They optimise individual strengths by choosing among themselves which company can best provide the product or service at the time. They outsource non-core functions. Inventory is registered on the intranet. Customers and clients can engage in virtual construction of kitchens, and bidding for product is done electronically. The purchasing still requires a “large human component” according to the firm. Transactions have not fully migrated to the Web, and it is not clear to the firm that this will increase their competitiveness in the near term. This is a point for study in the future.

Similarly, Novo Nordisk Servicepartner offers online ordering for up to 50,000 healthcare-related items. Clients can log straight into the actual inventory on the company’s ERP system. Even so, upstream contractors still have to make all the specification for the electronic catalogue manually.

#### **Stage 4: Integration**

Stage 4, “integration,” or multi-enterprise integration, is the point at which companies can be considered to be fully functioning virtual organisations. In this stage, companies are cross-functionally organised. They operate using integrated systems within the enterprise and with maximum external supply system integration using ICT in most if not all stages of the operation. The characteristics of firms at this level could include:

- collaboration across the supply chain;
- automated, Internet-based collaboration with trading partners;
- internal collaborative supply chain management focus on key service and financial goals;
- labour trained in functional and process skills that impact the supply chain;
- systems that integrate appropriate information across the whole company;
- fully integrated performance management system links supply chain results to company goals;
- labour is flexible and the cohort and skill mix may change with the needs of the marketplace;
- bidding on supply is offered electronically and is updated continuously.

In many cases, the assembly firm does not take title to parts – title is passed through to the final customer.

We found very few companies operating as multi-enterprise integrated VSOs in our survey. This was particularly true of SMEs, which were most likely to be operating between stage 1 and stage 2. (The survey for the European e-business Showcase report reports a similar finding on page 47.) One company interviewed as part of the BEEP Project operates as both a stage 4 VSO and a VSO enabler. Mayetic is a French company that, since 1996, has operated without an office: staff works at home or at the client’s location to build websites and intranets. They do consulting and engineering in collaborative information systems. All non-core functions (e.g., accounting, recruitment) are out-sourced. Each staff member has a permanent connection to the company’s Web-based information system for rapid information sharing. They meet as a group once every six weeks. Remuneration is tied to the company’s success. Mayetic reports that they have fully retained their workforce in the years since becoming a virtual company.

#### **Common Steps**

Through the case studies, we identified a number of key processes that firms undertake no matter what stage they have completed. Each of these steps is listed below with an example from the case studies. These are presented in Table 3.2 along with examples drawn from case studies and literature.

**Table 3.2**  
**Common Steps Towards Virtual Operations with Case Examples**

Steps	Examples
Automating supply and delivery	Rockwool, a Danish company, found that a major aim of setting up the ERP system and the Web-based interface at this firm was to make the interaction and data-gathering process taking place in communication with customers and suppliers easier and more efficient. Today, all processes taking place in ordering, billing, production, ordering of raw-materials and delivery is done electronically. The result is much better opportunities for information delivery to customers and internal efficiency.
Outsourcing non-essential tasks	Rational Windows, a Danish company, reported that, as a result of setting up the new ERP system that facilitates communication and data-sharing between customers, Rational and its suppliers can concentrate their efforts on activities where value is added – the design of the windows. Management of raw-materials and stock is still needed, but this is done electronically and is more or less a responsibility of the suppliers. They have a responsibility that Rational Windows always has a sufficient stock of their spare parts.
Shifting labour activities or re-constituting the skills pool in response to horizontal integration	Rational Windows told us that implementation of new systems caused some changes in competence needs among employees. A revised training programme focused not just on using ICT but on a more general approach to teaching employees how to handle the new systems, how the systems supported the business, and how employees could add to corporate understanding about this. "The main aspect was data-discipline among all our employees," they told us, since the "system is never better than the data stored in the system and this data comes from the employees. The system needs to provide a credible picture of the physical world and therefore the main aspect of changed competence needs and training has both been formal training in how to use the system, but also a shift in culture within the firm."
Tendering for new supplier relationships	Similarly, Celesta mBusiness Oy, a Finnish software company, has found that the business challenges of being more virtual and quickly responding to customer needs meant that the firm needed to improve the productivity of their field personnel, giving them access instantly to corporate information, and to be in constant contact with them anywhere and anytime. This required hiring people able to be flexible in the field, and then providing them with scalable, mobile technologies. [EES 121]
Maintaining direct, continuous links with customers and clients	Konkraft: The network of five small producers of kitchen furniture and equipment allows flexibility in response to customer needs. Customers can design their own products and send an online request to the network of manufacturers. Then it is decided among the virtual network which one should produce the goods. If it is a large order the companies in the network can share their equipment, thus enabling them to accept much larger orders than if they were operating independently.
Using more open-system, open-platform processes to create links	The French-based DesignNet system, a group of small and medium-sized businesses, instituted a standardised monitoring of the workflow of textile design. By validating each process step online, the system facilitates customer interaction all along the design process, increasing transparency and reducing errors in printing. [EES p. 29] I-know-Law: This firm facilitates different kinds of juridical advice and templates using the Web. The network consists of different kinds of professionals working with juridical aspects. These users together with I-know-Law employees feed data into the system which is used by other users afterwards.

## Understanding Virtual, Smart in a Competitiveness Context

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In order to move towards virtual and/or smart operations, companies must be able to see an economic benefit in this change. In addition, they must see the business structure that will enable their transition to more virtual, smarter operations. Even then, as business studies show, the inability of organisations to embrace superior practices is often found in business history. This section discusses the question of how companies can think about competitiveness and what business structures can enable the transition towards VSO.

### Adoption of New Technologies and Business Practices

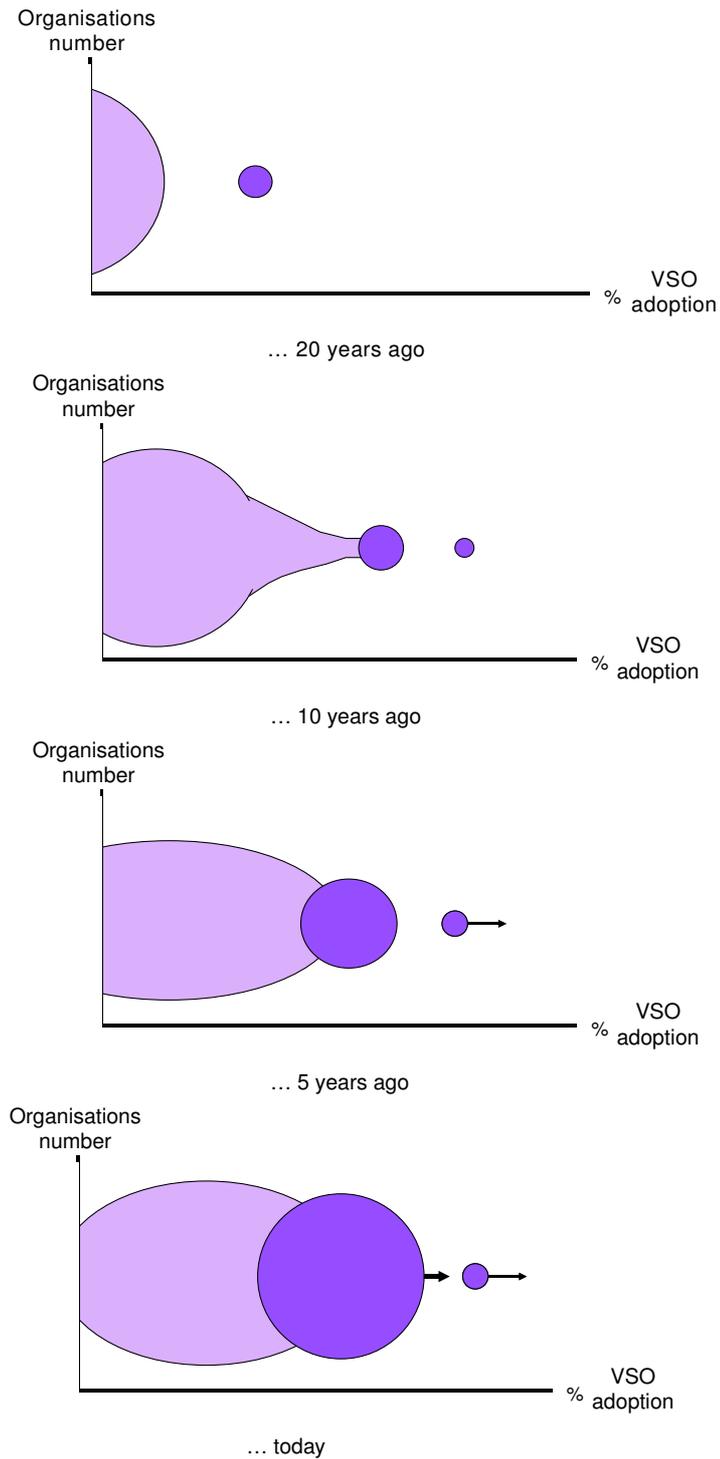
One way of understanding the benefits of VSOs is to think of them in competitiveness terms. The development of competitive advantage can be seen in stages. First is the straightforward adoption of ICT in the workplace - to a great extent a near-completed step for many organisations. For the first movers there was a short-term competitive edge initially, but now that nearly all business have implemented ICTs in some form, the only effect on competitiveness is to disadvantage the few laggards. In this first stage what is being improved is process efficiency - doing all the same old things, but doing them better and more economically.

A second stage is the introduction of the Virtual Organisation: the “climate change” that characterises this is that every aspect of the organisation (and, crucially, everybody in it) is brought into co-ordinated communication so that full advantage is taken of all the skills of all the players. The characteristic here is endogenous (i.e. from within) innovation - not just doing the same old things better, but now changing and improving to do new things that derive from the old. The benefit here (and the key distinguishing feature from “plain vanilla” ICT implementation) is the avoidance of the price-cutting commoditisation that arises from merely concentrating on process efficiency. The benefits arise not from increased per-unit profitability but from the continual process of keeping ahead of the market and avoiding commoditisation: the Virtual organisation gives itself the ability to profit from being an innovating market leader.

The third stage is a variant on the second: less frequently observed and so here discussed as being ‘third’ but in fact potentially attainable at the same time as the second stage. This is the Smart Organisation, in which the innovation capacity is potentially exogenous (i.e. from outside the organisation) and enabled by an even wider scope of meaningful communication (extranet rather than intranet) so that now most crucially the whole client/customer base is utilised in improving not just the way things are done but also what is done, to the extent that the Smart Organisation is able to respond to latent demand by doing completely new things. This completes the progression from “efficient” (via ICT adoption) through “market-leading by innovation” (via Virtual Organisation) to “market creating by innovation” (via Smart Organisation).

As shown in Figure 4.1, the early adopters of ICT in the workplace have taken the lead. The present state of play is that the first stage is nearly complete; very many leading companies are seen to be implementing the second stage; but only very small numbers are yet moving to the third stage (each stage generally adds to rather than replaces the others). The first stage is essential to survival; the second enhances profitability by breaking free from commoditisation; and the

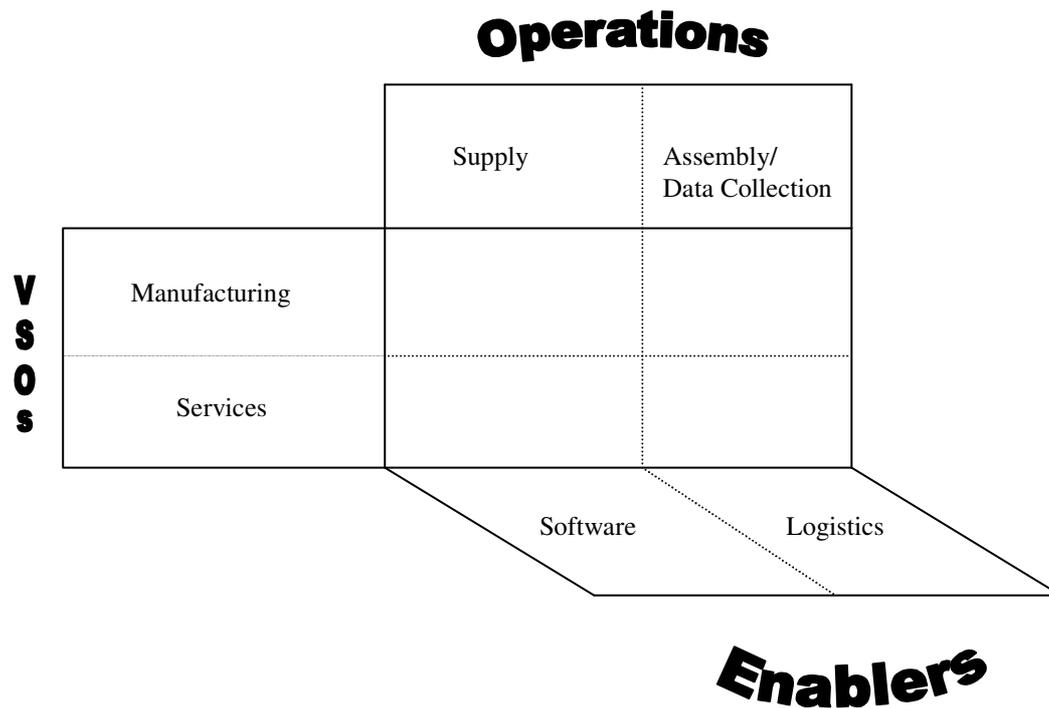
**Figure 4.1**  
**Stages within the Marketplace, Incorporating VSO Changes**



RAND MG195-4.1

third enables step-wise growth by creating and exploiting markets. Early adopters and risk takers remain out in front of the marketplace, spurred both by technical possibilities and the profitable rewards offered by taking risks.

**Figure 4.2**  
The Relationship of VSOs to Enablers



RAND MG195-4.2

### The Role of Enablers

Virtual, smart organisations become competitive over time, as they either build a new company or transition to VSO status. As a horizontally-integrated company creates the links that allow them to form virtual companies, they make use of firms that we call “enablers:” companies that provide services that enable VSOs to operate. These include communications technology (e.g. the Internet) software providers and transportation and logistics suppliers. The software providers are companies like SAP that provide the protocols for internal interconnection (smartness) and external linkages (see box in second section). The relationships of these firms can be visualised as shown in Figure 4.2. The benefits of buying the services provided by enablers are generally measured by firms using a Return on Investment (ROI) measure.

We examined two cases of enablers that help create virtual links and provide logistics services between parts of VSOs. Jagged Peak is a U.S.-based company that specializes in Enterprise Commerce Management (ECM) solutions. It provides a software protocol called EDGE (for Enterprise Dynamic Global Engine). EDGE is a high value, real-time Enterprise Commerce Management (ECM) solution that collapses the entire chain into a single link. It enables disparate systems (ordering, shipping, procurement, pricing, personnel, administration and so on) to interact. It provides transparency, where needed, to multiple business partners (suppliers, manufacturers, distributors, customers).

This service is provided over the Internet. According to the company, the benefits of moving processes to an Internet protocol include:

- greater control over shipping and handling costs;
- reduced customer acquisition costs;
- reduced vendor dependencies;
- a reduction in IT and customer service staffing requirements.

