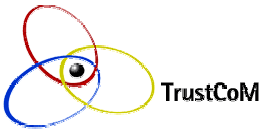

Deliverable

7

Market Study

WP15 Exploitation

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27/04/2005

V.2.3

TrustCoM

A trust and Contract Management framework enabling secure collaborative business processing in on-demand created, self-managed, scalable, and highly dynamic Virtual Organisations

SIXTH FRAMEWORK PROGRAMME

PRIORITY IST-2002-2.3.1.9

Prepared for the European Commission under FP6 Contract No. 01945 as a deliverable form

Deliverable datasheet

Project acronym: TrustCoM

Project full title: A trust and Contract Management framework enabling secure collaborative business processing in on-demand created, self-managed, scalable, and highly dynamic VO

Action Line:	4
Activity:	4.3
Work Package:	15
Task:	4.3.1

Document title:	Market Study
Version:	V.2.3
Document reference:	
Official delivery date:	22/03/2005
Actual publication date:	
File name:	WP15_MarketStudy_Final_V.2.3
Type of document:	Report
Nature:	Public

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Approved by:	

Version	Date	Sections Affected
V.0.1	10/07/04	All
V.0.2	10/08/04	All
V.0.3	31/10/04	All
V.1.0	09/11/04	All
V.2.0	22/03/05	All
V.2.3	27/4/05	1.6, 10.1

Table of Content

1 Executive Summary

This document provides a detailed market study on Secure and Trusted Virtual Organizations and the enabling open technologies for the European Business Environment. This market study is one of the key deliverables as a part of the exploitation plan for the TrustCoM project and the consortium.

The overall mission of the TrustCoM project is to provide a trust and contract management framework enabling the definition and secure enactment of collaborative business processes within Virtual Organisations that are formed on-demand, are self-managed and evolve dynamically, sharing computation, data, information and knowledge across enterprise boundaries, in order to tackle collaborative projects that their participants could not undertake individually or to collectively offer services to customers that could not be provided by the individual enterprises.

The market study document addresses the most fundamental question, which is the following: what is the market value of the Virtual Organization models (as envisioned by TrustCoM) and technologies for enabling trusted and secure business collaboration over the Internet in Europe and elsewhere? In addition, the market study also addresses the following: Will the VO model of collaboration, interaction and sharing between businesses provide better profitability, efficiency and reduced costs?

The main goals of TrustCoM project are to establish and validate advanced concepts, models, and open technologies for enabling multiple flavours of Virtual Organizations that connect various businesses in Europe in trusted and secure fashion. This market study aims to provide the necessary market value foundation for TrustCoM, and to enable better exploitation of TrustCoM concepts and technologies.

1.1 Scope

The market study is an exploitation deliverable for the TrustCoM project[1]. Its principle goal is to address certain questions relating to the market situation for VO so as to provide the TrustCoM consortium a market-placed view of the innovations and challenges to be addressed by the TrustCoM project. We summarise our answers to these questions in section 0.

A Market Study is an investigation of the current state of play within the market of literature and practice for a given area of concern. In this study, time constraints have limited us to secondary literature research on VO, but we have selected amongst our many references two particularly extensive empirical studies on VO. These sources are introduced in section 1.9.

We emphasise management and business issues and perspectives throughout this report, and not on technical issues. We recognise that most of the consortium partners already have considerable expertise concerning the purely technical issues relating to the VO and trust frameworks that they are tasked with developing and in addition, the project has already submitted a deliverable on the state of the art in technological requirements for a VO[2]. We do address technical issues in relation to enablers and barriers and we do draw on the State of the Art document when required.

The fundamental questions within the scope of this study are as follows:

[1] D7 in WP 15

[2] WP10, State of the Art

- What are the market size and value of the Virtual Organization models (as envisioned by TrustCoM) and technologies for enabling trusted and secure business collaboration over the Internet in Europe and elsewhere?
- Will the VO model of collaboration, interaction and sharing between businesses provide better profitability, efficiency and reduced costs?
- What are the key recommendations for TrustCoM consortium, and to enable better exploitation of TrustCoM concepts and technologies.
- What key innovations from TrustCom can help position it in the market to enable next generation “smart” enterprises.

1.2 Structure of Document

This document is structured into 9 major sections (starting from section 2). These sections address some very important market value questions for TrustCoM exploitation. The main questions are as follows:

- Definition of Virtual Organizations (VOs)
- Similarities and dissimilarities to existing Virtual Communities, Virtual Cities, Business Value Chains, and others
- Technology assessment and enablement
- Barriers to Entry for a Virtual Organization
- Role of Virtual Organizations for SMEs in Europe
- Impact of VO in the supply and demand chains of various industries
- Profitability and survivability of Virtual Organizations in Europe
- Market Value of Virtual Organizations in Europe and elsewhere
- Benefits and risks of Virtual and Collaborative working environments

The detailed questions for each one of the above main questions are described in section 2 for enabling the market study. In section 2, the term VO is defined and summarised based on some recent work by Warner and Witzel[3]. We summarise their common definitions, including their background discussions on purpose and structure. We then follow with a list of common terms used to describe a VO (or elements of it) and finally provide our own models of VOs that we think will be useful for subsequent discussion.

In section 3, the Taxonomy of VOs is described in detail. We also present the diversity in the literature describing the nature or structure of a VO. In this section, three different models are described, but we also note that the models described here are abstractions. We describe in detail the various characteristics of the VOs for each one of the models.

In section 4 and the appendix (section 14), we present several case studies, which provide important resource material for evaluating our definitions and taxonomy. Given that much VO literature is visionary based, and given that most studies we have referenced do not directly address the questions originally provided for the study, it is our hope that the case studies presented here will provide important guidelines, references, technology values and exploitation plans for the TrustCoM project.

In section 5, we present information about beneficiaries of VO and the impact VO has on business processes. We also address the question of industry types, sizes of companies involved and introduce the VO lifecycle.

In section 6, we describe the key technology enablers of Virtual Organizations in some details, including the open standards that are driving these technologies. The multitude of taxonomies indicates the difficulty in providing a usefully structured approach to making any clear elaboration of

[3] Warner and Witzel, 2004

infrastructure technologies. In this section we list some main technologies without the imposition of a taxonomic net.

In section 7, we present the barriers to entry of Virtual Organisations. We make an initial foray into barriers with a selection of barriers and challenges represented in the general literature, providing specific references where possible. We then describe the barriers to entry for VOs based on several characteristics.

In section 8, we summarise our findings in the literature dealing with trust and trust within the VO. The first section "Trust in and between organisations" is a general discussion adapted from a British Standards Institute publication on managing culture and knowledge. In it, various dimensions of trust are presented along with implications for VOs. We then summarise additional literature on the subject of trust, and finally introduce the work dedicated to trust in the context of VOs.

In section 9, we present the competitiveness of VOs in Europe. The VSO report concludes that VO will contribute to EU competitiveness, with a caveat on the culture of labour. VO 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.

In section 10, we discuss the market size and value for TrustCom technology. We provide indicators to the potential size of the VO market and the place of TrustCoM's in it. We draw heavily on the research results of others that have been made available in the public domain on the web an other published EC project results.

In Section 11, we present a SWOT analysis that highlights the potential risks and benefits of the current virtual and collaborative environment in which TrustCoM results are expected to operate.

1.3 Market Study Approach

The market study was conducted in a neutral fashion by exploring various sources of information, interviews with some of subject matter experts in the areas of value chain management and virtual organizations, and the various reports and studies conducted earlier on similar subjects (some of them were commissioned by the EU for other similar projects). The existing studies provided tremendous definitions and value behind virtual organisations, however, those studies did not focus on trust, security and reputation mechanisms and technology for enabling VOs.