**Table 4.1**  
**Different Types of Indicators for VSO Activities**

	Virtual	Smart	Notes
Market potential	All enterprises have the potential to be at least partially Virtual, although the <i>operation of facilities</i> (shops, airlines, restaurants etc) reduces scope of action	All enterprises seem to have the potential for Smart Organisation – even sole traders with restaurants, for example, can be Smart to quite a large extent.	Very small and sole trader enterprises are often virtual-size is not significant for potential, but availability of relevant tools may be
Market macro-indicators	Sales of EPR and EPOS systems Telework prevalence Non-interactive website prevalence	Sales of KM systems Interactive website prevalence (extranet on website)	Sales of CRM RTD spend may be significant in V.O.s, less so in S.O.s. which rely more on exogenous and/or social innovation
Benefit Classes	Process efficiency endogenous innovation 'sell what you make' and 'sell what you buy'	Endogenous innovation and exogenous innovation 'make what you sell' and 'buy what you sell'	Smartness is much related to feedback loops, network externalities and user inputs

Like similar firms that provide enabling services, EDGE reorganizes an enterprise's supply and demand chains using a single link, providing these over an open-system protocol so no standardised or expensive software is required. The software processes information in a database environment in real time.

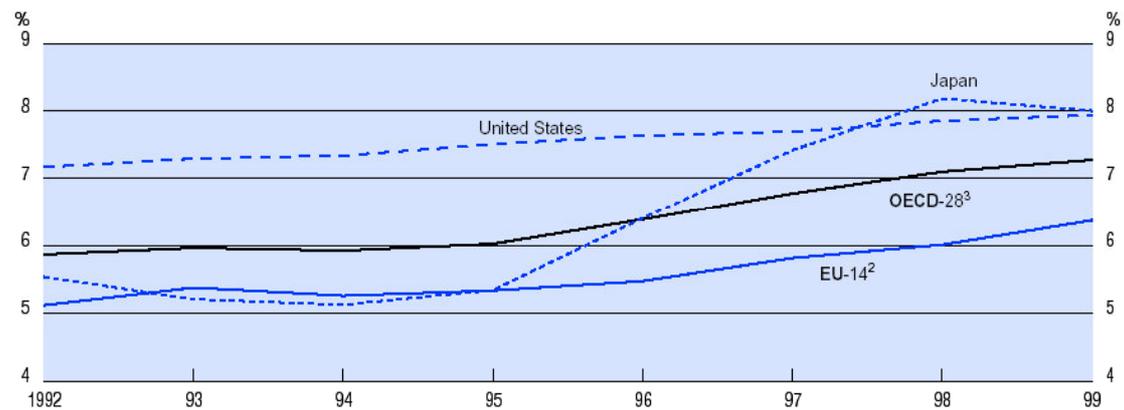
Kamigumi, an Asian-based company, provides supply chain and logistics operations. It has a worldwide staff of over 4,000 employees. Kamigumi is a third party logistics (3PL) supplier: Companies can outsource their transportation needs, thereby cutting and decreasing time to market. It has achieved success in various businesses all related to 3PL and outsourcing, including: port transportation, warehousing, freight forwarding, road transport and factory and warehouse cargo handling. Kamigumi uses V3 Systems (a Microsoft Certified Solution Provider) for delivery order management, inbound/outbound inventory management. V3 reduces inventory-carrying costs and provides visibility to its inventory and supply chain operations across multiple warehouse facilities. V3 Systems can thus be seen as a form of a WMS or a SCM. It enables the client to have full visibility of their inventory and order status online.

## Measuring the Impact and Activities of the VSO

Indicators and measures that have long been used to describe industrial activities are proving woefully inadequate to measure the progress and adoption of virtual trends in the economy, though traditional business metrics are still valid to measure the economic success of a company. Linear processes with material inputs and outputs are more susceptible to measurement. The dynamic, complex and non-linear processes that mark the B2B networks are much more challenging to characterize and even more difficult to measure.

Existing indicators possibly applicable to measuring the competitiveness or activity of VSOs fall into three broad categories: 1) macro indicators of economic activity, 2) meso indicators drawn from traditional business measures and surveys, and 3) micro indicators examining knowledge flows within the system. Macro indicators are those that have traditionally been used to describe market activities. These include measures of the strength of national and regional economies, corporate investments and profits and trade data. These measures have limited ability to reveal the effect of VSOs on the economy, thus we do not focus on them in this report. Meso indicators are those existing on the sector level and within firms that describe more traditional activities such as purchasing and sales, assessments of returns on investments and so on. Micro indicators are ones that measure the flow of knowledge and its use within the VSO.

**Figure 4.3**  
**ICT Intensity in Major OECD Zones 1992-1999**



ICT intensity= ICT investments as a % of GDP  
 SOURCE: OECD Scoreboard 2001

RAND MG195-4.3

### Meso Indicators

Within the scope of the research for this project, we searched for data that could provide insights into measuring the VSO and its dynamic environment. The data is presented here. These variables can shed some light on various issues related to VSOs, but cannot be taken to be more than indicative and anecdotal. The data and its analysis presented in the report are used to provide the reader with a basic “sense for what is going on,” building on traditional measurement concepts.

We searched for data in many places, both business oriented and governmental sources, including Eurostat, OECD<sup>8</sup>, Worldbank, ITU,<sup>9</sup> and within RAND reports and data tables. These data sources, to the extent they contain ICT-related data, mostly have a meso focus (e.g. Web purchases, ICT investment, etc.) and lack micro-indicators which would be more relevant for measuring VSOs, but which are not yet fully developed.

We also examined the products of commercial data providers like Gartner, IDC and Datamonitor. These sources have produced some interesting reports (see later in this appendix), but the data suggested in the abstracts of the reports did not appear to expand the understanding of VSOs enough to justify their very high cost.

E-business Watch was the source which provided recent, readily accessible survey-data on a sector level on more micro-oriented variables like ERP-sales, internal e-processes, etc. Thus, we primarily used the E-business Watch data for our analysis. Our assessment is that this data is useful and applicable to the VSO project, although it still falls short of describing the *dynamics* of VSO operations that we view as their defining feature.

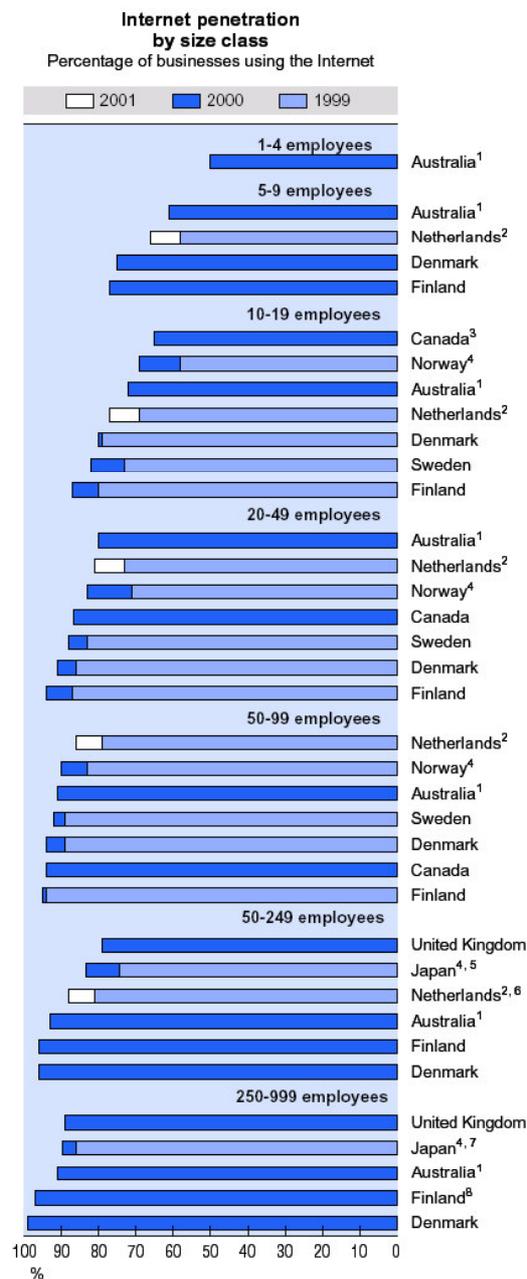
A review of the meso data shows that the Scandinavian countries are among the countries with the highest indicators of ICT penetration and use.<sup>10</sup> Although they still lag the United States in most ICT-related indicators, it is interesting to note that, in a recent poll of competitiveness, Finland, Sweden, and Denmark were considered among the most competitive

<sup>8</sup> Organisation for Economic Cooperation and Development

<sup>9</sup> International Telecommunications Union

<sup>10</sup> In all cases where data is reported, European indicators lag those of the United States, and very recently, of Japan. (Figure 3.3)

**Figure 4.4**  
**Internet Penetration by Class/Business Size**



SOURCE: OECD STI Scoreboard, 2001

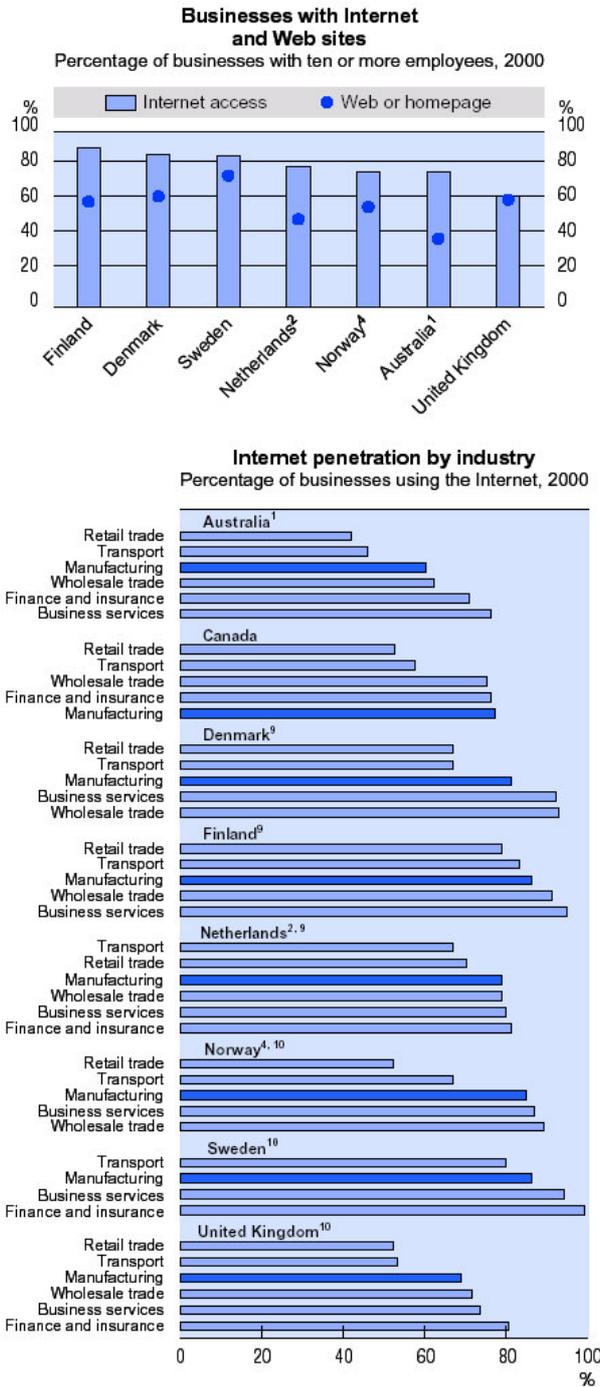
RAND MG195-4.4

countries in the world, and leading all other countries in Europe.<sup>11</sup> Although it is not possible to draw a direct link between these two sets of data, it is an interesting correlation that the lists of ICT-intensive and highly competitive countries are closely aligned.

In terms of Internet penetration by business class, (Figure 4.4) among the largest businesses, Finland and Denmark are the most ICT-intensive countries, followed by the United Kingdom. Among middle-sized and small companies, Finland, Denmark, and Sweden lead other countries of the world as well as leading within Europe. These same countries, joined by the

<sup>11</sup> Global Competitiveness Report 2003

**Figure 4.5**  
**Businesses with Internet and Internet Penetration by Industry**

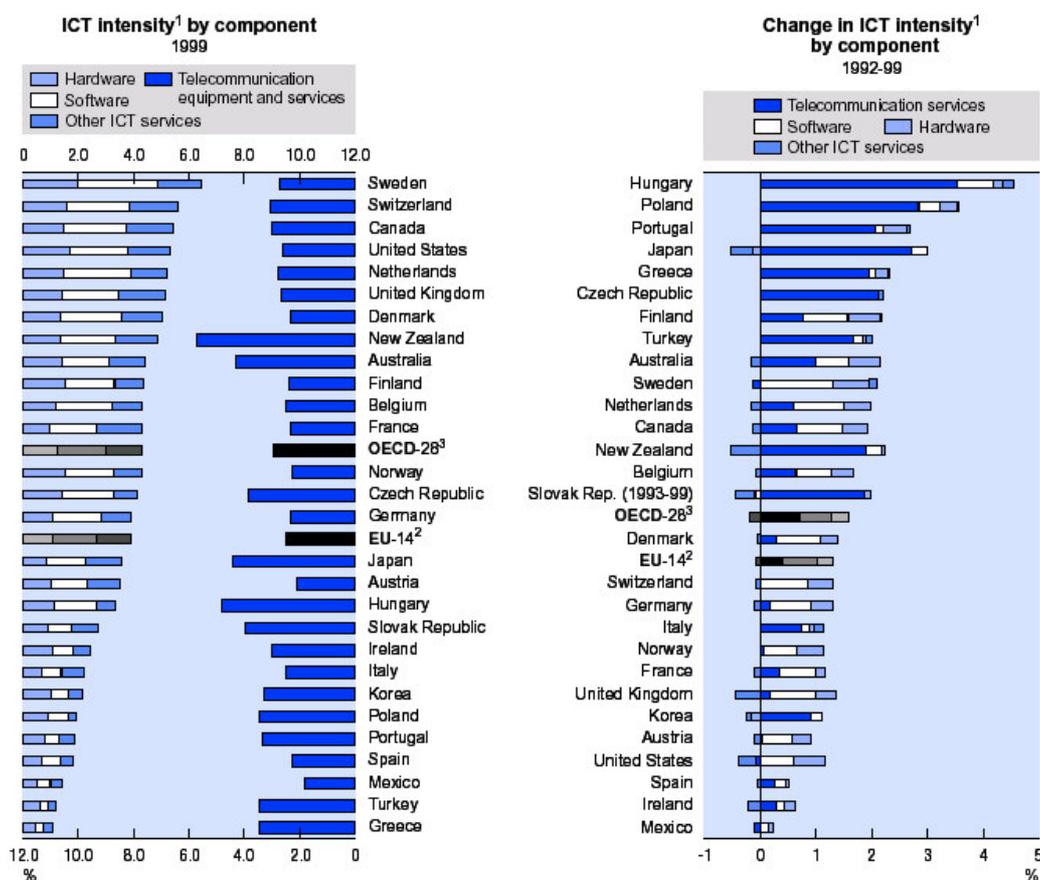


SOURCE: OECD STI Scoreboard, 2001  
 RAND MG195-4.5

Netherlands, also lead in terms of businesses reporting Internet use and website registrations. (Figure 4.5)

Internet penetration by industry shows that among countries of Europe reporting more than 50 percent penetration in 2000, the Scandinavian countries lead, joined by the United Kingdom and the Netherlands. (Figure 4.6) The Netherlands also joins the Scandinavian countries in the list of

**Figure 4.6**  
ICT Intensity among OECD Countries



SOURCE: OECD, STI Scoreboard 2001

RAND MG195-4.6

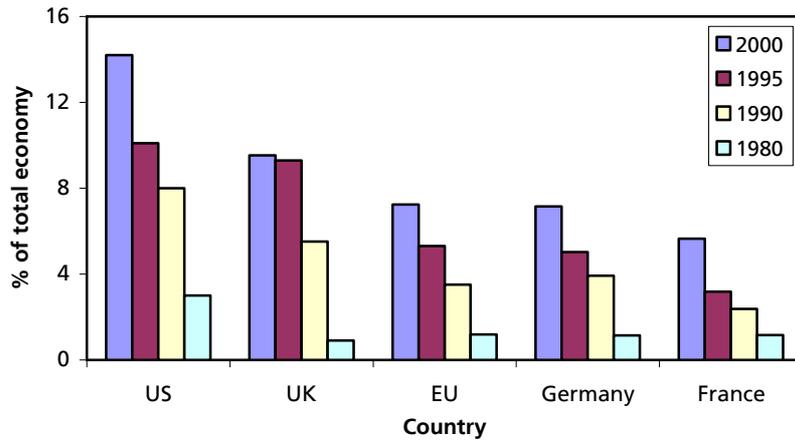
top European countries showing Internet and Web-based purchases and sales (Figure 4.9). The Scandinavian countries also lead the list of those countries where individuals ordered goods and services over the Internet in 2000. (See also Figure 4.9)

Internet penetration within business sectors has also been surveyed. Those sectors reporting Internet penetration percentages over 50 percent—meaning more than half of businesses in this category report Internet use—are finance and insurance, business services, and manufacturing (Figure 4.5). These industries also emerge high on the RAND Europe index created for this report. (Figure 4.10)

The percentage of businesses reporting sales over the Internet as a share of total sales is another data set we examined. Again, the list of countries with the highest percentage of businesses reporting Internet sales are led by the Scandinavian countries, Denmark, Sweden, Finland, and Norway (Figure 4.8 – 4.9). The same list exists for businesses using the Internet for purchasing and selling in 2001, although, here, the Netherlands leads all other countries in terms of receiving orders over the Internet, and closely follows the leader, Sweden, in terms of placing orders over the Internet. (Figure 4.9)

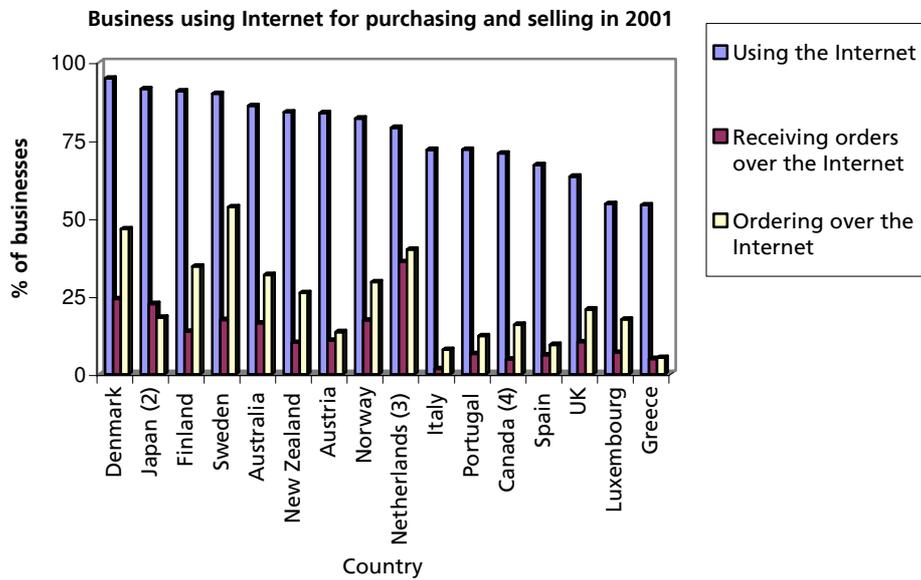
Countries of Europe showing the greatest *growth* in ICT intensity over the decade of the 1990s are Hungary, Poland, Portugal, Greece, and the Czech Republic. (Figure 4.6) In terms of overall growth over 20 years in ICT investment and growth accounts in spending on software overall, the United Kingdom leads other countries, followed by Germany and France. (Figure 4.7) European countries showing the largest percentage share of investment in ICT equipment and software over 20 years time are again led by Finland, followed by Italy, Germany, and the United Kingdom. (Table 4.2)

**Figure 4.7**  
**Software Investment within Large Industrialized Regions, 1980-2000**



SOURCE: ICT investment and Growth Accounts for the European Union, 1980-2000  
 RAND MG195-4.7

**Figure 4.8**  
**Within Industrialized Countries, Percent of Business Buying and Selling over the Internet in 2001**



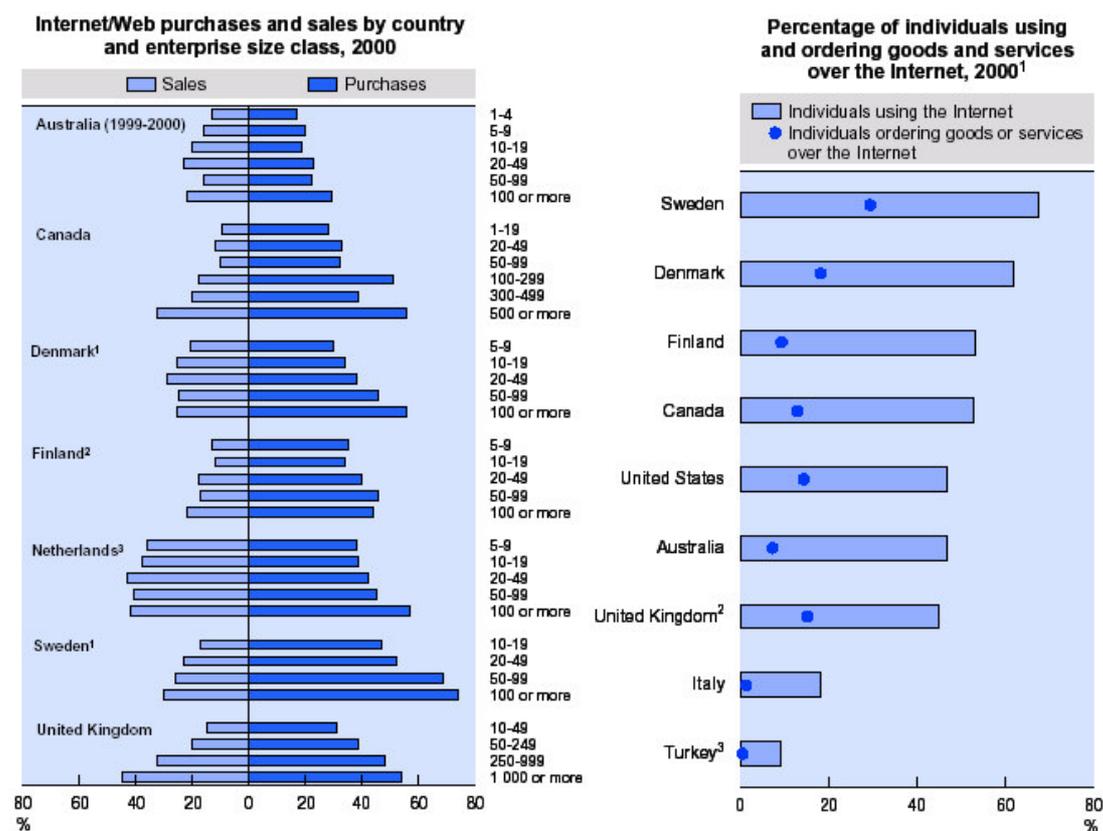
SOURCE: E-business Watch Data (June 2002),  
[http://www.ebusiness-watch.org/marketwatch/database/survey\\_info.htm](http://www.ebusiness-watch.org/marketwatch/database/survey_info.htm)  
 RAND .MG195-4.8

**Table 4.2**  
**Percentage Share of ICT Investment in Total Non-residential Investment in Current Prices, 1980-2000.**

		Australia	Canada	Finland	France	Germany	Italy	Japan	United Kingdom	United States
IT equipment	1980	2.2	3.9	2.0	2.5	4.6	4.1	3.3	2.9	5.1
	1990	5.5	4.5	3.6	3.5	5.5	4.2	3.8	6.0	7.0
	1995	8.4	5.7	4.0	3.9	4.6	3.5	4.6	8.6	8.7
	2000	7.2	7.9	2.9	4.4	6.1	4.2	5.2	8.4	8.3
Communications equipment	1980	4.0	3.0	3.2	2.9	3.9	4.0	3.4	1.6	7.1
	1990	3.8	3.8	3.9	3.2	4.8	5.7	4.0	2.0	7.5
	1995	4.7	4.0	9.3	3.5	4.2	6.7	5.3	3.6	7.3
	2000	5.6	4.2	15.3	3.9	4.3	7.2	6.9	3.6	8.0
Software	1980	1.1	2.2	2.6	1.3	3.6	1.7	0.4	0.3	3.0
	1990	4.6	4.9	5.2	2.6	3.7	3.8	3.1	2.1	8.0
	1995	6.4	7.1	9.2	3.5	4.5	4.3	4.0	3.5	10.1
	2000	9.7	9.4	9.8	6.1	5.7	4.9	3.8	3.0	13.6
ICT equipment and software	1980	7.3	9.1	7.8	6.8	12.2	9.7	7.0	4.8	15.2
	1990	13.9	13.2	12.7	9.4	13.9	13.7	10.8	10.1	22.5
	1995	19.5	16.8	22.5	10.8	13.3	14.4	13.8	15.6	26.1
	2000	22.5	21.4	28.0	14.4	16.2	16.3	16.0	15.0	29.9

SOURCE: Colecchia and Schreyer, 2000

**Figure 4.9**  
**Internet Sales and Purchases within Europe, and Percentage of Individuals Buying over the Internet**



1. Orders received or made via a Web home-page.
2. Percentage of businesses able to receive or send orders via a Web home-page.
3. Orders received or made over the Internet and other computer mediated networks. 1st quarter 2001.

1. Age cut-off: 16 years and older except for Canada and Finland (15+), Italy (11+) and Australia and Turkey (18+).
2. Last quarter 2000.
3. Individuals belonging to households in urban areas.

SOURCE: OECD, ICT database, July 2001

RAND MG195-4.9

**Table 4.3**  
Possible Indicators of VSO Activity

	Quantitative	Qualitative
Data	Web hits; email exchanges; bits processes; electronic orders	How software handles data
Information	Orders; shipping; market assessments; return on investment; profits	How companies perceive information within their competitive environment
Knowledge	Patents; publications; citations	How the user responds to new information; new concepts developed with new knowledge

### Micro Indicators

Micro indicators are measured at the point of flow of information between entities in the VSO, and by how the entities themselves use the information. Information theory suggests that the variety (complexity, richness, uncertainty) of the media (channel) must equal that of the message to be transmitted. Thus, the more complex the VSO, presumably, the richer the media needed to transfer the knowledge. Theorists have suggested that the richest media is face-to-face, while the poorest is numeric documents. Computer mediated communication (CMC), and especially email, is in the middle between face-to-face exchange and numeric data.

Indicators that are used to characterise knowledge production and communications in other spheres (articles published, for example) cannot be used in the B2B environment. In fact, the B2B environment is marked by the reduction in paperwork and need for information exchange. This has happened because data and information that was formerly in people's heads or written down in order books are now codified. This both increases the operating complexity, but it also frees workers from mundane tasks.

Some efforts are underway to measure virtual exchange of information. Although these measures are still in their infancy, they hold some promise for characterising VSOs. They include measures of data flows, information exchange and knowledge creation and transfer, and they range from highly quantitative to purely qualitative. Table 4.3 provides an initial overview of these types of measures. The table shows examples of information that could indicate use of data, information and creation of knowledge using quantitative and qualitative measures. While information is the flow of data, knowledge is a stock of information that is organised into a conceptual schema. Knowledge exists when an individual understands what to do with the information he or she receives, what that information implies, what its limitations are, and how to create value from it.

It is quite challenging at this early stage of the development of the electronic economy to track quantitative data: no framework exists to assess the meaning of the indicators. This needs additional research, some of which is being undertaken as part of the European Commission-sponsored WISER project (<http://www.Webindicators.org/>). Moreover, it is not immediately useful to view quantitative measures of knowledge creation as a whole because it is difficult to decouple VSO operations from knowledge creation in a larger context. However, there exist micro-indicator that show the degree of success a VSO is experiencing or the degree to which a company is transitioning to VSO status. These are:

- **Collapsing of ROI cycles.** In traditional, non-VSO companies, *return on investment* (ROI) is often difficult to measure, because of the difficulty of arriving at an "all-in" cost estimate against which income can be compared and the extended time over the ROI of a campaign or initiative is measured. But with VSOs, because of their inherit process transparency, their auditable digital traffic, and the strict cost-allocation of labour and technology, ROI studies are highly feasible, they can indicate and track across time the success that a VSO experiences; moreover, they can be used as "spot checks" of a

campaign's success. For instance, if a VSO were to commence an emarketing campaign to offer retail sale of leather coats, the software a VSO uses can present a "dashboard" view of the campaign's various metrics: inventory on hand, purchase orders to material and labour vendors, orders from customers, shipping status of inbound and outbound inventory, and the marketing costs of the campaign. Calculating ROI on a similar campaign without VSO techniques and VSO tools would be time-consuming and indeterminate.