The approach taken for this study includes the following core activities and methodologies:

- Understanding the existing market studies conducted in Europe on similar topics related to Virtual Organizations.
- Performing detailed case studies of some of the emerging Virtual Organisations in Europe and World-wide.
- Composing a taxonomy of Virtual Organisations based on existing literature, business case-studies and market reports.
- Performing a detailed market value assessment of the Virtual Organisation model and enabling technologies.
- Interviewing various subject matter experts within the TrustCoM Consortium and external third-party experts.
- Analysing the role of technology for trust, security, and others in enabling the VOs to succeed and thrive.

1.4 Value and Relationship to TrustCoM Activities

The main goals of TrustCoM project are to establish and validate advanced concepts, models, and open technologies for enabling multiple flavours of Virtual Organizations that connect various businesses in Europe in trusted and secure fashion. TrustCoM will develop a framework for trust, security and contract management in dynamically-evolving virtual organisations. The framework will enable secure collaborative business processing within on-demand created and self-managed, dynamic collaborative networks of businesses and governments built on top of the emerging convergence of Web Services, agent and Grid technologies.

TrustCoM addresses new requirements for scalability, responsiveness and adaptability that necessitate the on-demand creation and self-management of dynamically evolving virtual organisations (VO) spanning national and enterprise borders, where the participating entities (enterprises or individuals) pool resources, information and knowledge in order to achieve common objectives.

The relationships between TrustCoM Market-Study activity and the rest of the activities are illustrated in the figure 1. The relationships to the various TrustCoM action lines are as follows:

- AL7[4]: Market Study considered as input the State of the Art work that was done in Action Line 7 in order to evaluate and compare with the existing market definitions of virtual organizations, and their deployments. The market study provides recommendations to the Scientific and Technology roadmap that is needed for TrustCoM exploitation (see section 5, 6, 7, 8 and 12). The market study provides sufficient information on the current technologies used forming and managing VOs.
- AL1: Market Study considered as input the Virtual Organization lifecycle model, the generic processes, security and trust models, and the VO framework definitions as defined in AL1 workpackages. The market study has provided as input a technology assessment (in section 5, 6, 7) for AL1, and is recommending a strong emphasis on simpler yet rich enough of trust and security models, and using industry defined standards for virtual organization models.
- AL3: The Market Study provides tremendous input to the demonstrations and business scenarios for AL3 activity. Based on the section 6, 7 and 8 in this document, the Market Study provides input on what needs to be considered in AL3 in order to exploit through demonstrations the value behind the TrustCoM framework and technologies.
- AL2: Market Study considered as input the Business scenarios from Aerospace industry and adhoc-collaboration community frameworks. The Market study provides input on the VO definitions and processes that are needed to make TrustCoM marketable and viable for real-deployments (see sections on Barriers, Technology assessments). In addition, the Study provides the taxonomy of the various VOs. TrustCoM fits into one of the three VO types described in section 3.
- AL4: The Market study provides guidelines to enable the training and management of the system. These guidelines can provide better training material for enabling the positioning of TrustCoM systems in the market for value.

[4] The TrustCoM overview and technical annex present the various action lines, and the corresponding workpackages within each Action Line. AL7 is the action line on Scientific and Technology Roadmap. Similarly, AL1, AL2, AL3 and AL4 are all major activity areas of TrustCoM.

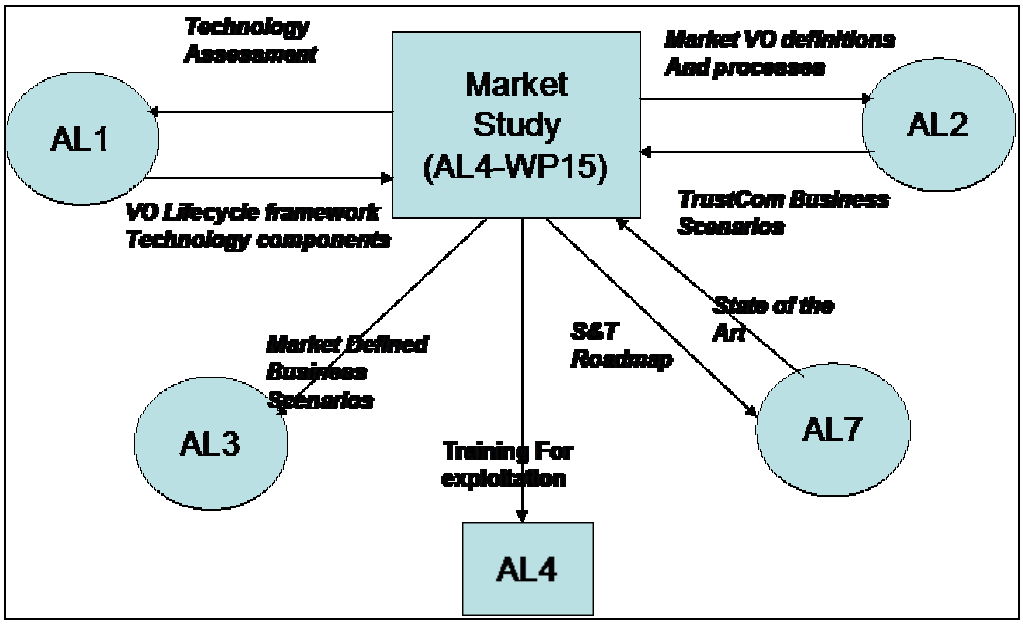

Figure 1: Market Study Relationship to TrustCoM Activities

1.5 Recommendations for Exploitation

In this subsection, we present the key findings and recommendations for TrustCoM from this market study. The main recommendations are as follows:

- *Strategy and Leadership:* The strategy taken by TrustCoM on using secure and trusted VO models is advanced compared to the existing open virtual communities, business networks, and private business exchanges.
  - TrustCoM needs to devote more on thought-leadership and proof-of-concepts for industry related best practices, tools for VO Services and not expand the scope on providing the end-to-end solution.
- *VO Concepts and Usage:* TrustCoM is on the right path with respect to the use of Virtual Organisation concepts and framework for enabling a secure and trusted model of interaction, collaboration and communication between businesses.
  - Additional work has to be done in extending the concepts into industry supply chains and industry dynamics. The TrustCoM project makes no explicit reference leveraging industry specific standards and practices
- *Core Issues and Requirements:* Compared to the private and limited models of VOs in practice, the TrustCoM project is addressing the core security, trust and contract issues in a radically practical way.
  - TrustCoM definition is given sufficient attention in the literature to satisfy us that it is one of the most important areas of VO organisation for the future.

- TrustCom needs to leverage the advanced concepts it currently advocates in security and trust, and innovate new technologies that will help position the technologies better in the market.

The detailed recommendations are divided into specific categories and described as follows:

Right Strategy and technology positioning

1. ***Strategy and Leadership:*** The strategy taken by TrustCoM on using a VO model and incorporating security, trust and contract models is advanced compared to the existing open virtual communities, business networks, and private business exchanges. Compared to the existing models of VOs (see section 4, 5 and 6) and real deployments, TrustCoM approach and extensions are new, and the models proposed by TrustCoM are novel, but complex. In order to be effective within the European Industry, TrustCoM needs to devote more on thought-leadership and proof-of-concepts for industry related best practices, and not expand the scope on providing the end-to-end solution. For TrustCoM to make an impact in any of the Industries, input is needed to various well-known business practices such as: SCM[5], CRM[6], SRM[7] and PLM[8]. In addition, TrustCoM should provide leadership in enabling "adhoc", decentralized virtual community enablers for SMEs in a trusted environment.
2. ***VO Concepts and Usage****:* TrustCoM is on the right path with respect to the use of Virtual Organisation concepts and framework for enabling a secure and trusted model of interaction, collaboration and communication between businesses. For TrustCoM to provide frameworks for key business areas, additional work has to be done in extending the concepts into industry supply chains and industry dynamics. The TrustCoM project makes no explicit reference of VO2 – VO5 (see chapter 3), but these are clearly seen as VO in the marketplace. A danger exists in marginalising the TrustCoM concept unless care is taken to position TrustCoM within the general market conceptions of VO.
3. ***Core Issues and Requirements****:* Compared to the private and limited models of VOs in practice, the TrustCoM project is addressing the core security, trust and contract issues in a radically practical way. TrustCoM has set out to not only do research the issues, but to provide solutions that will work. While the majority of literature is dedicated to the simpler forms of VO, the TrustCoM definition is given sufficient attention in the literature to satisfy us that it is one of the most important areas of VO organisation for the future. But we recognise that many issues need solutions and for many of them, the TrustCoM project should focus on providing the thought leadership, and core technology enablers through standards driven software.