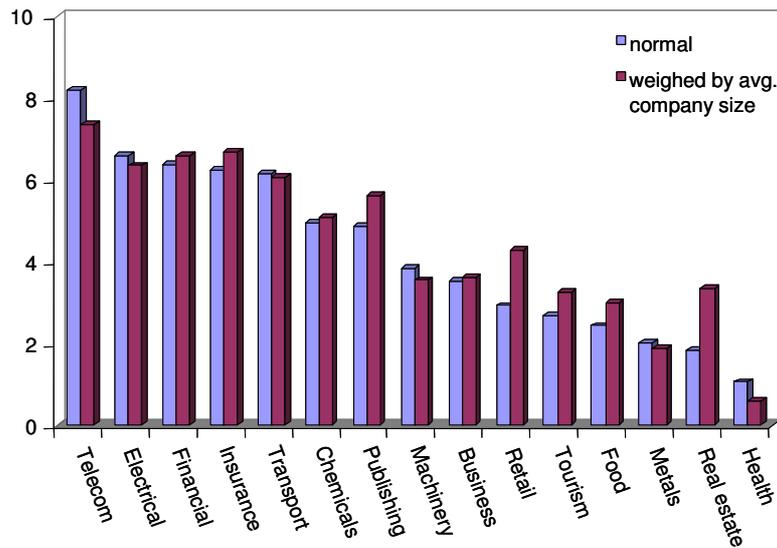
- **Website traffic.** VSOs should rely on the Web for a) customer interaction and b) as a portal for employees to access business data. Tracking Web traffic (and the *duration of stay* from a visitor or employee on any single URL) can give a good indication of company activity. It can also provide a metric for evaluating the success of a VSO and the overall health of a business. Let's continue to use the example of a VSO's marketing campaign to sell leather coats. By using widely-available Web traffic analysis software, a VSO can measure the success of a campaign by the number of click-through or "Web hits" the coat campaign's Web page receives. But even more importantly, by comparing Web traffic data to call-centre activity, as logged by a CRM, a VSO can evaluate the utility of their online retail ordering system. If a good number of customers are landing on the Web page due to the marketing campaign yet using that website only to get a toll-free number to phone in orders, then the VSO is incurring human costs to process orders that could be entered in an automated fashion on the Web page, if it were more attractive and easier to use. These micro indicators can be collected continuously.
- **Electronic purchase orders.** The number of purchase orders a company receives is generally a good indicator of the health of the company's health, and this is true for VSOs and non-VSOs alike. The more customers you have committing to take financial title to a product, the more cash flows in the door. The same digital attributes that enable VSOs to establish, automate, and monitor transparent business processes also give the VSO transparency to traditional business activities like purchase order volume, and they serve as a ready, easily-monitored indication of the health of the company.
- **Collapsed sales cycles.** The digital attributes of a VSO allow the entity to collapse the duration of the sales cycle, compared to non-VSO companies selling the same product. In other words, the marketing, sale, and fulfilment of goods and services happens faster with a VSO than with a non-VSO, and the VSO realizes financial gain through obtaining money faster (often through "AFT" –automatic fund transfer) and through not having to allocate labour and resources to a sales process over a comparatively long period of time. Through digital marketing, automated website sales, CRM and outsourced fulfilment, the time from inquiry to fulfilment can be dramatically shortened. Since "speed of delivery" can be as much a metric of value as the product itself, VSOs that collapse the sales cycle can use this as a measure of success.

## The Virtual – Smart Continuum

Introducing an Index of Virtual-Smart activities suggests that there is a very clear demonstration that "virtual" and "smart" are systematically linked. At face value, little extra value derives from considering "smart" as being distinct from "virtual." There is, however, a real distinction to be made between VSO's and the generality of ICT adoptions. The data provided above provides the large context within which VSOs operate, and we indexed data in two ways, described below.

In our case studies, we identified two companies where ICTs are put to use, but don't create a "virtual" company. Rationel Window, a Denmark-baser producer of high-quality windows and doors with about 700 employees. Today, the technology used to facilitate integration between Rationel and its suppliers involves ICTs is plainly used and low tech: Rationel regularly sends a

**Figure 4.10**  
**Industry against Virtual and Smart Indices**



RAND MG195-4.10

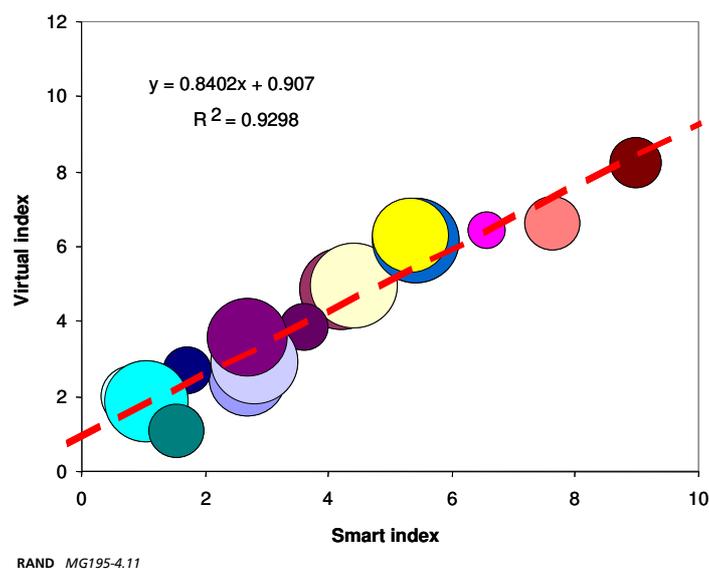
comma-separated file to update their suppliers, regarding the production planning. Rationel acknowledges this lack of “virtualness” and plans to introduce an ERP system by autumn 2003. This system enables Rationel to “open” up for direct access to data in their ERP system for their suppliers. Suppliers can instantly look up key data in the ERP system – for instance on sales. Rockwool, a Denmark-based fire-proof insulating materials producer with about 7,000 employees had a lot of different, unconnected ICT-systems. According to a Rockwool ICT-manager: “this resulted in severe communication problems internally as well as externally.”

In order to view these relationships quantitatively, we indexed the data we found on ICT implementation with other relevant data. The index based on less significant indicators tends to undervalue highly virtual sectors (with the exception for telecom) and overvalue less virtual sectors (food, real estate, etc.). This suggests that the less significant indicators, which are rather simple issues of ICT adoption, often provide a “leading indicator” for the more sophisticated subsequent move to being “virtual.” It is clear that there is a chronological or historic progression being observed here, from ICT adoption, through virtual to smart.

Figure 4.10 is prepared from data on “impact on sales” (a crude measure of effectiveness) for enterprises showing both “virtual” and “smart” characteristics. 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 “percentage 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)

Figure 4.11 shows the regression of the Virtual Index on the Smart Index. The size of the bubbles is a measure for the impact on sales. Three points emerge from this figure. Firstly, and at a rather trivial level of interpretation, it appears that the best benefit arises from moderate levels of virtualness and smartness – high levels produce less satisfaction. Much more interesting is the very firm correlation between “virtual” and “smart” evidenced by the extraordinary straightness of the line. Such a strong correlation is likely to indicate that these are near-equivalents.

**Figure 4.11**  
**Virtual and Smart Indices against Impact on Sales**



RAND MG195-4.11

One possibility would be, of course, that “virtual” and “smart” are identical – but in that case the “best-fit” line (shown dotted on the graph) would pass through the origin. Although the intercept is not large, it is clear that an intercept does exist – implying that it is necessary to be at least in part “virtual” before becoming “smart.” This supports the general approach that the virtual is a necessary precursor to the smart (just as ICT adoption is a necessary precursor for both), and leads in turn to a consideration of how this time-progression or trajectory of VSO formulation arises. It is necessary to consider one further possible distortion that may have been introduced to the tables by virtue of the specific indicators chosen: the size of the enterprise.

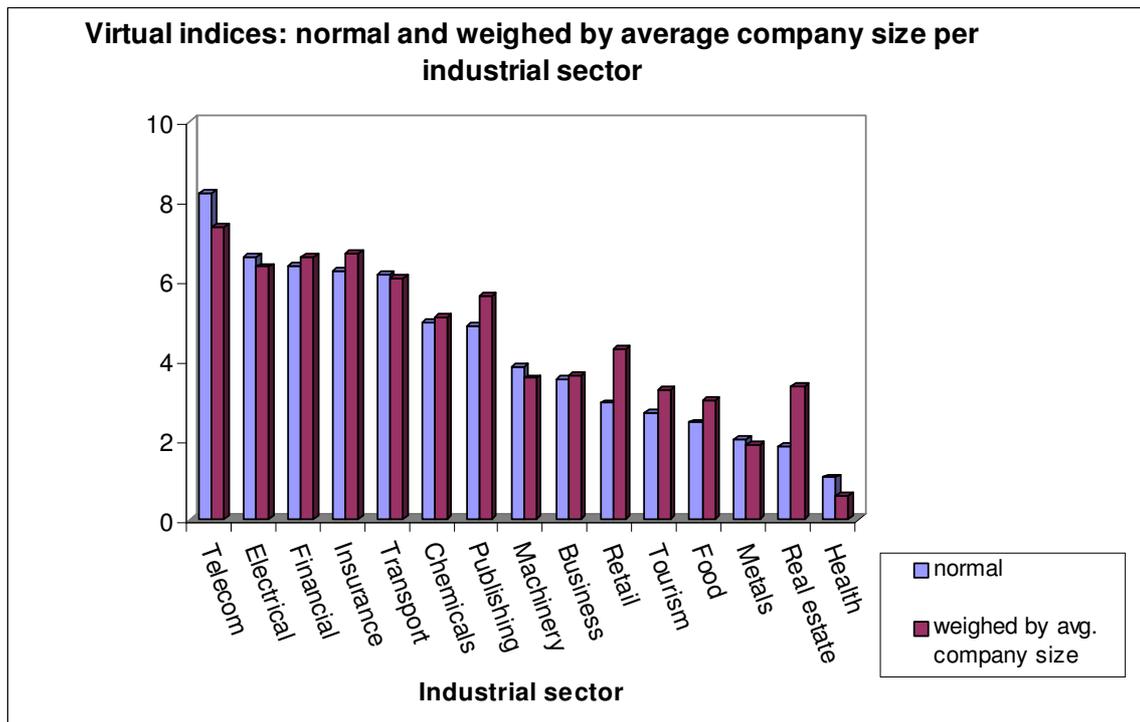
### Effects of the Size of Enterprise

Some of the chosen indicators (LAN usage, for example) are reasonably unaffected by the size of the enterprise: sole traders may not use LANs so widely, though many do, but their distribution through the size range of enterprise is otherwise fairly even. Other indicators (e.g. use of ERP software) point to implementations that are commonplace in large enterprises; frequent in medium; but rare in small. (ERP software for micro-enterprises can hardly be observed to exist at all). In our case study sample, we found that only large companies adopt sophisticated ERP, CRM and KM software packages. Examples of large companies using these software packages are: Rockwool, a Denmark-based fire-proof insulating materials producer with about 7,000 employees, implemented a SAP solution, to facilitate accessibility of data and enhance customer responsiveness. With this implementation, Rockwool effectively migrated from a system that provided access to information internally to opening up the system for Web-based access by customers. Now the on-line dealer network and the internal SAP system are fully integrated. “We expect to open up the system for suppliers to make it possible for them to check the order and stock status at Rockwool,” says a Rockwool ICT-manager.

Novo Nordisk, is a healthcare company with more than 18,000 employees in 68 countries having its products marketed in 179 countries. In 1999 Novonordisk adopted eProCure: a sophisticated electronic catalogue system. Currently, every member of The Novo Group is using the customized system. The system is a product of Officient. Examples of small companies in our case studies that don’t use large off-the-shelf software packages are:

Global Recycle offers an online “marketplace” for trading in a large number of scrap metals and various other products, like computer parts, plastics and used building materials. Their business is

**Figure 4.12**  
**Normal and Weighted Virtual Index by Size of the Company**



RAND MG195-4.12

built around a website through which the selling of goods is facilitated. As one founding manager put it:

An integrated software program is not at all the kind of software Global Recycle needs. Our aim is simplicity, flexibility and adaptability. An integrated software system is much too expensive cumbersome and rigid for it to be useful.

I-know-Law, a small company in the Netherlands, sells online knowledge of business law. The company is owned and operated by three people. Making use of advantages of the Internet, I-know-Law competes in an innovative fashion with other sources of juridical knowledge, such as publishers and juridical experts at larger firms. The Web technology I-Knowlaw uses is in-house and tailor-made.

In order to account for the variation in size of different firms like these, Figure 4.12 is a modified version of Figure 4.10 in which a weighting is applied for the mean size of enterprise in that sector. In some sectors where large numbers of small operators exist (e.g. retail, and real estate) this makes a noticeable adjustment to the detail of the figure. Overall, however, there is no great change between the figures – in most sectors little change is seen, and only slight changes in relativities between sectors are observed.

### **Benchmarking: Who Benefits from a Virtual, Smart Operating Environment?**

The key to unlocking the issue of the actual and potential market (and thus the identity and roles of stakeholders) for VSOs is the concept of benefit (which, it should be observed, may be either perceived or actual). The project being reported here has adopted a benefits-led approach to

determining the measures and defining the stakeholders within a European VSO environment. (See Table 4.4)

In the case of VSOs, the anticipated benefits are of a class that will ultimately relate to increased competitiveness. In general, theory suggests (and our initial observations confirm) that the Virtual Organisation is the precursor: its benefits are delivered first and operate in a shorter time scale than those of Smart Organisation. The key benefit of Virtual Organisation is the improvement of process efficiency (in the provision of services as well as in the production of goods) which will probably be associated with BPRE and may involve extensive re-organisation over apparently long time scales but which is actually a single event (even if phased); bounded; static, and reactive.

The competitiveness benefits delivered may, however, be large and relatively enduring. Ultimately, however, the benefits are accessible to, and may be expected to be adopted by, the particular sector of the Virtual Organisation as a whole, so that in the medium term one would expect a reversion to relative equality of efficiency within sectors. At this stage the competitiveness benefit will shift from being aspirational (where implementation takes the business to a leading position) to being normative (so that failure to implement produces a clear hindrance, takes the business to a trailing position and may lead to failure).

The benefits of Smart organisations follow at a later stage (it is hard, although not impossible, to envisage a Smart Organisation which has not been through the prior stage of Virtual Organisation). Benefits are thus delivered later: they are also of a long-term nature. The key aspect is the improvement of innovative capability (again as applicable in the provision of services as in the production of goods) and in the creation of a Smart Organisation it is almost certain that significant process re-engineering will be necessitated, potentially as a continuous process (tracking the evolution of the market) over substantial or even indefinitely long time scales, so that the development of Smart Organisation is a process which is unbounded, dynamic and proactive. The competitiveness benefits delivered have the potential to create a nearly permanent edge, even as others in the particular sector themselves move to Smartness, because there is an implication of market capture and potential lock-in.

From a brief market survey, we can deduce that the VSO concept has wide applicability across most sectors of the economy: stakeholders in VSO implementation are accordingly very widespread and very numerous. Stakeholders analysis is thus more concerned with categorisation and with the nature and timing of the delivery of benefits than with merely identifying stakeholders. This is a non-trivial finding: ultimately we are all stakeholders in VSOs to some extent, so that we may correctly identify VSOs as an appropriate locus for public policy consideration.

In order to understand the place and role of stakeholders it is necessary to locate VSO implementation in time in sectors of the economy, in sectors of society and in space (i.e. geographically). In creating the macro-indicators for VSOs (discussed above) we relied on three broad categorisations of benefit (all tending to deliver enhanced productivity and/or competitiveness):

- process efficiency;
- endogenously-derived innovation;
- exogenously-derived innovation.

We observe that currently (although not necessarily inevitably) they tend to be delivered in that order. This is in line with well-established understandings of the evolution of organisational change as in Figure 4.13. From this an evolutionary listing of stakeholders (both winners and losers) is produced in Tables 4.4 and 4.5.

**Table 4.4**  
**Understanding the Benefits of VSO**

	<b>Winners</b>	<b>Losers</b>
Process efficiency	Shareholders Retained staff National economy Customers Retained suppliers (inc. ICT)	Competitors Non-retained staff Local economies (local staff losses impose costs) Non-retained suppliers
Endogenous innovation	Shareholders Almost all staff Local economies Specialist ICT suppliers	(competitors may be little affected) note – few staff lost) displaced suppliers
Exogenous innovation	Shareholders All staff Local economies National economies Customers New suppliers in new fields Specialist ICT suppliers	(competitors may be unaffected)

**Table 4.5**  
**Long-term Winners and Losers**

<b>Winners</b>	<b>Losers</b>
V.S.O. implementers	Non-V.S.O. implementors
All Employees	All unemployed
Local and national economies	Extra-territorial economies)
New suppliers in new fields	Suppliers in displaced fields
Newly developed sectors	Existing economic sectors
Aware suppliers inc ICT	Non-aware suppliers

Concerning these tables, some observations need to be made:

- ICT suppliers tend to be only marginal beneficiaries in process efficiency because of commoditisation of supply;
- innovation has little disbenefit but process efficiency is problematic at first;
- transformational innovation may, in principle, have no losers.

It helps to parse out the stakeholders' concept in the short term and in the long term, and then in terms of "winners" and "losers." In the short term the winners could include people with ICT skills and companies that sell software and services to network the value system. Service companies -- such as logistics suppliers -- are also likely winners in the short term. Regions that are highly networked and have a high penetration rate for computers can also be seen as short term winners or stakeholders in the VSO environment.

This also suggests that there are "losers" in the list of stakeholders, groups that will find they cannot stay competitive, or cannot appropriate the value of the VSO. These can include some listed here: people who do not have ICT skills, more traditional (and entrenched) manufacturers, and regions that are not highly networked or computer literate.

Stakeholders are those who receive benefits from VSOs – but also those who receive disbenefits. There are always losers as well as winners. At the societal level, there is a particular characteristic disbenefit (exclusion) and a particular characteristic benefit (quality of life enhancement)

**Figure 4.13**  
**Evolution of Organisational Change**



RAND MG195-4.13

associated with ICT use generally; it seems likely that this dichotomy (exclusion versus quality of life enhancement) can be extended through the VSO continuum, both in the short and in the long term. Tables 4.4 and 4.5 show winners and losers over the longer term. Some winners are the same as those in the short term list (skilled workers), but other groups can be seen as gaining a winning place over the medium to longer term.

Terms such as virtual and smart are applied to describe the emerging phenomenon of business networking and use of knowledge, encompassing ICT, to enhance competitiveness. The shifts from hierarchical and linear business models to more networked models are taking time and their impact is not yet clear. (Figure 4.13) Being knowledge and network-based, these activities are inherently difficult to measure and thus to assess. We can observe that companies are taking on the new methods with some vigour, suggesting that they sense the value of operating along a networked structure based on knowledge. This will affect many stakeholders within the VSO domain as well as outside of it.

VSOs are enabled by a number of factors, including logistics suppliers, information technology and software companies all of whom have a stake in the future of VSO operations. They also operate within a regulated environment that sometimes encourages and other times hinders their operations. Finally, there are winners and losers within this system over the short and longer term. Government may need to be aware of and prepared to mitigate the impacts of changes adopted by industry on the labour force.

## Further Insights: Results of a Survey of Experts Conducted at the e-Challenges Conference

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During the e-Challenges conference in Bologna 22-24 October 2003 we held a series of structured written interviews concerning Virtual & Smart Organisations. A total of 55 people voluntarily responded to 15 statements. Due to the small size of this population, it cannot be seen as a statistically representative sample. Rather, this poll is an exploration of opinions among a specific group of experts. Within the sample, there was a good geographic distribution across Europe and an equal spread among representatives of business, government, and universities.

### General Consensus on Competitiveness of Virtual & Smart Organisations

The most important finding in our explorative poll is that major consensus exists among the participant on the competitive value of VSOs. Almost everyone agreed on the following statement: *Do you think that implementing Virtual Smart technologies generally will make European companies more competitive?* To go further into what this competitiveness could consist of, we probed for more specific concepts we drew from the literature review. Most would agree that the competitiveness of VSOs would manifest in: flexibility (86% “Yes”), innovativeness (82% “Yes”) and responsiveness to customer inquiries (78% “Yes”), with flexibility as the main competitive advantage of VSOs. This is supported by the VSO project case studies, where the flexibility in terms of customer responsiveness, use of production equipment and collaboration with suppliers is most frequently mentioned as main benefits. Flexibility can therefore be seen as benefit to the issue of VSO competitiveness.

However, even though there was a general agreement that VSOs can provide a positive impact on competitiveness through improved flexibility, there were some concerns. One respondent mentioned, for example, that pure service companies should consider not only using technology for customer contact, as the companies may become “faceless.” This is a very interesting aspect, as this may impact the economic sustainability of investing in technology.

Other research projects (*e.g. the back-office integration project, done by University of Bremen and the Danish Technological Institute*) point out that, when service companies invest in new technology for customer support, this often have two drivers. First and foremost the companies wants to extend their openings hours (24/7/365) as this is perceived as being good service. Secondly they think that by using ICT for customer contact they can cut costs on traditional forms of support (*customer service assistants*).

However, there are examples of this not being possible because the users still want to have the opportunity for a personal point of contact. Thus the result is that the companies have to keep two parallel systems – one digital and one personal. It is evident that this may affect the economic sustainability of ICT investment in a negative direction. Finally it should be mentioned, that if it is public companies that use ICTs for contact there might be a democratic problem as far from all have access to the technologies – and these people are often those who have the most significant use of public service.

Thus, it is a good point that is raised by this Belgian respondent, who puts focus on the fact that organisations may become faceless, which again may have a negative impact on competitiveness. Other experts, who generally agree that VSOs have a positive impact on competitiveness, also mention that this benefit depends on the levels of system integration and thus the scope. This is both in terms of upstream (*towards suppliers*) and downstream (*towards customers*) integration. The system will never bring better services than the partners involved and the access points/interfaces available to the end-users.

Finally, a respondent mentioned that VSO operations can enhance the competitiveness of the companies, but the focus still needs to be on the underlying business models – i.e. whether or not the companies have operational excellence and product leadership. Virtual smart technologies will never give anything really valuable to companies that do not demonstrate excellence in core disciplines.

This general agreement on the competitiveness of VSOs is not due to a general tendency of the audience to agree. To prevent this bias, we also probed for negative statements. Here a similar strong consensus can be detected. Literally, everyone disagreed with the following statements:

‘there exists significant labour market legislation that prevents full exploitation of VSO benefits.’ (100% “No”)

“With current technologies it is impossible to link different companies together.” (96% “No”)

“Even if it was possible to link different companies together there are market boundaries (e.g. VAT restrictions) that prevents companies from fully exploiting VSO benefits.” (96% “No”)

“Current technologies and software will create “lock-ins” that will keep SMEs out of the market.” (93% “No”)

Thus, as can be seen, only a limited part of the respondents had the opinion that there were significant barriers to the exploitation of VSO benefits. However, if we look further into the survey results, it was generally agreed that there is a need for more information on this topic: respondents said that many businesses, especially SMEs, are still left in the dark on what they should do and where to look.

Furthermore, a Dutch professional mentioned that perhaps the main barriers were not to be found in terms of technology and legislation but more on the fundamentals of trust and cultural differences, which still exist, although not limited only to Europe. This problem could be even more fundamental and encompass the ability to have trust in the data stored and exchanged within the systems. This has both an internal and an external perspective, as the case studies highlighted, that the benefits of data sharing between partners would never be better than the data stored in these systems. It required very little data-disturbance before all data were considered unreliable and thus not a benefit, but a bureaucratic hassle. As concerns the external point, the end-users need to have trust in the data facilitated by the system – and this is especially important for service companies. Similarly as to the internal trust perspective, it does not take many errors before trust disappears. However, the general trend of the expert survey is that VSO may have a positive impact on competitiveness through a number of mechanisms. At the same time there is a need for paying close attention to potential areas that can cause problems.

## Discussion Topics

Apparently, the participants see VSO as flexible and innovative and there exist no boundaries for companies to become smart and virtual concerning labour market legislation, market boundaries or technology in their view. It could be argued that this optimism for the business model is the reason these respondents attended e-Challenges, but even then, more variation of opinion could be expected. Only on two topics did responses vary: *effectiveness* (69% “Yes”) and *efficiency* (36% “Yes”). On the statement that “*VSOs will operate more effectively*” only a small majority would agree, while a similar number of people would disagree with claims of efficiency. Efficiency was measured with the question “*VSO competitiveness will manifest in that companies can reduce staff needs significantly*” and almost two-third would not agree on this. This is also supported by the project case studies, where it is found that VSOs can result in reduction of employees with “basic tasks” such as customer service assistants, but these functions does not disappear entirely, nor did staffing drop.

In general, participants see great advantages in VSOs and although they see few limits in becoming smart and virtual, they still think the European Commission do more to promote it. (93% “Yes”) The following statements measure what should be done:

“Do more for implementing VSO friendly legislative frameworks.” (87% “Yes”)

“Make more research and experiences available.” (85% “Yes”)

“More effort on promoting flexible software (open source, XML).” (76% “Yes”)

“Do more for promoting extranet implementation and wider involvement of supply-chain participants, including end-users.” (76% “Yes”)

When capturing the feedback from the experts on how and what the European Commission could do to facilitate a better environment for VSO in Europe, we also asked the experts to provide more qualitative feedback on this. Among the most interesting aspects was a general need for *sector studies*. Generally, the experts believed that VSOs would have a positive impact on competitiveness, but that the scope of these benefits could vary much between different industry sectors (*and more significantly, that the technologies and mechanisms adopted by different industries were very different*). This is not a broad distinction between service and manufacturing industries, but a far more detailed assessment of individual industry sectors such as automotive, building and construction etc. A Norwegian expert highlighted that a common system for measuring (*and perhaps even benchmark*) benefits were needed. It could be very difficult to convince management (especially among SMEs) to invest in technology and competencies for VSOs if there were not a clear system that could measure outcomes (*or at least give an indication*).

It was also mentioned that more case studies and experiences were needed. An Italian expert highlighted this. During the case study part of this project, we have used resources on finding good examples for our empirical work and this has often brought us to the homepages of the main technology and software suppliers. On their homepages a number of case studies are available, but one could hardly claim that these are neutral. Seen in the light of the many biased case studies that exist on the Internet and the proposed need for sector studies, we could conclude that work on establishing a forum for neutral sector specific case studies (*and perhaps a benchmarking tool or at least common systems for measure outcomes of VSO*) would be appropriate. This is also supported by a British expert, who very practically highlighted the need for an open forum, where practitioners and experts could meet and exchange ideas and experiences.

Thus, it seems that for this audience, VSO remains a topic of great interest. The belief in the competitiveness of VSO appears to be well established, but the phenomenon is still rather new.

Seeing these results also urges the question: *“If everyone believes in the competitive advantage of being smart and virtual, why is not every organisation doing it?”* This is an interesting matter for future surveys.

## Observations and Conclusions

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The set of observations and conclusions emerging from this project can be grouped into three areas: 1) identification of possible obstacles and barriers to VSO transitions within Europe, 2) observations about business strategies; and 3) observations and recommendations for the role of government in enabling VSOs and conducting further research into their operation. This section discusses points that can be taken within these three sets of observations and recommendations.

### Barriers to VSO Transitions

The barriers to VSO operations and transitions within Europe are diffuse, but occur within a number of definable areas. These are: capital and banking barriers, trade and tax law barriers, labour law barriers, technological barriers, logistics barriers, and more diffuse cultural barriers. Each of these affects businesses in different ways and some types of businesses are better positioned to address these barriers than others. Large companies with a multinational or intercontinental reach have more options to find capital than a small business operating locally. Still, the relevance of any of these barriers for government policymakers at the local and European level is also quite difficult to define. Table 6.1 summarises the findings and reports of businesses about these different barriers and obstacles. The specific outcomes are addressed in the business and government sections below, with recommendations for action to address the obstacle or barrier, where appropriate.

In the area of the more diffuse question of cultural barriers, here the issues move into a more speculative or philosophical discussion. The climate in which the information revolution is developing is clearly different for the North America, Asia and Europe. A RAND study, reporting on a U.S.-Europe conference on the information revolution, noted that participants viewed Europe to be overall more risk-averse than the U.S. or Asia, and more cautious about making social or economic changes. The study says: "As a result, many more obstacles to change have arisen in Europe than in America, including a financial sector that is less supportive of small start-up companies." (Hundley et al. 2001). Moreover, the study noted that Europeans place a greater value on equality of outcomes than do Americans, which may affect the calibration of risks and rewards within the economic sphere. This also accrues to the labour sector, where it is more difficult in Europe to lay-off workers who have become redundant. While this may aid social welfare in the short run, the result for some businesses may be slower economic growth than in the U.S. or Asia.

**Table 6.1**  
**Barriers and Obstacles to VSO Operations in Europe**

Potential obstacle	Nature of impact on SMEs	Nature of impact on large companies	Ability of business to address	Ability of European Commission to address
Capital and banking barriers	These fall into two areas: one is capital needed to invest in the technologies for more virtual operations; second is the potential regulatory barriers to holding title to products together with virtual partners	Capital investments in software for internal management and external links can be very expensive. Many large companies are willing to make these investments with an eye towards ROI within 2 years.	Business needs to team with governments at national and regional levels to address the capital and banking issues associated with virtual operations	The EC can use its convening function to bring together different players around the question of regulatory and practical barriers here.
Trade and tax law barriers	Cross border problems hampering the exchange of good and hiring of skilled staff	Cross border problems hampering the exchange of good and hiring of skilled staff	Limited	The EC could examine the affect of these barriers on virtual operations; a special "tax free status" could be offered to qualifying virtual activities
Labour law barriers	Labour law restrictions can be weighty on SMEs, particularly when training requirements, social benefits, and long-term contracts add to the costs of employees	Affects the flexibility of companies to respond to market changes	Limited	The EC could work with national governments to harmonise labour laws, and to create exemptions to benefits requirements for VSOs
Technological barriers	Standards associated with "buying into" an SCM or ERP can be prohibitive for SMEs; the costs of accessing broadband can also affect SMEs ability to participate in VSOs. Anti-spam laws could hurt some small businesses	Access to broadband and spectrum could block or inhibit certain applications. An installed base in older technology could inhibit the larger companies. They may wish to seek tax relief for long-term investments.	Businesses have some affect on the standards used within industries; they should seek to have greater influence in the ITU and within other standards groups	The EC can act as a demonstration site for some advancing technologies. A European-wide study of open source software or protocols would help VSOs.
Logistics barriers	"Location matters" to the manufacturing and service sectors, so the question of where a company is located relative to the logistics needed to move product may be significant	Large companies have fewer constraints on location, labour, and transport of goods. However, they can also become in themselves a barrier for smaller companies.	Different types of businesses can work together with logistics suppliers to enhance the capabilities of the third party companies to work effectively in Europe.	The EC should initiate a study on the role of third party logistics suppliers within Europe.

It has been observed in the literature that the VSO business model emerged within North America, largely in California, and that the tenets of the business: agility, flexibility, rapid time to market and so on, are well matched to the U.S. system. Similarly, the Asian emphasis on quality and inventory reduction means that some parts of Asia are also well adapted to the VSO model. It is not clear that the European cultural system is consistent in all places with the VSO model. The stage 4 VSO business operations means that rewards are offered to the highest producers, some workforce will be highly unstable and easily laid off, and tax laws, competition policies, and standards will need to be more harmonized than they are today. Perhaps there is a third model of VSO operations that will emerge within Europe, different from the North American or Asian models, that can accommodate the new business model while still retaining European values.