Adopting the Technology Standards and appealing to the open Environment

[5] Supply Chain Management

[6] Customer Relationship Management

[7] Supplier Relationship Management

[8] Product Lifecycle Management

1. ***Standards and Open Systems:*** TrustCoM strategy in using standards such as Web Services, XML, and others are critical and crucial for success. However, a focus on industry specific standards such as RosettaNet and others is needed in order to enable various instances of the TrustCoM framework in Industry specific domains. In order to be effective in the market, TrustCoM should ensure standardisation of the VO framework components, such as trust, security, policy and contracts. The current Web Services only addresses the fundamental issues, but not in a VO environment.
2. ***ICT Environment:*** We consider that TrustCoM is ahead of other research and literature dedicated to ICT support for VO, where we consider other sources to be rather incomplete or very weak. The TrustCoM efforts to provide an ICT environment for VO lifecycle support is of particular importance. The use of VO lifecycle technologies, negotiation and contracts, security and trust, and others is critical for VO frameworks to be accepted. TrustCoM should ensure that the ICT environment is easy to use and customize.
3. ***SME Framework and Viability:*** TrustCoM has conceptualised a framework based on open standards, which can be implemented using off-the-shelf and "low-cost" software and technologies, thereby enabling the creation and management of virtual organizations easily for small and medium industries. Most of the case-studies we found were for large organizations, which had control over the creation of their virtual networks. TrustCoM should ensure that proof of concepts for validations purposes needs to be done with smaller number of SMEs.

Managing and Reducing Cost for viable Secure Business Collaboration

1. ***Manageability Cost:*** TrustCoM is currently focussing on using Standards based technology components and standards based platform for enabling the business scenarios and applications (as defined in AL2 action line workpackages) in Aerospace, Telecommunications and ad-hoc networks. For real-deployment, the costs of maintaining the business processes, the process tools, technology components, security and trust systems, reputation systems, can be substantially high. TrustCoM frameworks have to provide the necessary management tools or suggest reasonable low cost ways to manage the VO lifecycle in a simple and effective fashion.
2. ***Deployment Cost:*** Real-life deployments of TrustCoM frameworks have to support a business value model for specific industries such as Aerospace or Telecommunications. The deployment model needs to be simple enough to enable the end users to manage the frameworks in a low-cost manner.

Economic and Social Positioning

1. ***Market Value:*** The market value of TrustCoM framework and software can vary based upon the application domains and the industries. For Industrial systems and sectors which cover Aerospace, Electronics, Automotive, Petroleum and others, the size of the market for the software is hundreds of millions of Euros (but less than a billion Euros). This value is based upon market studies conducted for CRM, SCM, PLM and SRM. The market value for adhoc-collaboration amongst smaller businesses is not easily available or computable. For TrustCoM to succeed and provide market-value, deployments over the Internet are critical.
2. ***Social and Trust Models:*** We do raise specific concerns regarding some of the softer or social issues, which are quite acute in the case of VO. Organisations are human institutions and while ICT support and legal frameworks are vital for their success, these are not sufficient on their own. Various barriers and issues of trust presented in the study will provide the TrustCoM consortium with indications as to which of these areas need attention.

Given the technical nature of the TrustCoM project, we are not sure as to how these issues should be addressed, but we are confident of their importance.

1.6 Market Size and Market Value Analysis

In this subsection, we present the market value analysis, the magic quadrant, and detailed market size analysis. In this subsection we provide indicators to the potential size of the VO market and the place of TrustCoM's in it. We draw heavily on the research results of others that have been made available in the public domain on the web or through other published EC project reports

We also face another challenge in this aspect of the research. The type of VO we envisage in TrustCoM, like that of the Virtual Smart Organization (VSO) in the VSO report, is an emerging organizational form in its early stages of appearance. The studies we have sited on the subject of market trends having acknowledged this problem look for indirect metrics to forecast the VO market. Understandably these focus on ICT penetration of various types.

We quote from the VSO report. "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"[9]. A little further, the VSO report acknowledges that the metrics they need are not fully developed. That data collected "cannot be taken to be more than indicative and anecdotal"[10] that will provide them with a sense of what is going on. We now consider the role of TrustCom in the Software and Services market.

The IT services market (as shown in the table below) is expected to grow world-wide considerably over the next few years. With current spending (World-Wide) is in the region of 570 billion USD (2003) Gartner is expecting a growth to around 754 billion USD in 2008[11]. If we correlate IT services expenditure with trends in VO growth we can envisage considerable investment in ICT services focused on those elements outlined in the ThinkCreative VO roadmap. The VSO "phases to a virtual organization" is a useful tool here. Sufficient trends are noticeable in software utilization to see that organizations are pushing the boundaries along the maturity path. Organizational theory is also maturing to meet the new organizational forms as is the ERP, CRM, SRM including eProcurement software and product lifecycle management software industry. So we expect significant shares of the IT services market being spent on aspects of applications that increasingly support collaborative work.

Region	2002	2003	2004	2005	2006	2007	2008	2003-2008
Asia/Pacific	25,114	27,827	31,000	33,238	36,257	39,652	43,425	9.3
EasternEurope	4,068	4,425	4,741	5,100	5,505	5,947	6,436	7.8
Japan	65,214	72,844	80,839	84,811	90,132	96,167	102,729	7.1
LatinAmerica	17,719	18,077	19,476	21,432	23,512	25,791	28,304	9.4
Middle-East-Africa	7,102	7,658	8,242	8,935	9,711	10,581	11,561	8.6
North-America	256,313	259,886	270,191	283,707	299,584	317,737	338,225	5.4
Western-Europe	160,040	178,895	192,764	198,494	206,587	215,061	224,113	4.6
Total	535,572	569,612	607,253	635,717	671,288	710,936	754,793	5.8

[9] VSO report, page 27

[10] VSO report, page 29

[11] Gartner Dataquest Alert, November 2004.

Source Gartner Dataquest-2004 – Data in Millions of US Dollars

Gartner is expecting growth in the areas of system integration, core outsourcing connectivity and process management over the next 3 years. And each of these areas is strongly correlated to the virtualization trend. Of we estimate that about 30% of IT investment will be in technologies leading to or supporting the evolution or phases to VO, then the market for VO investment in 2008 will be approximately $225 billion. Provided sufficient support is given at the governmental and European wide level[12] the investment in the higher phases of the VO maturity stages will grow. Given that TrustCoMs primary target is providing the frameworks for enabling this growth, and that its partners form influential software product vendors, research institutions and major industry partners, a high expectation is being placed on the influence of TrustCoM to stimulate growth in VO maturity. We estimate that the anywhere from 10-30% of the IT investment in supporting business collaboration will be the market for TrustCom Technology. More details are offered in Chapter 10.

However, the IT software market where TrustCom plays and is building technology components is only 2.2 Billion over the next 4 years. The areas where Trustcom plays are in Software tools and framework are as follows:

1. Smart Suite Software – Enabling businesses to build out collaborative computing, and content sharing systems with some real-time collaboration capabilities.
2. Collaborative Software tools – Tools and frameworks enabling ad-hoc or structured collaboration amongst businesses or virtual community building tools and others.
3. Business Process Management Tools and Collaboration – Tools and frameworks for enabling business process modeling, process deployment, process management, process monitoring and others.
4. Security technologies – These include Web Services technologies

The table below illustrates the potential IT software revenue market size over the next 4-5 years for the above areas:

Software Technology	TrustCom overlap	2003	2004	2005	2006	2007	2008
SES- Smart Suite SW	Strong	1,034M	1,164M	1,316M	1,483M	1,1665M	1,843M
Collaboration Technology	Strong	300M	424M	507M	1,118M	N/A	N/A
BPM, and Collaboration Tools	Medium-Strong	532M	610M	650M	685M	710M	753M

Table 1: Software Tools and System Market where TrustCom plays

[12] See the VSO report, ThinkCreative publication and enablers and barriers in section 6 and 7 in this study. For example, legal frameworks need to change in order to better support the legal status of a truly virtual organization.