## Observations on Business Activities

The survey conducted for this study showed that businesses see great advantages to incorporating VSO operations and related technologies into their business practices. Nevertheless, we found very few companies operating as fully virtual or smart organisations in the European context. This suggests that companies may be considering VSOs within a narrow definition of simply implementing ICTs into their business operations.

### Creating Competitive Advantages through the Use of ICT?

One of the key findings in this study is that the competitive advantage of ICT in VSOs is not just based on doing things faster and cheaper, but also by innovation: creating a competitive advantage through flexibility, adaptability and product differentiation. As ICTs are incorporated into business practices on a very broad level, it is becoming less and less likely that an enterprise will achieve any long-term competitive advantage by the use of those very basic ICT systems that are aimed only at improving process efficiency. Studies show that the short term advantage will quickly be dissipated as others in the same sector take the same steps: the end result will be generally high sectoral efficiency with corresponding cost reductions offering benefits to society but not to individual enterprises.

Accordingly, VSOs should be seen as a fully integrated system of efficiency, interconnection, flexibility, and market awareness. This concept is considerably beyond the SCM or ERP implementations that marked previous generations of the devolution of business organisation. More pervasive knowledge-based systems, enabling the full utilisation of all the skills and potential of all the participants in extended and flexible value system enterprises, enable endogenous innovation and thus produce a competitive advantage. The greater depth of innovation within the enterprise allows a Virtual enterprise to take a leading market position. Innovation research differentiates between three forms of innovation described below.

- R&D innovation: this is based on identifying and commercially exploiting R&D that has taken place within the firm or in research institutions. R&D innovation may result in the patenting of new products, but may also result in innovation in processes, organisation, or new delivery mechanisms.
- User-driven innovation: the primary source is strategic knowledge about new or existing markets and about customers. The purposes of innovation work will typically be to differentiate the firm from its main competitors through a combination of new products, individualised services, product adaptation, marketing, etc. This gives the company a stronger brand among the different customers. Innovation ideas are often identified by customers or employees with a particular understanding of market developments.

- Price-driven innovation: this targets the improvement of profitability by increased sales of existing products/services at lower costs per production/delivery per unit . The sources of price-driven innovation are price differentiation, efficiency in delivery, and logistics, for example through supply chain and innovations in ICT usage.

The case studies have shown a number of examples of how price-driven innovations have occurred through efficiency improvements in organisation, processes, and delivery mechanisms. To a certain extent the VSO organisation itself has in some cases led to what could be defined as user-driven innovations particularly in services applied. The study also shows there is a trade-off between levels of efficiency and employment security/job growth. Some increased efficiency is obtained at the expense of shifts in job skills required. Given the Lisbon Objectives for 2010 and given that most European enterprises are not R&D intensive at this stage, the study on VSOs has given us certain indication that once firms have reached a certain level of ICT capacity they are in a position to exploit this infrastructure beyond a price-driven innovation strategy, and they can put more emphasis on user innovation which again could lead to job creation or spinouts from the VSOs.

The empirical work on the different network types has raised some issues concerning technology and openness of the network and the risks of lock-ins due to lack of open standards, but no concrete evidence has been found in the study. The individuals surveyed for the project did not see standards of interconnection as a major problem for companies, and the case studies did not reveal this as a major problem. Thus, the issues hindering VSO transitions appear to be ones of practice within the value system itself. Certainly, time will eventually allow many of these problems to be solved, but too much time lost also means a loss in competitiveness, as North American and Asian companies make significant strides in increasing flexibility, driving down transactions costs, and speeding time to market. Within the case studies, we found that some practices are enabling a quicker transition for some firms:

- Build and promote flexible technological industry standards
- Use customized mature (“commercially available off the shelf” or COTS) software as much as possible to avoid the cost of custom coding, malfunction, and user problems. For most companies it is wise not to develop the system in-house, unless the business decides to be an IT leader
- Be aware of both internal (fraud, unauthorized employee access, etc.) and external (hacking, denial of service attacks, etc.) security issues and the impact it can have on business
- Develop a company-wide ICT-policy around core competitive advantages and focus on “need to have” instead of “nice to have” features to avoid an unrealistic or fuzzy scope
- Create a solid strategy where business needs of (future) network partners are taken into account
- ICT implementation should be aimed at getting sustainable competitive advantages, instead of investing in technologies which are quickly adapted by the sector resulting in quickly eroding profits
- Companies must explicitly think about the trade-off of first mover advantages and the use of immature technology: “do we lead” or “do we follow”?

Within the value system itself, we found that some lessons learned by early adopters of ICTs related to VSOs could be derived. They may have broader applicability:

- Ensure that implementation of ICT systems in different parts of the organization are properly aligned
- Create a clear mechanism to track and evaluate performance periodically, by quantifying important goals like “increase of customer base” or “increase customer satisfaction”
- Integrate ICT systems already in place.

### **Building Trust in a Changing Environment**

Organisations must be able to cope with the dynamics of the changing environment of forming and altering the network structure in which the VSO resides. Trust seems to be an important criterion for VSO operation. (Ertlanger 2003) Trust is built within the value system by a willingness to address problems quickly, to deliver products on time, and to provide feedback throughout the process. This involves both the strategic use of ICTs, as well as interaction among people. Finding a balance among these types of communication methods cannot be reduced to “best practices:” they will be highly case dependent. Nevertheless, businesses should keep in mind that VSOs, even more than traditional business, operate on trust.

### **Addressing Human Resource Issues**

We found that migrating through the “step-and-assimilate process” of becoming a VSO is accompanied by uncertainties, and requires a highly flexible attitude from both management and staff. For instance, internally, information flows will alter with respect to destination, channel and intensity, job profiles need to be revised, and new jobs need to be created. ICTs do not substitute for motivated and skilled employees, but rather empower them. At a minimum, companies must make sure that skills to implement the strategy are in place and sufficient comprehension about the project is gained in all relevant echelons. This implies a significant shift in training programs of current employees and the hiring policy of new ones. Our research points out, management should at least understand the following areas:

- Even more than in traditional companies, a VSO needs to keep track of the skills in-house, supporting the right team compositions and closing gaps between existing and needed skills.
- Skills gaps need to be responded to by stimulating a right environment for on-the-job training
- Employees should be encouraged to use and promote the ICT system by rewarding initiative and involving them in early phases of implementation
- Management should seek to build a corporate culture that supports the strategy where technological and human innovation is welcomed.

Within our case studies, for example, we found anxiety about job security. Although the experts polled for the study did not see substantial staff reduction as a result of VSO operations, this must be considered in the human resource context. Summarizing, we believe the following lessons can be learned:

- Create bottom up incentives (via e.g. department awards or budgeting) to incorporate networking structures as an interface within the value system.
- Design a clear communication strategy to staff and involve them in the process, making clear what they can expect from the changes and how it will affect their work.
- Assign executive project champions to ensure sufficient (political) support.

### **Generating Endogenous and Exogenous Knowledge Flows**

Being part of a dynamic and knowledge intensive network of organisations, the VSO can take full advantage of its position by capturing and reusing gained knowledge. Here virtual facilities are an essential requirement for smart business. More pervasive knowledge-based systems, enabling the full utilisation of all the skills and potential of all of the participants in extended and flexible (value system) enterprises, enable endogenous innovation and thus produce an enduring competitive advantage. The greater depth of innovation within the enterprise allows such a virtual enterprise to take a market leading position, and to maintain it. While the skill mix may change, the overall result can be a net increase in jobs within Europe.

Systems which are not only pervasive but which are also open and inclusive (e.g. to the input of customers; of critics and reviewers; of students, etc.) enable exogenous innovation that is potentially more radical – no longer doing the same things better, but now doing quite different things. This is the Smart enterprise situation: Given the right conditions, which include “agile” attitudes and growth-orientation, this can produce enterprises which are actually market creating. If combined with the Virtual capabilities, the resulting VSO can in principle be both market leading and market creating, although such enterprises are as yet not widely observed.

### **Observations on Government Action**

This study demonstrates that VSOs are a response to a highly complex marketplace, one that requires flexibility in organisational structure and strategic use of knowledge in a networked environment. ICTs and the information infrastructure are only one component of this. Other components are a trained and aware labour force, a flexible financial system, and on-the-ground logistics for the transfer of goods. Just as the complexity of business operations and the enabling features of ICTs have challenged businesses to restructure, so the restructuring of business can be expected to challenge policy entities to restructure both in policy and in structure. These changes can be anticipated and planned for, at least to some extent, by consideration of the needs of the VSO in Europe (see Summary section “Should VSOs Be Stimulated? If Yes, How?”).

Assistance can be offered directly with aid to software implementation, management changes, and labour training. A focus on open systems software may be an aid to small businesses or entrepreneurs seeking to operate on a virtual basis. Management support, such as training classes and opportunities to network with other types of businesses (such as logistics suppliers), may be an aid that could reduce risks at the management level. It is possible that the abilities, attitudes and ambitions of senior management are crucial to the enabling of exogenous innovation (and thus to the generation of competitive, market leading and market creating enterprises) as are the technical components: government can aid here by studying good practice as well as encouraging networking among leading practitioners at the management level. An “open forum” for discussing good practices, was how one of the survey respondents put it. Finally, labour training in software such as SCM or ERP, to build skills in networking and use of ICTs for efficient operations, may also be an aid to industry.

Assistance can also be offered indirectly by creating the conditions for favourable business practices. This is a particular lesson to be learned here in the implementation of knowledge management in enterprises: concepts such as the “Enterprise University” which are aimed at creating endogenous innovation but which are closed and have limited access may actually work against the emergence of exogenous innovation with Europe. In such cases, the appropriate degree of openness of access has to be carefully considered. Similarly, Networks of Excellence that are confined within a single group of “people like us” will necessarily experience the same limitations. The case studies provide little evidence that the VSOs at this stage have capabilities or are ready to exploit the network for user-driven innovation purposes or indeed R&D driven

innovation. Broad, cross-sectoral networking and better knowledge transfer between R&D and industry can be a real benefit to innovation: government in its role as convenor can make a difference here.

Current policy is still largely designed to support traditional, linear manufacturing systems. Tax systems, regulatory structures, contract law and labour training all need to be re-examined in light of the emergence of dynamic network operations within VSOs. That said, on an overwhelming basis, the participants in the opinion poll conducted for this report did not see significant barriers to VSO formation existing within labour or tax laws. (Each more than 95 percent said “no” to the existence of barriers.) Participants in the 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);
- Stimulate knowledge transfer: make more research and development outcomes available to business, particularly small and medium sized businesses (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).

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

- Foster adoption of “entry software” for small, medium 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;
- Help with data assurance mechanisms to enhance trust in information passed through electronic systems within the value system;
- Aid in the development of benchmarking and assessment of VSO operations;
- Examine VSO operations at the sectoral level to see if there are differences affecting operations based on sectoral dynamics;
- Review labour laws that may inhibit companies from laying-off workers or from hiring temporary labour – help ensure flexibility in the workforce;
- Conduct research into genetic algorithms that show promise in solving advanced planning and scheduling issues facing VSOs.

## **The Longer Term Future: VSOs in Europe**

VSOs offer an attractive and exciting way to conduct business. It can be argued, and we have discussed the possibility in this report, that many of the changes in the virtual-smart continuum are inevitable for most businesses. The complex global marketplace combined with the possibilities and opportunities offered by ICTs mean that most companies will take on at least some of the operating principles of VSOs.

As a thought experiment, consider the European marketplace in 10 years' time. If many companies shift towards a VSO method of operating, a number of changes will be evident:

More people will be changing jobs more frequently, or, more people will be part of what could be called an “agile workforce” – they may be self-employed, they may not have an “office,” they may provide their own benefits and pay for their own training.<sup>12</sup> They may not be paying into traditional pension plans. This may mean that attention to workforce issues such as ease of insurance or subsidies for training may be needed. Pension plans may need to be re-thought. An agile workforce may also be one that is *unstable*, or where people can expect to be out of work at a higher frequency rate, and perhaps a shorter time, than is the case today. This will make it difficult to count “unemployment” as a feature of an economy. An unstable or rapidly shifting workforce may put pressure on unemployment insurance to react quickly to the changing marketplace. It may also have social effects similar to those in the U.S., where, a majority of families have two income earners. This two-income-earner family helps build income stability for a family over time in an economy where people are often changing jobs. However, it means that social services such as day care, after-school care, and elder care become even more important.

One characteristic of VSOs is fast and flexible response to changing requirements, with corresponding need for flexibility in staff utilisation. Model VSOs are able to expand, contract, or outsource their work force in response to actual demand. This need for flexibility inevitably creates the potential for tensions to arise when it comes up against the commitment to responsible employment practices that typifies the best European companies. There is a double paradox because the population of companies who lead in VSO implementation are largely drawn from that population of companies who also lead in responsible employment.

Dealing effectively with this human resource flexibility paradox is essential for realising the potential of VSOs. The rise of VSOs (unlike the generality of ICT implementation) does not mean that fewer people overall will be employed; more will be employed, but by a larger variety of companies, and possibly as contract labour. This is because a country or economic sector supercharged by VSO best practices will experience higher volumes and greater economic activity. (See below Will VSOs Contribute to EU Competitiveness?)

In the largest corporate entities, what we observed by way of dealing with the need for labour flexibility, was a degree of internal ‘intermediation’ in which the group as a whole maintains the fullest responsibility for employees’ well-being (including career progression as well as the more obvious issues of security of employment, health benefits, pensions etc) whilst individual VSOs within the group expand and contract their dedicated human resource in a fully flexible manner. For smaller entities, however, this degree of internal intermediation is not realistically attainable and what is required is probably some degree of external intermediation (e.g. through agencies etc). Additional RTD work is required to complement existing research here (e.g. Shapiro, Jones and Suava 2004) if VSO growth in smaller companies is not to be stifled by inadequate labour market arrangements, and also if VSOs are to avoid the taint of association with insecurity of employment.

Businesses will need greater bandwidth through cable and wireless connections than is the case now. If businesses move towards the VSO model, then they will draw increasingly upon interconnection through the Internet and the Worldwide Web. These connections will not be limited to Europe. In fact, as most companies move towards the VSO model, it is possible to imagine that the pressure on trade policy to remove trade barriers will come strongly from the business sector. If it makes sense to bring in parts from Asia, and they must arrive within hours

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<sup>12</sup> It is also possible to imagine that the labour force may resist these changes. Resistance to changes in business structure and operations, due to social transactions costs, could slow the growth and competitiveness of European businesses.

of being ordered, then the shipping, duty, and processing of these parts at traditional trade “borders” will become an even greater issue affecting business competitiveness.

New software tools will be needed, and the many businesses will press for open systems.

Business units may completely change definition from the way we understand them today. Rather than being defined by co-location of operations or location of headquarters, or even by a product line, a business entity in the future may be more defined along branding lines – small companies or individuals join larger franchises of business to acquire branding rights and linkages, but otherwise have few hard ties. This will have implications for how we “count” business activities, and for how business is taxed, how economic growth is measured, and how countries view their “national champions.”