Trustcom focus is currently in the Software Tools and Framework (middleware) market, which has a very slow growth of only 3-6 percent per year. The market for software tools and framework is only at 1.8 Billion for 2005, when compared to the SW services, which is at 530Billion for 2005. The difference between Services and Software is tremendous. TrustCom has a small play in Services side for providing VO management services, but this role is not for providing deep tools for Services, but more towards providing technology for managing Virtual Organizations. Given that the growth and market for Software Services are much higher than the growth in the Software tools and framework for TrustCom related areas, TrustCom needs to focus on a combination of technologies that can not only enable the underlying middleware in a secure and trusted environment, but also provide services tools to create, deploy, manage and tear-down Virtual Organizations.

When these indicators are considered with the conclusions of the VSO report that ICT investment is strongly correlated across different countries within various industry sectors, we can expect a very broad market in VO organizations and supporting ICT, consulting and legal support. In section 10, we present a detailed analysis of the market size, the positioning and the market value of TrustCom technology for Virtual Business Organizations.

Consider the SCM[13] Market, where TrustCom can play a strong role in enabling businesses to reach out better to the supply chain. The market sizes are illustrated in figure 2. The market size for SCM software (only software) was around 1.1 Billion in 2001-2002, which includes Collaboration, SCM software tools, SCM applications and others. The SCM services market (according to IDC) was around 26B for 2001-2002 and 39Billion USD for 2003-2004 and growing at a tremendous pace.

[13] SCM: Supply Chain Market

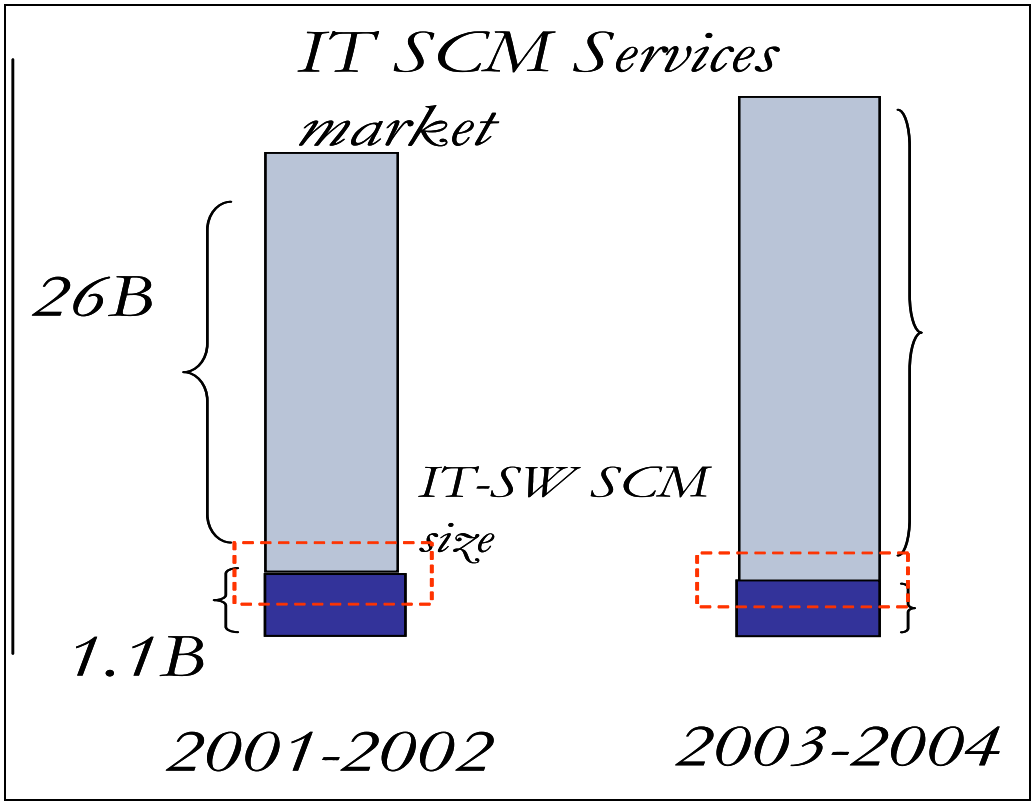

Figure 2: SCM Market Distribution by Services & Software

It is very clear from the figure above that investing in underlying technology layers will only result in a smaller market growth when compared to investing in the services for SCM. TrustCom currently is developing frameworks, tools and methodologies for the underlying software base and also in Services (as shown in the figure above). In order to tap into the Software Services market for SCM, TrustCom needs to invest more time in developing tools, methods and methodologies for enabling the deployment of TrustCom software and provide tools for services, which could include the following:

1. VO deployment and software services for SCM
2. VO management and governance for SCM
3. VO technology components and integration to legacy frameworks

1.7 Document in Brief

There is no single concept of a VO and this is not because the various concepts are competing or contradictory, but because the factors contributing to an interest in VO and those making it possible are acting on the diversity of organisational already existing and their products and services.

These factors are contributing toward a movement away from various traditional organisational activities in terms of products, knowledge, organisational form and the establishment of new organisational types.

We begin the study in section 2 with an overview of characteristics of VO. It is noted that these characteristics are quite varied and while many of these characteristics are sufficient for a VO, none of them are necessary. There is, therefore, a wide range of acceptable characteristics of VO, of which different sets are emphasised by different authors sited in the literature.

However, summarising these characteristics, common to the movement to VO is a break away from the traditional reliance on organisations centred on single sets of brick and mortar locations where all or most employees are located and all of the major undertakings of the organisation are performed. During all periods of the industrial age organisations have been interacting with other firms in a supply chain. A VO takes inter-organisational or environmental interactions to more radical extremes. The different concepts represent different ways the interactions can occur between people associated with an organisation and between organisations themselves.

The most radical form of VO concept is the VO as a legal entity that exists purely as a customer interface with little staff and potentially no stock or physical assets, or as an organisation that exists purely for the development of some product or service or establishment of some goal. The focus of the TrustCoM project is such a radical form.

Having covered the main characterisations of a VO, we then add a section of common terminology used to refer to a VO. The diversity of terms reflects the diversity of conceptions and indicates the care that must be taken when ever discussing VO. One writer has even advocated the complete abolition of the term VO, given that these separate terms provide a more accurate description of a particular form required in discussion. This admonition should make us very careful when making claims about VO using this blanket term.

Given this variety of characterisations, we then present three different dimensions in which these characteristics are manifest. The first is the product dimension. Products are firm produces may be traditional or virtual. The new information and knowledge age has enabled new types of products that are deeply rooted in intellectual capital. Certain products, such as information brokering, are often considered to be sufficient to identify the firms providing them as VO. The second dimension is the duration dimension. VO are often distinguished as organisations that are created to fulfil a very short term goal and then disbanded, contrasting them from the traditional idea of an organisation as a going-concern – effectively treated as permanent existence. The third dimension, which is the dimension that has the most influence in literature attention, is that of structure. VO are structured differently to traditional organisations although we show that this is not so straight forward.

In section 3 we discuss VO structure, offering five different definitions of VO that takes a unique set of structural characteristics that could be configured into real-world VO. While in reality, an organisation could adopt portions of more than one of these definitions, or a VO could embrace several at once or even change through various definitions through time, each definition we propose are entirely stand-alone and can be regarded as containing sets of necessary and sufficient conditions for a VO[14]. The five definitions we introduce are the *tele-working organisation*, the outsourced organisation, the free market networked organisation, the free market mobile working organisation and a definition similar to the TrustCoM definition. Briefly, a tele-working organisation is where an organisations employees are based from home, who hot-desk when they occasionally do attend an office and it includes cases where employees are on the road (sales staff, for example) or located frequently at client locations (professional services, for example). An *outsourced organisation* is one that has taken many of its traditional functions and given them to another organisation to perform. These may range from highly uncritical to critical activities and even those that are considered core. The *free market networked organisation* is where pools of organisations form together to service or supply certain markets where they both work together and compete. A *free market mobile working organisation* is where individuals or small groups work as self-employed

[14] Obviously we are thinking of a weak sense of "necessary" because we offer more than one definition.

units making themselves available to a market. This has become common in IT and management consulting where people may have previously been employed full time for an organisation are now free-lancing between organisations to keep fully employed. The final form, which is closest to the *TrustCoM view*, is where an organisation is constructed as a VO from existing organisations (which may in turn be traditional or virtual) in order to perform a particular service, develop a product, solve a problem, respond to a tender etc. The implications of these definitions for TrustCoM are related to its position and uniqueness. TrustCoM cannot assume that others will understand their conception of a VO unless it is made clear. Our survey of the literature has made us conclude that the idea of forming a new organisation as a VO in such a manner is known and recognised in the literature, but is not given sufficient depth. In most areas, the TrustCoM project is providing significantly more detailed research into the nature of this type of VO than any other literature sited. The TrustCoM project also recognises many challenges and important components that are neglected by other research.

In section 4 we introduce the use of case studies in the study. Case studies are important to the market study because they act as an important source of empirical verification of what is actually happening. They also support our recognition of diversity in characterisations of VO. The main case studies, which are contained in the appendix, confirm the existence of all varieties of VO in terms of structure, purpose, size and location. We regard the case studies as vindication of our caution over the use of the blanket word VO and for the importance of contextualising discussion and research in VO to explicitly defined characterisations.

Section 5 of the study addresses the area of beneficiaries and impact. It begins in section 5.2 with five case studies from the THINKCreative project that motivates much of the analysis to follow, in particular, the development of a number of VO scenarios for 2020, presented in section 5.4. The case studies also illustrate the rich variety of VO conceptualisations which are then directly reflected in the scenarios. From the case studies we indicate in section 5.3 the types of industries that are most likely to take up VO form. But the important questions addressed in this section relate to reason and impact. Why it is that VO are being formed at all, who will benefit and what impact is this having in the business world. There are many drivers that are influencing and enabling the formation of VO as a viable (and as some say, necessary) organisational form in the early 21st century. We could mention the many drivers associated with the knowledge economy and the globalisation of industry, but in section 5.5 of the report concentrates on those that are more directly connected to VO.

The changes to VO will also impact how organisations work, and we discuss in section 5.6 the impact VO will have on business processes, namely in the areas of product development, supply chain creation and management, manufacturing and operations, service operations, marketing, finance and coordination and management. Other aspects of impact are discussed in section 7 on barriers to VO.

While the sources do not discuss detailed implications for these areas of impact, it is clear that many of them are of significance to the TrustCoM project. For example, TrustCoM will research the implications of complex inter-firm integration of supply chain computing in some form of shared ERP. TrustCoM are also addressing the issues of trust/authentication, VO life-cycle management, in-depth ICT implications which are not covered in as much depth in the general VO literature.

We then continue section 5 with a discussion on the related topics of competitiveness (section 5.7) beneficiaries (section 5.8) and sizes of organisation (section 5.9). VO are expected to be more competitive than equivalent traditional organisations, and the case studies support this view. The main reasons cited in the literature is that VO operate with lower costs, are more competitive, faster to market, more innovative, have access to more capital and larger markets. SMEs can participate in

VO, giving them a considerable advantage over SMEs outside such an arrangement[15]. So the beneficiaries of VO can be considered to be everyone, but with the winners, there may also be losers. For example, those firms or individuals that are not able to work in such dynamic and less structured environments or those that cannot cope with the complex ICT that will support the VO are less likely to succeed. Those organisations that are already established in high networked environments are likely to be early adopters and therefore beneficiaries of VO, whereas those that are more isolated or work alone, are less likely to gain. And these aspects indicate that organisations of various sizes will become involved. Different types of VO will support different sized organisations, but there are no reasons why most sized organisations cannot partake in the various definitions of VO on offer in section 3.2.

As a result of its conception of a VO, the TrustCoM project also supports a well-defined VO life-cycle, which is of central importance to the type of ICT support it will address as well as its legal and trust frameworks. We include in this study the VO lifecycle defined by the VSO report, a project instigated by the EC to report on trends in VO as a form of contrast. The VSO study presents a lifecycle based on the ladder concept, where the lifecycle increments in maturity stages. The TrustCoM lifecycle follows a project management approach, which is in our opinion more suitable for addressing the ICT, management and legal requirements for supporting VO. We present the VSO lifecycle in section 5.10.1 and the TrustCoM lifecycle in section 5.10.2.

In section 6 we provide a summary of the technologies supporting VO. The technologies required will depend on the VO concept involved. For example, tele-working organisations will invest in technology to support workers based at home, including broadband connection, e-mail, distributed diary and CRM applications and group-ware support. We found that most of the literature on VO ICT did not address the technology challenges in detail, whereas the TrustCoM project, in its deliverable entitled State of the Art, does provide a significantly detailed analysis of the technologies required, although it does not cover technologies outside the TrustCoM conceptions of a VO. We will use the TrustCoM deliverable to provide management-level coverage of technologies required to support VO.

We then move in section 7 to present barriers to the formation and management of VO. These are wide and varied and also depend on the concept of VO under consideration. This again indicates that care must be taken to isolate those barriers that are of concern for the VO definition being used. But most of the barriers centre on the uncertainties created by the increased dynamics and interactions required in managing a VO, the complexities of ICT support required, the lack of face-to-face contact, culture, language, capital supply and trust. A key challenge for the TrustCoM project is to keep the non-technical challenges in view. While a consortium such as TrustCoM can focus on the more “hard” issues such as legal and technical challenges, it will be more difficult within the project time-frame to make specific allowance for the softer challenges. As examples of these challenges, VO that span multiple countries will posses cultural and language differences and hence will create challenges for communication, planning, management and organisational unity. VO requires new skills for management, who may be more use to working in a more structured and controlled environment. VO are based on concepts such as openness, mutual support and trust that are quite different to traditional organisations. Trust is a central concern for all types of VO.

In section 8 we examine the nature of trust; firstly with respect to organisations in general and secondly within the context of VO. Trust is a pervasive concern in everything we do, from crossing a bridge, to engaging in social life. Trust is always based on experience and knowledge and has its own types of reasons. But trust takes on new forms in a VO, where face-to-face contact is reduced or in some cases eliminated. Our principle thesis with respect to trust is that it is based on human

[15] The manner in which SMEs participate will vary with the conception of VO involved. For example, as an outsourcing supplier, the SME may have guaranteed sales, but may have little bargaining power over prices and supply. As a partner in a larger VO (maybe with an all SME membership) the SME may have a much stronger market position.

experience of encounters and experience with others within a context. It is something that is earned and takes time. The TrustCoM conception of trust has a similar basis, but is much more centred on the ICT concept of trust as authentication and identification. The TrustCoM project has taken considerable steps to further advance the information technology solution to ensuring trust in this context. Its research takes it beyond current practice and certainly advances a solution beyond that found in any of the VO literature we sited. However, we do have concerns that an over emphasis on trust as identification and authentication may overlook the important, although more traditional issues of trust that is still treated rather extensively in the VO literature. We expect that most VO formation, at least when high stakes are concerned, will occur between those that already have trust, or those that take effort to establish a degree of personal trust prior to VO formation. Trust will be established in the same way as trust is established in business today. It will be a mixture of personal contact, interviews, references and trying it out.