Business activities will become highly transparent, due to use of the Internet and the Web. As consumers and clients can use the Web to test prices and check quality of products, to see if a business entity is reliable, or to check past history, it is possible to imagine a much more highly transparent set of business functions. Companies may be pressured to put more information into public hands to demonstrate acceptable business practices. This can also have a downward pressure on prices, and subsequently on wages. The pressure on costs will accrue because people will be able to check the costs of products coming from anywhere in the world. Thus, competitors from developing countries who can get on the Web and where they have access to overnight shipping, will be competing with other businesses all over the world. This may mean that European businesses either must become more innovative to stay ahead of the pack, or that they will see their profits bargained down to the lowest common denominator.

Completely new forms of business contracts and agreements will emerge, testing the ability of courts to adjudicate them. As business use the Web, and have a click-point contract to assure a relationship, and as these relationships are established anywhere in the world, courts that handle business questions will also be transformed to deal with new forms of business agreements.

#### What Will Be Required for Future VSOs?

EU-based VSOs are likely to make the EU more competitive. By category, here are some observations for what is required within the EU over the longer term and what to expect.

**Connectivity.** Persistent, high-quality, wireless, low-cost, broadband Internet connectivity will become pervasive and core to the success of any business. Expect to see the rise of pervasive RFID in global and local supply chains of all types. Privacy issues will emerge as consumers realize they can be tracked when wearing or housing RFID chips. It is likely that technology solutions will eventually mitigate these concerns, as RFID chips will be made to carry activation codes consumers can control through the Internet and low-cost devices.

**Hosted Databases.** Open, Internet-hosted databases (rather than closed client-side databases) will become the norm, not the exception, allowing VSOs and their trading partners to thrive without geographic restrictions. Companies will become more confident with hosted, off-site storage of data and applications. There will be a rise in Application Service Provider (ASP) delivery of software that today people are used to installing on their personal computers or company servers. Expect to see a lowering of IT requirements; the most powerful software in the world is available today over the Web, not—as in years past—installed on mainframe servers in client locations.

**Data Portability.** Common data standards will be driven throughout the world by global trade, and companies seek VSOs’ competitive edge will adopt these common standards. Expect data standardization to continue at its current rapid pace and to prevail without the help of governments.

**Labour.** The EU must show a willingness to examine labour laws and evaluate the fiscal and political costs of an insecure labour force or higher churn as VSOs out-source work to cheaper

labour markets, leaving native labour looking for new jobs. VSOs need to be allowed flexibility not only to out-source labour, but to strictly index all labour to cost-allocated projects. Expect to see VSOs using highly portable, active business information and collaborative software to seek the world's lowest cost labour.

**Lowest Cost Labour.** Weighting shareholder pressure more heavily than political or social pressure, VSOs will use their virtual abilities to seek the lowest cost labour available for a task. As business data gains higher portability, expect to see the diminishment of national allegiances and preferences for local trading partners. Also expect to see worthy capitalist models of linking availability to Third World labour with progressive, incremental human rights demands and "living wage" requirements; consumer involvement and advocacy will rise in these areas as well, especially with increased transparency to labour and trading practices.

**Migration to VSOs.** Few existing companies will simply recognize the merits of a VSO and migrate there on their own. Rather, they will be incrementally drawn into VSO practices by cross-border and native market leaders who are using VSO practices to gain competitive advantage. The question is: Will they be nimble enough to change and respond to this market change, and will they have the models to aspire to when seeking direction during that transition. Start-ups will learn the lessons of fledgling VSOs and adopt COTS VSO solutions that were tested in the marketing place by companies reactively seeking to attain commercial viability.

## Policy Research Needed to Further Explore VSOs

Future research may profitably focus on the problems of business as well as on understanding the network dynamics driving the VSO transitions. Specifically the following areas appear to need additional research:

1. The *entry* problems of businesses that start up using the VSO business model (rather than transition from an old economy model). What are the obstacles facing entrepreneurs who want to start a virtual organisation? Since we only found two micro businesses that had begun as VSOs, the entry phase may present difficulties.
2. The *transition* problems of businesses moving along the "step-and-assimilate" process. What are the obstacles that management faces when they seek to move their (existing) company to the next stage of VSO operations? Do these differ by sector? Are they related more to technology or to management practices? Our research suggests that latter, but this needs to be confirmed in further socially-based research.
3. The role of *indirect policies* on VSOs (tax, cost of capital, trade, and labour policies) also needs further assessment and scrutiny. To what extent are the transitions within the "step-and-assimilate" process hindered by any one or a combination of these indirect policies? While our expert poll did not view these policies as obstacles, the case studies and expert interviews suggested that, at times, these policies can in fact be obstacles to the transition. This requires further economically-based research.
4. Further testing of the *role of "smart"* in the VSO operating scheme. The hypothesis that "Smart" is an end-of-the-line outcome of "Virtual" is not upheld: there is clear evidence that the Smart enterprise can emerge in parallel with the Virtual, and that they need not be interdependent.
5. Drivers for *user-driven innovations* within VSOs. This should include a mapping of the VSO in its extended string in order to capture processes and experiences from the different perspectives and the dynamics driving these, rather than just outcomes.

6. How to measure VSO *progress* for instance in close collaboration with the European Community Innovation Survey (CIS) in order to create time series data, thus allowing longitudinal studies.
7. As mentioned above, the role of *management* in enabling VSO transitions needs additional research. It is possible that the abilities, attitudes and ambitions of management are crucial to enabling exogenous innovation as are the technical IST prerequisites: future research in this field should have a heavy socio-economic bias accompanying the technical development. Nevertheless, some technological issues remain to be investigated, such as the role of middleware in facilitating compatibility between networking organisations.
8. Finally, a thought piece about the “*next generation*” of VSOs as part of a European Foresight (both technology and management) would prove an interesting experiment in long-term thinking that may provide insights into policy and technology choices that may emerge over the next decade or two.



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## **Appendices**

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## Case Study Methodology and Description

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This appendix contains information on the case study methodology and some extra insights gained from these. Furthermore, the 9 case studies that formed some of the empirical background for the conclusions reached in the final report are included as an annex.

### Empirical Foundations for the VSO Project – Case Studies

As part of the analytical work within the VSO project a number of case studies were performed. These were intended to provide practical input to the more quantitative work done in the start of the project. The desk-research work was based on a number of different sources, including the following EU-sponsored projects:

- eBusiness Marketwatch (<http://www.ebusiness-watch.org/marketwatch/>)
- SIBIS (*Statistical Indicators Benchmarking the Information Society* - <http://www.empirica.biz/sibis/>)
- BEEP (Best eEurope Practices - <http://www.beep-eu.org/>)

Together with other material, these projects provided insights into the penetration of VSO in Europe as well as provided impact to the case study methodology (*indicators for exploring into the benefits and shortcomings of VSO operations*) and possible examples.

After the initial data gathering work, a common case study template that should govern the empirical work was developed through close co-operation between the VSO project partners. The case study template was structured as follows:

1. **Short information on the type of company, environmental factors and customers/suppliers** (in order to understand the business and its environment and thus form the basis for assessing whether or not the VSO-operations made sense in terms of improved competitive advantage)
2. **The Virtual operations** (which part of the company is involved in Virtual Smart operations, why, how, when and contractual/legal issues)
3. **Reasons for entering into the Virtual Smart operations** (why did the company engage in virtual operations instead of creating or maintaining the capacity in-house?)
4. Relationships between the various partners involved in the virtual operations and characteristics of information exchange.
5. **Technology** (Which platforms are necessary and used in order to facilitate the technical environments and standards for companies working together in virtual operations), and finally
6. **Social issues** (How the described operations impact employees, labour market and not the least individual and organisational competence issues).

It was never intended, nor possible, to make the case studies representative in any way (*either in terms of sectors, size, geography or technology platform*). Therefore it was decided by the project team to look for what we called “good examples” (*intentionally avoiding the term “best”, as it would require some kind of non-existing benchmark*). The companies selected for case studies should moreover represent existing and more or less traditional companies. In the literature there exist many case studies of highly innovative companies who have implemented virtual smart operations (*the best known examples being amazon.com and DELL computers*). We sought to avoid replicating the work of other researchers and at the same time include companies who had a rather close resemblance to existing companies in Europe – thereby securing that others can learn from the VSO-project experiences.

Based on the experience by the project partners, a search for likely case study companies was started. The search was not only based on inside sources, but also via interrogation of national websites (*most countries have various e-awards, where winners could make good candidates*) and experts. Furthermore, the cases from the BEEP project were a good source for inspiration. However, it was decided to avoid direct inclusion of BEEP-cases, as we would hereby replicate previous work. This is not to say that the BEEP resources were not included in the project, but this was limited to background information.

**Service/manufacturing and fixed/loosely coupled networks:** Finally, some criterions for inclusion were established. First and foremost it was expected that the final case study list should have a sensible balance between *service* and *manufacturing companies*, regardless that this distinction in some instances not made much sense (*for instance, a manufacturing company could use virtual smart operations in relation to its service activities. This was found in the Novo Nordisk Service partner case study – a company which is rather difficult to place on a service-manufacturing continuum*). Furthermore, we were at the lookout for different types of network typologies in a narrow sense. We made a distinction between relatively fixed networks and more rigid/fixed networks. The basis for these two selection criterions was that we had a hypothesis that different types of network typologies suited best different needs and to some extent that there would be a difference in the preferred network settings for respectively service and manufacturing companies. The expectation was, that highly flexible service companies would have a preference for highly flexible network constellations, where new partners can be involved and replaced continuously – this due to the very fast changes in market circumstances. On the other hand it was expected that relative stable manufacturing companies would be more oriented towards rigid network forms, where focus is on cutting costs (*improve process efficiency*) and that this was mostly obtained through *digitalisation* of existing links in the network.

Even though the VSO sample is not representative in any way it can be argued that our initial expectations have been confirmed in regard to the correlation between company basis (*service/manufacturing*) and network typology. It seems, that manufacturing companies are more focused on improving process efficiency through a digitalisation of the linkages between the key network node (*the production facility*) and its partners (*suppliers, customers*). On the other hand, the service companies are interested in maintaining flexibility through open networks, where partners can be continuously replaced as a function of the fast changing requirements posed upon the company. However, from this it does not follow that we can end all discussion and establish an eternal link between network typologies, company characteristics and competitiveness. The data is too limited, it is difficult to make a clear distinction between service and manufacturing and finally we saw an example on how a manufacturing company, based on their initial experienced with virtual smart technologies, has more or less changed from being a manufacturing to a service company! (*The Oestergaard Auto case study*).

However, the empirical work on different company and network types did raise some issues in regard to technology and openness of the network. As mentioned above, the manufacturing companies were more oriented towards the more fixed networks and this was partly due to the relatively stable development in environment (*relationships with both customers and not the least supplier were often relatively stable*). VSO was seen as a digitalisation of the existing operations, which improved efficiency, often rather drastically. However, there is an ever-existing risk of “lock-ins” – that is, companies who have invested in technology based on certain standards that cannot communicate with other systems (*that could be with suppliers and even more crucial with customers*). Crucial examples on lock-ins have not been found in the VSO case studies, but has been highlighted by other sources as a potential problem. This puts focus on the fact that even though a company engages in relatively fixed and stable networks, they need to be open for communication and data interchange with others. If this is not possible, then the company can be excluded from the market – not because they do not have a competitive product, but simply because they do not have an adequate technological infrastructure that allows integration and data interchange. Some customers (*companies/B2B*) are simply not ready to engage themselves in a bureaucratic transaction process with companies who may have a good product, but a poor digital infrastructure.

Finally, back to selection criterions, it was of course also evident that companies (*on a right managerial level*) could only be included in so far that they were ready to speak with the researchers and provided information on the needed aspects.

## The Case Studies and Selected Lessons

Based on the above criterions, a total of 9 novel case studies were performed by the researchers in the VSO team (*all cases are available in full length in the enclosed annex*). The case studies includes:

- Global Recycle, Glasgow, Scotland. Service company with loosely coupled network.
- Bonfiglioli group, Italy, Manufacturing company with loosely coupled network.
- I-KnowLaw.nl, Holland, Service company with loosely coupled network.
- Koncraft Manufakturen, Manufacturing company with fixed network.
- Rationel Windows, Denmark, Manufacturing company with fixed network.
- Novo Nordisk Servicepartner, Denmark/global, Service company with fixed network.
- Oestergaard Auto, Denmark, Service company, fixed network.
- B&O Bang & Olufsen, Denmark, Manufacturing, fixed network.
- Rockwool International, Denmark, Manufacturing, fixed network.

It should be noted, that these case studies were not the only empirical basis for the VSO project, as a number of expert interviews were also performed and moreover the significant amount of case studies developed by the BEEP project.

The discussion on manufacturing vs. service, network typologies and technology lock-ins has already been described in the above. However, two issues remain (*as annex to the discussions in the final report*). These aspects are specific information on how VSO impacts financial aspects and competitive advantage and not the least whether or not companies actively learn from their virtual operations.

**Cost/benefit:** In regard to VSO impact on financial characteristics, it was deemed impossible to make a direct measurable link between VSO engagement and financial surplus. However, this is not to say that this does not exist – on the contrary. In most case studies, the respondents highlighted good return on investment on ICT expenditures and furthermore, and perhaps most importantly, they often highlighted that the move towards network and digitalisation of processes

has had a profound positive impact on their competitiveness. It is always impossible to say what would have happened if no investments had been made but, for instance, Danish Rational Windows found that the new technologies formed the background for their whole existence! If they had continued without VSO it was likely that they would go out of market – simply because their prices would go up (*VSO drastically minimised transaction costs and bureaucracy*) and they would not be able to deliver the services they can today. Another example is Rockwool – this is a very big company with only a limited number of significant competitors. It is not likely (*at least within a short time span*) that they would go out of market if no investments had been made in ICT. However, similar to Rational Windows, the investments in ICT has reduced transactions costs and improved process efficiency. Moreover, the initial experiences have resulted in an ability to provide new services to the customers (*they learn from the first experiences*).

**Critical mass and parallel structures.** However, as stated in the above, it has not been possible to find direct measurable cost-benefit analysis from the case study companies. Some data could be taken from the annual reports, but it is impossible to make a link between these costs and the profitability of the company as many other factors play a role. However, it should be noted that most cases included are financially prosperous. There is one exception, which is the Dutch I-KnowLaw.nl. This company is facing some problems and this is related to the missing critical mass, which face many Web-based service companies. It is a well-known and still existing dilemma that service companies need to have some content before they can attract customers. On the other hand, content generation is expensive and it is difficult to generate this before customers are “in the shop – and not in the shop but actually after they have left the cash desk”. This is a dilemma facing the new entrants, which is not found to the same degree for established companies – they have the inventory, suppliers/content generators and customers in place. However, these companies have other problems, which is closely related to “confidence in systems”.

Companies such as Rational Windows and Oestergaard Auto implemented VSO to improve process efficiency – that is, in the first round, digitising existing procedures (*subsequently when the companies learn from their systems, they change procedures to something smarter! Thus it often starts out with digitising the existing and subsequently changing the existing procedures and support this via ICT*). When doing this, we found a tendency to have parallel structures. For instance in terms of maintaining stock. The companies had two systems. One based on human counting of parts, which was reported in a paper based file systems and another structure based on ICT (*what is stock status, what has been sold and what have come in from suppliers and it is always possible in a second to generate a current stock report*). It is evident that the ICT based form is the most efficient, but it was often found that senior management did not have confidence in the ICT generated reports, because they for some reason were inaccurate. Inaccuracy emerges when the daily users of the systems (*the ones who fill in input*) does not have enough *data-discipline*. Thus, when it comes to training related to ICT implementation it is not only a question of educating the end-user end, but also the employees who have to continuously fill in data.