Section 9 gathers important material relating to government, legal and contractual issues. Our key findings here include that while workshops within Europe has indicated business people wanting minimum governmental disruption, there is a clear recognition that they do need to make provision to address issues relating to taxation, company law and contract law, and to increasingly support enabling mechanisms for SMEs. The nature of VO, especially if they cross country and region boarders, exacerbates problems in all of these legislative areas. For VO to succeed and to be considered safe for customers, these legal and taxation issues need to be given special attention.

In section 10, we discuss the market size and value for TrustCom technology. This section provides indicators to the potential size of the VO market and the place of TrustCoM's in it. We draw heavily on the research results of others that have been made available in the public domain on the web an other published EC project results. We summarised the VSO, THINKCreative and other survey findings. We then present a quadrant produced by Gartner for the Enterprise Collaboration market. Section 10 also presents a positioning of TrustCoM with respect to the rest of the industry participants.

We conclude the main part of the Market Study in Section 11 by showing the results of a SWOT analysis. This analysis that highlights the potential risks and benefits of the current virtual and collaborative environment in which TrustCoM results are expected to operate. The present SWOT exercise provides the basis for comparing expectations with real outcomes provided by the technology.

1.8 Questions in Brief

In this section we provide an overview answer to each of the questions provided to the study. In some cases, we have indicated that further empirical research is necessary to come to satisfactory answers if they are really required. This is a reflection of the breath and depth of a subject that has, in our opinion, received too little in the way of in-depth empirical study[16].

We now present each question with a short overview of our proposed answers, which are drawn from the study.

Q1. *What is the current understanding of the term "Virtual Organisation" (VO) in a European context*? The study indicates many different understandings from outsourcing, tele-working to the more advanced understanding adopted by TrustCoM. The different understandings are outlined in section 3.3 below. Our main conclusion is that these different definitions do not form a maturity

[16] With limited exception of the THINKCreative project, which while strong in most areas, is weak in providing in-depth empirical results relating to technologies, legal, trust and security frameworks and current commitments to VO models of doing business.

ladder such as is found in the e-business maturity ladder model, but they can exist reasonably independently of each other. There is, therefore, not one progressive form of VO, but several.

Q2. *What is the next best related organisational structure nowadays to a VO*? Organisational studies such as Hatch, Mintzberg et al. and Stacey[17] indicate that one needs to take a multiple perspective on organisational structures and strategy. The varieties of definitions of VO alone indicate the requirement for taking a multiple perspective and that it is not possible to identify a "next" or a "next best".

Q3. *What are the definitions of VO*? In section 3.2 we have provided the different definitions reported in the THINKCreative project and in section 3.3 we have given our own taxonomy of definitions that include Tele-working, outsourcing, free lancing and the stronger TrustCoM concept of VO (being an organisation formed by multiple organisations to perform some task or achieve a goal.) We also found an extremely wide vocabulary of terms used to refer to different types or aspects of VO. These are listed in section 2.2.3.

Q4. *What size organisations are engaging in VO? Large, SME, Self-employed*...? The case studies indicate that organisations of all sizes are engaging in VO, although each of the definitions will provide different mixes of organisations. For example, freelance organisations are normally run as SMEs, but engaged by firms of any size. Outsource organisations can be any size, but normally engaged by larger organisations. Tele-working is also done by a cross range of sizes although more common as a form of VO in large organisations.

Q5. *Which industries are engaging in VO? Engineering, Manufacturing, Consulting, Software-Development*...? Again the case studies suggest that different industries are engaging in VO. Further study would be required in order to provide a statistically reliable indication that correlates size, industry and type of VO.

Q6. *What is the current extent to which technology used and which technologies are/would be leveraged by a VO*? The literature indicates that in some cases technologies actually deployed in many VO are too primitive to fulfil their real requirements, but again the different definitions of VO place different demands on the technologies. Technology underpins all VO simply because communication is at the heart of VO, and that is required across boundaries or off-location. Technologies range from e-mail, on-line conferencing to advanced inter-organisational project management tools. The indications are that the TrustCoM requirements go beyond most of the standard technologies in use today.

Q7. *How are the relationships generally established*? The THINKCreative project indicate that trust relationships are established initially amongst areas where organisations are already engaged in networks of organisations and that the less connected an organisation is, the more difficult it will find VO type of structures. We expect that in most cases engagements amongst organisations do not occur without significant human contact, although this is not mentioned outright in any of the case studies.

Q8. *Would the market be willing to invest in more automated tools for the support of VO*? We have refrained from addressing this question, which will require further research. We have yet to confirm whether any investments are being currently made in "less" automated support in the sense meant here. Additional empirical work should enable an answer to this, but to get a meaningful result, much care will be needed in formulating the study.

Q9. *Are there technology providers investing significant resources in VO research, development and support*? This is another question we have not been able to address. We know of the work currently undertaken by the consortium members to support VO in numerous ways, but we were not able to develop our research in this question within the timeframe.

[17] Hatch 1997, Mintzberg et al. 1998 and Stacey 2003

Q10. *Would VO enhance European competitiveness? If yes, why*? The results presented in sections 5.6 and 9.1 indicate that VO will enhance European competitiveness because it will reduce costs, improve knowledge capabilities and expand markets for European organisations.

Q11. *What could the EC and other governance units do to aid in the development of VO*? The results here are mixed. The THINKCreative project found during its workshops that business people wanted minimum involvement (interference?) from governments, but there are many legal and taxation implications that need to be addressed by Governments and the EC. These are covered in detail in section 9.

Q12. *Are VO abstract entities imagined by academics or are there real-world examples for VO? Which ICT is used by these VO*? The case studies indicate that VO are real, although we did notice that many writers on VO write in visionary terms without significant empirical support. However these visionary writers, such as Handy, are important because they provide possible roadmaps for the future and certainly highlight likely problems.

Q13. *Is a VO more competitive than a non-VO*? This is answered via Q10, but we could add here that at the micro-level (individual firm) competitiveness may necessitate the move to VO for many organisations at some point. At that point, VO will become mainstream and therefore a necessity, losing its special competitive status.

Q14. *What are the key factors underlying the formation of VO (e.g. data portability, connectivity, process integration, open bidding etc?)* The case studies suggest that VO are formed in a variety of ways, and at present, no formal models have been found. The life-cycle presented in the VSO document (see section 5.10.1) is of little value for TrustCoM because it follows a maturity ladder approach and there is no evidence in the case studies to suggest that organisations follow such a life-cycle. However, the TrustCoM approach is universally valid, since the steps contained in the model are applicable to the formation of any type of organisation. But we did not find any in-depth model that has been applied to the formation of various types of VO and even Hatch[18] does not provide an embracing and cohesive model for VO formation.

Q15. *Do existing standards need to be extended for VO*? We understand that TrustCoM's Standardization work package (WP13) has provided a document providing an organisational roadmap on standards that need supporting. We see from the State of Art document produced as a TrustCoM deliverable, that there are many standards that require extension for VO support, particularly in the area of Web Services and application integration. Most standards seem to have stopped at simple B2B relationships and not extended to the more complex VO relationships envisaged by the TrustCoM project.

Q16. *Should VO be stimulated? If yes, how*? We found many references to the requirements of further research, although little attention has been given as to how this should be done. Much of the research will continue within the universities, but contact with industry seems to be made possible with the EC ICT projects such as TrustCoM.

Q17. *How can governments help facilitate VO business models*? We outline government roles in section 9.3. Research indicates that firms would like the governments to address legislation to make it more VO friendly, reduce the legislative burden of firms and to review labour laws. The availability of affordable VO software for SMEs is another area of concern for governments.