**Learning from past experiences.** From how we saw VSO implementation take place in the case study companies it was evident that the companies learned from their past experiences. This could take several forms – sub-optimising, inclusion of new fields and/or expansion of existing technologies or a move into completely new business areas.

The companies start out with small, but crucial aspects, and from here the projects expand as the ICT responsible and managers gain insights into the opportunities (*and gain confidence in the systems not the least!*). For instance the company Rockwool. They started implementing ICT to improve the internal data-exchange between different departments. They learned that this improved communication speed and new information emerged. Especially the latter was relevant. In the first round the customer service employees now has a system they could use when

customers phoned in. However, management found that it was much better if the customers themselves could look up this information – they had to do it themselves, but it was possible 24/7/365. Therefore, the data created through interlinking internal systems was now opened up for external access via the Internet. As customers learned this (*and a critical mass of Internet users were established among the customers*) it was found that much more services (*both existing as well as new ones*) could be implemented at the homepage. Thus the project expanded through learning (*and creation of critical mass*) from linking existing systems to opening this up to customers and create new services.

And even more radical example is found at Oestergaard Auto. This company also started up with using ICT to improve existing processes (*mainly related to internal ordering and stock management*). Similar to Rockwool it was found that the ordering system was so easy to handle so it was deemed appropriate to open this up directly to customers. However, the problem was that no critical mass existed – the number of customers having experience with Internet ordering was minimal. Therefore Oestergaard Auto focused on education of their customers (*the salesmen no longer sold spare parts but were not competence development consultants!*) and providing the necessary ICT infrastructure (*a computer and Internet connection*). After initial success with this, the company learned that a whole new series of services could be developed and offered to the market via the now existing infrastructure. It was found that the customers needed a simple book-keeping system and this was developed and implemented at the same platform as the ordering system. Thus today, Oestergaard is still selling spare parts, but more and more of the turnover comes from sale of Internet-based bookkeeping systems.

Thus, there is some evidence from the VSO case studies that companies actively learn from their experiences with ICT and that this takes part in several phases, where the companies gets more and more advanced. Often it starts out with digitising existing procedures, but as a critical mass is established and management gains confidence and insight in the system capabilities we see that the solutions becomes more and more advanced.

## SAP Customer Successes – Case Studies

1. **From mySAP Supply Chain Management:** Automotive, Chemicals, Consumer Products, Engineering & Construction, High Tech, Mill Products.  
<http://www.sap.com/solutions/scm/customersuccess/casestudies.asp>
  - Automotive: Volvo Construction Equipment -- One of the world's leading producers of construction equipment reduced shipping lead times by 43%, reduced inventory levels by 53%, increased sales by 89%, and enhanced per capita revenue from \$85,000 to \$340,000.
  - Chemicals: MG Industries -- This leading North American industrial gas company improved forecasting accuracy to more than 95%, optimised resources by using distribution scenarios, and improved its gross margin by 3.4%.
  - Consumer Products: Fischerwerke -- This company increased production capacity by 10%, achieved nearly 100% on-time, in-full delivery, and realized a 10% increase in output.
  - Engineering & Construction: KAESER Kompressoren -- This innovative leader in the compressed air industry used mySAP SCM to reduce lead times, lower inventory levels for spare parts by 23% in its subsidiaries, and achieve a 100% service level for ex-stock spare parts.

- High Tech: Palm -- The world's leading provider of handheld computers reduced planning cycle times by 50%, lowered channel inventory by 32%, and decreased cash-to-cash cycle time from 23 to 14 days.
  - Mill Products: NIBCO Inc. -- This international leader in the flow control industry increased its perfect order rated from 29.5% to 87%, improved on-time delivery to 99%, and lowered annual distribution costs by more than \$10 million.
2. **From SAP Nederland, various solutions SCM, CRM, etc.:** Chemicals, Education, Engineering & Construction, Financiele Dienstverlening [financial services], Health Care, High Tech, Insurance, Media, Public Sector, Retail, Service Providers, Transports, Utilities) – No quantitative data immediately available.  
<http://www.sap.com/netherlands/oversap/klanten.asp>
- Health Care: Isala Klinieken, Simplified the merger between two smaller hospitals, streamlined the logistics, purchasing and service aspects of the hospital.
  - Insurance: Interpolis was forced to improve the productivity of its own accounting department. In addition, there was an urgent need for management information. By choosing SAP software the company killed two birds with one stone.
  - Media: Aldipress: primarily used SAP to enable it to make forecasts and look at the economic “health” of the company.
  - Retail: Guilbert, created a SAP based e-business environment, to facilitate systems between important customers, + using the SAP online store.
  - Transports: Rotterdam public transport Company RET: Used SAP to allow the different aspects, infrastructure, management, maintenance, etc. To be linked by one system.
3. **From MySAP customers relation Management:** Automotives, Chemicals, Consumer/Retail, Engineering & Construction, Financial Services, High Tech & Electronics, Pharmaceuticals, Public Sector, Service Providers, Telecommunications, Textiles, Utilities) <http://www.sap.com/solutions/crm/customersuccess/>
- Financial Services: BKK Baden-Wurttemberg, Germany
  - Pharmaceuticals: AstraZeneca, Germany  
ratiopharm, Germany
  - Public Sector:
  - Service Providers: Amadeus, France  
Messe Frankfurt, Germany
  - Telecommunications: Netscalibur, Italy
  - Textiles: Comasec France  
Vorwerk, Germany
  - Utilities: Energie AG, Austria  
Romande Energie, Switzerland

### mySAP SCM at Fisherwerke

- Manufacturer of construction anchoring technology. Due to the stark opposition Fischerwerke encounters in this line of work they decided to implement SAP's Supply Chain Management system. This led to improvements in customer service, inventory and productivity.

- SAP's SCM allowed the company to remain competitive even though the manufacturing activities all took place in high-wage-cost Germany.
- The reason Fischerwerke refused to switch production to low wage countries was because they wished the production sector to remain close to the source of technical innovation.
- The SCM system allowed for an improvement in planning, a reduction in cost and a superior customer service. Basically, along the same line as other companies, they tried to lower the quantity of in-house stock, optimize machine use, minimize necessary workforce, etc.
- Fischerwerke invested heavily in this SAP technology though it plans to break even within two years.
- They haven't as yet, though are planning to integrate customers, suppliers and transportation partners into their supply chain.
- In terms of a success story for SAP this is a good case study, but for our project this company isn't nearly as far along as some of our other examples. Getting the internal system integrated is one step in the right direction, but as yet, this company doesn't have any real up- and/or downstream integration to speak of.

### **FAG Kugelfischer**

- Company specialized in roller bearings. Large company 18,000 employees worldwide, 450 in FAG Sales Europe.
- FAG Sales Europe used CRM - Customer Relationship Management - to integrate the customer base of 4000 customers and to integrate with the already existing SAP R/3.
- Made downstream integration more efficient, field sales employees had access to up-to-date, consistent customer data, etc. In truth the integration with the actual customer was not changed by this system, rather the way the customer's data was gathered, presented and evaluated was changed, for the benefit of the customer as well obviously.
- This CRM system is only the first stage and FAG Sales Europe is planning to connect mySAP CRM to SAP's data warehouse solution, though this will still classify as internal integration.
- Expect a return on investment in less than two years.
- Some goes for FAG as for the previous company, upstream and downstream integration is hardly touched as a topic.

### **Danfoss GMBH**

- 19,000 worldwide, 2,500 in Germany, manufacturing, retail and installation of heating control products.
- Like FAG Sales Europe, Danfoss already used SAP R/3 and decided to implement CRM. Same story as above really...

### **Banco Urquijo – 57 Offices in Spain**

- mySAP CRM provides a number of tools to meet this banks requirements:
- Agenda management
- Customer management
- Potential customer management
- Product management
- Activity and commercial action management

- Alarm management (idle accounts, negative balances, etc.)
- Once again nothing on upstream or downstream integration with suppliers and customers.

#### **Netscalibur – Internet Service Provider**

- Provides three services.
  1. Internet connectivity for enterprises.
  2. Housing and hosting services.
  3. Mail service outsourcing.
- Implemented SAP CRM for an effective system for managing all our administrative and financial workflow.
- No difference really with the above success stories, there is no mention of further virtualness.

#### **GEW Rheinenergie**

- Same story as the previous ones, used SAP CRM and mySAP Business Intelligence to allow seamless integration within the company, but no mention at all of further integration.

## Web-based References

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### Porter's Five Forces

<http://www-mmd.eng.cam.ac.uk/people/ahr/dstools/paradigm/5force.htm>  
[http://home.att.net/~nickols/five\\_forces.htm](http://home.att.net/~nickols/five_forces.htm)  
<http://www.investopedia.com/features/industryhandbook/porter.asp>

### Warehouse Management

<http://www.accpac.com/products/awms/>  
<http://www.montego-sys.com/warehouse.htm>  
[http://www.inventoryops.com/warehouse\\_management\\_systems.htm](http://www.inventoryops.com/warehouse_management_systems.htm)

### Enterprise Resource Planning

<http://www.cio.com/research/erp/>  
<http://www.jdedwards.com/>

### Supply Chain Optimisation

<http://www.sas.com/solutions/supplychain/index.html>  
<http://www.gsca.com/>  
<http://www.arcweb.com>, <http://www.arcweb.com/research/studylisting.htm#sc>

### Smart Organisations

<http://www.cordis.lu/ist/ka2/al22.htm>  
<http://www.cordis.lu/ist/ka2/rmapsmartorg.html>  
<http://www.roundrose.com/smart3.html>

### Additional Internet Sources and Sites

<http://www.gartner.com>  
<http://www.virtual-organization.net/>  
<http://www.ejeisa.com/nectar/update/stories/1999072002.htm>  
<http://www.cs.tcd.ie/Virtues/ocve98/proceedings/009.html>  
<http://www.virtual-organization.net/files/articles/Saabeel-Verduijn-2002.pdf>  
<http://www.ejeisa.com/nectar/update/stories/1999072002.htm>  
<http://www.ejeisa.com/nectar/update/stories/1999072003.htm>  
<http://cic.vtt.fi/projects/voster/public.html>  
<http://www.thinkcreative.org>  
<http://www.inderscience.com/catalogue/n/ijnvo/indexijnvo.html>  
<http://www.cordis.lu/ist/ka2/rmapsmartorg.html>



## Glossary

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### **ASP** – Application Service Providers

In most cases, the term ASP has come to denote companies that supply software applications and/or software-related services over the Internet. But an airline company, or a power company could be seen as an ASP as well. Central importance of an ASP is the low cost of entry and the short setup time.

### **Beep** - Best eEurope Practices

The Beep project will collect, analyse and refine best practices in a variety of socio-economic areas, by collecting case studies and coding them according to a wide variety of indicators. This will result in an extensive Beep Knowledge System relating to employment and skills, the digital SME, social inclusion and regional cohesion. <http://www.beep-eu.org/>

### **BPRE** – Business Process Re-engineering

“By mapping the functions of the business process, low value functions can be identified and eliminated, thus reducing cost. Alternatively, a new and less costly process, which implements the function of the current process, can be developed to replace the current one.” (from: <http://www.dfca.org/bus/bpre.html>)

### **CRM** - Customer Relationship Management

“CRM focuses on managing customer relationships well beyond automating sales, marketing and customer service. J.D. Edwards CRM includes Sales Force Automation, Marketing Automation, Partner Relationship Management, Service Management, Contact Center, Business Intelligence, Customer Self-Service and Advanced Order Configurator.” (from: <http://www.jdedwards.com/public/0,1413,0%257E133%257E,00.html>)

### **E-Business** – Electronic Business

Business that predicates itself online. Selling goods, or sharing information.

### **E-Commerce** – Electronic Commerce

Commerce that goes on online, Internet business between firms and individuals.

### **ERP** – Enterprise Resource Planning

ERP attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments’ particular needs. [www.cio.com/research/erp/](http://www.cio.com/research/erp/)

### **ROI** – Return on Investment

Attempting to calculate the potential of an investment through various methods. See for instance: <http://www.computerworld.com/managementtopics/roi/story/0,10801,78511,00.html>

**SAP** – Systems, Applications and Products in Data Processing

The largest inter-enterprise software company and the third-largest software supplier, SAP is the recognized leader in e-business solutions. [www.sap.com](http://www.sap.com)

**SCM** - Supply Chain Management

Similar to SCO, prudent management requires optimisation.

**SCO** – Supply Chain Optimisation

Basically optimising, not just different areas within the supply chain, but the chain as a whole, interaction between the different chains is crucial here, not just the specific improvement of one small area. [www.sas.com/solutions/supplychain/index.html](http://www.sas.com/solutions/supplychain/index.html)

**SEC** – (US) Security and Exchange Commission

The primary mission of the U.S. Securities and Exchange Commission (SEC) is to protect investors and maintain the integrity of the securities markets. This may provide useful information when we have names of specific companies. It did not seem like such a useful tool to browse for groups of countries. <http://www.sec.gov>

**SIBIS** - Statistical Indicators Benchmarking the Information Society

Project on Electronic commerce (E-commerce)

**SME** – Small and Medium Enterprise

**SRM** - Supplier Relationship Management

SRM offerings go beyond strategic sourcing and e-procurement to optimise the relationship between enterprises and their suppliers— allowing you to compete more effectively. (from: <http://www.jdedwards.com/public/0,1413,0%257E133%257E,00.html>)

**VO** – Virtual Organization.

**VSO** – Smart and Virtual Organization

As working definitions for these terms, we assume that both “virtual” and “smart” involve the use of information and communications technology (ICT). By virtue of adroit use of ICT, the virtual organization forges temporary links among the otherwise independent entities that add value to an economic system (such as the supply chain of a large manufacturer). These virtual links arise and dissolve as needed to reduce transaction costs, increase efficiency, and respond much more quickly to the needs of customers and the initiatives of rivals. Building this, the “smart” organisation uses the information from this value system within its own internal operation, iterates on this information, and responds back to the virtual organisation. In this way, the “smart” organization can appropriate extra value developed within the value system as a result of the virtual links, and use that value to provide new products and services to customers more quickly and at lower cost than traditional rivals. Thus, virtual is something a company *does*, while smart is something a company *is*. (From the Analytical Framework)

**WMS** – Warehouse Management Systems

“WMS is a powerful, feature-rich solution for automating the inventory-handling process in your warehouse that scales to accommodate the varied demands of small and mid-size distribution centers to highly complex, high-volume environments.” [www.accpac.com/products/awms/](http://www.accpac.com/products/awms/)

**XML** – Extensible Mark-up Language

“XML is the Extensible Mark-up Language. It is designed to improve the functionality of the Web by providing more flexible and adaptable information identification.

It is called extensible because it is not a fixed format like HTML (a single, predefined mark-up language). Instead, XML is actually a ‘metalanguage’ —a language for describing other languages—which lets you design your own customized mark-up languages for limitless different types of documents. XML can do this because it’s written in SGML, the international standard metalanguage for text mark-up systems” (<http://www.ucc.ie:8080/cocoon/xmlfaq#acro>)