Q19. *Which European organisations have begun the transition from a traditional to a virtual business model*? This question has a strongly empirical basis for which we did not have sufficient time to undertake. The case studies indicate that where the benefits are available and the organisation owners have the vision, organisations are transitioning to VO structures. The question is also difficult to answer given the different definitions of VO. For example, outsourcing is closely related to the

[18] See Hatch 1997

TrustCoM definition (we did come across commentators who considered outsourcing as a forerunner to VO) so it would be difficult to know exactly how to count firms passing through the transition.

Q20. *What are the stages towards becoming a VO*? The TrustCoM life-cycle has been developed to address this question (section 5.10.2) and the case studies suggest that this cycle is a realistic model for VO formation.

Q21. *What are the features of the virtual B2B entity (e.g. networked, trust-based, dynamic etc)*? The virtual B2B organisation is represented by more traditional e-business organisations and outsourcing. In the B2B market, the emphasis is on the supply-chain as seen from the perspective of an individual organisation. Little respect is given to the whole supply plane, which requires a perspective that incorporates customers and suppliers and while centred on the VO, it doesn't prejudice its view toward any one organisation. Research from the THINKCreative project indicates that early adoption of VO will come from organisations that already have trusted relationships – and they therefore will be less dynamic. We consider that the literature we examined does not address the dynamic model and certainly does not provide case studies that would match the TrustCoM concept.

Q22. *Who benefits from a virtual operating business environment*? Interestingly the VSO study identified winners and losers. The winners are those who have the vision and capabilities to organise in VO structures and the losers are those who can't (see section 5.8). But they do recognise that all parties involved will benefit, and indicate that VO structures will become a necessity in many business areas.

Q23. *What are the roles of IT security and trust for the successful formation of VO*? We were surprised to find so little in the literature about IT security and trust in the field of VO. While the issue of security was mentioned by most sources and expanded in some cases, the subject was never given sufficient depth or concrete representation in terms of available technologies. The TrustCoM report "State of Art" has addressed both these issues in a depth we have not elsewhere sited. But we have challenged the TrustCoM members to take a wider view of trust. Much literature has been devoted to the problems of a more traditional view of trust. We consider that the TrustCoM view of trust is really identification and authentication, much of which can be accomplished using software. We recognise that the TrustCoM consortium is developing models of reputation systems, but we wonder if organisations will ever entirely dispense with face-to-face negotiation and meeting (for at least their first commercial engagement). Examples from the recruitment industry would suggest that most employers cannot take references and CVs on trust, but need to supplement these devices with interviews, psychometric profiling, tests and portfolio inspection. We provide our analysis of trust in section 8, with the most important result being that trust requires time and contact. It is likely that legalistic frameworks for trust will be insufficient to establish trust.

Q24. *Are there legal barriers to the formation of VO in Europe*? This is a large question that really requires considerable legal expertise to answer fully, especially as many of the references we sited talked about legal issues in very superficial terms. We summarise our findings in section 9.4, where we briefly examine the concept of undertaking, raise the problem associated with jurisdiction (for both the VO partners and customers/suppliers trading with the VO) taxation issues and the problems relating to agency in VO.

Q25. *Are there technological barriers to the formation of VO in Europe*? A number of technical barriers are introduced in section 7, the section specifically addressing barriers. We also cover technical barriers indirectly in section 6, our technology section. The State of Art document also provides ample evidence that there is still a considerable amount of research in many areas of technology for VO. One author warned against an oversimplification of ICT support requirements for VO. In general terms, the barriers are (1) in many areas of technology, considerable research is required to bring the technologies into fruition for VO (although an aim of the TrustCoM project is to help reduce this technology gap and to provide a more focussed research agenda) (2) SMEs find it difficult to afford the technologies required (3) software designed to support teleworking, B2B and more simple outsourcing types of VO are not sophisticated enough to support the genuinely multiple-organisation interactions required in the TrustCoM conception of a VO. (4) technology

standards are still in their infancy and it is not clear in many areas, including web services, which standards will gain widespread acceptance.

Q26. *Are there barriers to the adoption of peer-to-peer IT system created contracts or SLAs in VO*? This technical question was not addressed in the study as no information was found in the literature relating to adoption of p2p. Problems with p2p adoption were raised at a recent meeting with the EC,[19] where a number of commercial projects have indicated their interest in p2p networks. The primary issues raised during that meeting were the lack of a standards organisation to develop and promote p2p and the poor press p2p has had in relation to its primary use as a music/video download service. The establishment of a standards body to develop the commercial use of p2p was seen as an important step.

Q27. *Are there barriers to the adoption of security certification services for VO*? We did not address this question, which we felt required primary research. The market study project was not able to undertake such primary research in the timeframes given for the work. It is clear that the TrustCoM consortium has addressed security certification issues[20] but probably has not addressed the adoption issue.

Q28. *Are there barriers to automated trust recommendation services in Europe*? Section 8 provides an in-depth analysis of the trust problems associated with VO. The primary barrier is whether automation is even a starter for trust. But even if it is, the TrustCoM State of Art document highlights where research is going on in reputation system research.

Q29. *Will governments be willing to contract work to VO? Assumption is that a VO applies for a "request for proposals"/"call for tender". Would governmental bodies feel comfortable with such consortia*? This is another question that was dropped from the study because there was insufficient time to undertake the necessary primary research.

Q30 *Do people feel comfortable in getting trust and reputation recommendations when it comes to large-scale business*? Again we have been unable to undertake the necessary primary research and we were not able to locate other research that made specific reference to the acceptance of reputation systems like those required for TrustCoM. While much has been written on the ebay and Amazon style rating systems, commercial VO organisations established to undertake large commercial projects within timeframes that also impose penalties is quite a different environment to ebay. We believe that this question should be answered through carefully designed primary research that could illicit people's conformableness with such reputation systems. The TrustCoM State of Art document contains an in-depth study of reputation systems and trust economics, which will shed some light on this question.

Q31. *What price tag can a VO toolkit have to let individuals and small companies deploy VO-based solutions?* This includes how easy it should be to add/interface own services with the VO toolkit. This question was removed from the question list during a conference call early on in the market study. It was deemed to empirical and close to the commercial interests of some of the consortium members to justify the time requited to investigate this question.

Q32. *What products exist that customers would like to have VO-enabled*? Like the previous question, this question was also dropped from the question list.

Q33. *What is the market value of VOs in Europe and elsewhere?* See section 10.

Q34. *What are the potential risks and benefits of the current virtual and collaborative environment in which TrustCoM results would operate?* See section 11.

[19] A meeting, attended by one of the authors, with the prime objective of establishing relationships with standards organisations.

[20] In the State of Art document and in papers presented at eChallenges 2004

1.9 Principle EC Sources and Their Relationships

In this study we have referenced a large quantity of research material published in papers, books and on the Web. Content we have used is referenced in the literature section in section 11 below.

We classified the literature into three main groups. In the first group we placed sources that we could not treat as authoritative. While we could not make an absolute certain judgement on this, we were concerned to limit the material we used to those from known reputable research work, such as the THINKCreative project and VSO report summarised below. The second group contained visionary work on the nature of VO, trust and other subjects. Many of the results in these references are particularly speculative and personal, but the overall professional status of the authors concerned gave us confidence that where applicable, these results should be made known in the study. Tom Peters and Charles Handy are examples of two authors we have used in this way. Our third group are studies of a more empirical basis, where the authors have undertaken or sited empirical studies. We consider that this market study needed to be biased toward the empirical work, primarily because the questions it has sought to answer are of an empirical nature.

The EC has previously financed studies examining the nature of VO. We have drawn much material from these studies[21] in addition to our other references. As indicated in the introduction, our use of these studies has provided a complementary synthesis of their different perspectives on VO. In this section, we provide a basic summary of the two principle EC studies indicating why they have been selected as sources for our study.

1.9.1 THINKCreative Project[22]

The THINKCreative project was a European Commission IST-2000-29478 project, as presented in Camarinha – Matos and Afsarmanesh.[23]

The importance of the THINKCreative project research for the TrustCoM market study lies in its depth of research and its empirical basis. A number of regional discovery workshops were held by the project team and a Delphi study undertaken to capture the views of academic, industry and government experts on all areas of the subject of collaborative networked organisations.[24] We will frequently refer to the THINKCreative results in this Market Study, where appropriate quoting their results in detail.

In addition to the primary research carried out by the THINKCreative project, many project consortium members have up to a decade of experience researching virtual organisations. The study is also very open about those areas of research that still face ongoing challenges and where further research may be necessary.

[21] As indicated in the introduction.

[22] This study emerged from a previous EC funded study on VO called VOMap, whose results have also been consulted in this study.

[23] Camarinha –Matos and Afsarmanesh, 2004

[24] Effectively their term for a virtual organisation.

1.9.2 The VSO Study

This study is the result of a commercial project undertaken for the European Commission[25], Information Society. This report details findings of a study on virtual, smart organisations (VO) in Europe. It examines the development of VO 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 VO. A framework for understanding VO 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 VO 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 VO into a European context.

Despite making references to many EC funded IST projects, the VSO study does not make any reference to the THINKCreative project or other papers published by the THINKCreative primary authors. We are not sure of the reasons for this, or its implications, but these studies do appear to be orthogonal in results and sources making both studies valuable sources for this market study.

1.9.3 Relationships between the Two Major Sources

Both studies represent a European perspective on VO and both make extensive use of existing research results and case studies. The THINKCreative project additionally performed a significant amount of primary empirical research across many regions within Europe.

For us, the most striking significance of the VSO study is its close resemblance to the initial questions posed for this market study. We have, in the body of this report, not always kept directly to these questions. We believe that this study should represent an exposure to the market intelligence as it is presented in the material and not merely a synthesis and interpretation of the existing market studies. We have also found that the VSO study is unique in the questions it raises, and while we quote some of its answers to the questions outlined above, we do not provide guarantees as to these answers' accuracy. We need to state this, because many of its answers are still addressed as open questions in other studies and because we found the VSO report to be more assertive in providing definitive results than other studies.[26]

The close alliance of the market study questions to the VSO structure has made it difficult for our research, principally because it potentially biased our own findings towards the approach undertaken by the VSO study, which as mentioned above, is quite unique. We therefore left our study of the VSO document until the end of our work, and have tried to introduce some of its results into this study only when strictly appropriate - where this has occurred we have indicated clearly that the results referred to have been taken from the VSO study.

[25] Wagner et al. 2004.

[26] For example, the question of "steps of VO formation" is not addressed by other studies, principally because there is not yet likely to be consensus on "the" (i.e. definite article) steps. To be fair, the VSO study does indicate in this example, and others, that its results are based on theoretical and not empirical foundations,.

2 What is a VO

2.1 Introduction

This section describes the defining characteristics of virtual organisations (VO). We begin by outlining the common characteristics (drawn from a wide range of literature) on VO. We then provide a substantive list of terms used almost synonymously with "VO" and then provide a taxonomy of VO characteristics that will form a perspective for later discussion. We also introduce, as background information, aspects relating to the formation and management of VO.

The term VO is understood in many different (but related) ways in the literature. Warner and Witzel provide a succinct summary of the various definitions of a VO, emphasising the common elements of various approaches. We summarise their common definitions, including their background discussions on purpose and structure. We then follow with a list of common terms used to describe a VO (or elements of it) and finally provide our own models of VO that we think will be useful for subsequent discussion.

In terms of further introduction, we wish to make some general points about VO. The first is that it is unlikely that any organisation will become wholly "virtual" in the foreseeable future. The implication here is that, for management, traditional skills need to be continually developed along with the new skills required to manage a VO[27]. Most physical products, such as a car cannot be built in virtual space[28] although the factory can be controlled or managed virtually[29]. The decision to go virtual needs to be made in light of strategy – what are the goals of the organisation and what are the best ways to structure and organise it to meet its own and its customers' objectives?[30].

[27] Warner and Witzel, pg 1

[28] Warner and Witzel pg 6

[29] Fineman pg 67

[30] Warner and Witzel pg 7

2.2 Characteristics and Definitions of VO

2.2.1 Characteristics in the Literature

Warner and Witzel[31] provide a comprehensive synopsis of the literature describing the characteristics of VO. They list six characteristics, quoting a number of authors[32], which we summarise here[33]:

- A VO has fewer tangible assets that a traditional organisation; is more decentralised and characterised by networks more than by hierarchical structures. A VO is not constrained by physical location or physical space and computer links take the place of physical infrastructure.
- A VO has a high reliance on communication technologies in order to link people and places. In some definitions, technology is seen as the heart of the VO, although we would rather see it as an important enabler (bearing in mind the recommendation from Alfred Chandler that structure should follow strategy[34]). We will show that technology has already been helping organisations to move virtual [35], but it is the advent of the Internet and broadband and the technologies that have developed from them that has made the modern concept of a VO into an organisational form potentially useful for almost every organisation.
- In a VO one is likely to find employees working in a mobile manner, using telecommunications technologies instead of buildings and related physical assets as the primary means of work and communications. Departments no longer have to work together in a co-located workplace, but department members can be dispersed and located anywhere in the world.
- VO display hybrid forms. This means that one can imagine VO primarily as collaborative agencies enabling the integration of core competencies, capital, markets, knowledge and risk, all working collaboratively toward a shared goal. Such an organisation may exist for the short or long-term.
- "Boundarylessness" and inclusiveness are typical features of VO, which are not limited to our traditional conception of organisations as being well-defined and identifiable entities, but which draw on other organisations within the supply and customer chains, making boundaries between member companies very tight.
- VO are flexible and responsive. This is true at least in theory. The aim is to enable business ventures to form very quickly, pulled together from a variety of disparate elements in order to

[31] Warner and Witzel, 2004 pgs 3-5

[32] Barnatt (1995), Bleeker (1998), Grenier and Metes (1995), Goldman *et al.* (1995), Dunbar (2001), Edith Penrose (2001), Franke (1999, 2002), Osborn (2001) and Pennings (2001)

[33] It will be noted later that in fact these points do not together make necessary conditions for a VO. For example, mobile work is not necessary for a VO but may be sufficient. Likewise with hybrid forms.

[34] Chandler 1962

[35] For example, Warner and Witzel quote the use of telegraph by Reuters in the 1850's to introduce a new virtual product (information) in a geographically dispersed organisation.

achieve a purpose and then if necessary, quickly dismantle it again. To succeed in being flexible, management must learn to manage in the new environment, which means different practices in information technology (IT), human resource (HR) management, strategic management and even new legal frameworks.

In her study of the evolution of the VO, Alea Fairchild[36] has indicated that writers on VO have either focussed on process or structure within the organisation. She provides a table or authors, classifying them as either process oriented or structure oriented. She explains that given that a VO is a "set of independent organisations and their mutual relationships" that should possess the characteristics that enable it to "function as a single organisation to reach a common goal" then the process and structural aspects are equally important. She says that it is technology that acts as the "enabling infrastructure to connect the structure of an organisation to its processes".

Charles Handy[37] gives the following characteristics of a VO:

- Using the example of a virtual library, Handy notes that a virtual library is "a library as a concept, not a place; an activity, not a building".
- He raises a point made my many authors that the concept of a VO is not new, especially where a virtual service or product is involved[38]. He provides examples of where information is the raw material of work and a network of salespeople which he says "we would not think of giving such a grandiose title as a virtual organisation. Yet salespeople operate on their own, out of no common place - out of sight but not, one hopes, out of touch or, for that matter, out of line". Journalism and the UK-based Open University are given as further examples. While the Open University has a home base, few of the faculty staff and students are to be ever found there, the home base being primarily an administrative hub.
- Handy claims that "Large parts of organisations are now made up of ad hoc miniorganisations, projects collated for a particular time and purpose, drawing their participants from both inside and outside the parent organisation. The projects often have no one place to call their own. They exist as activities not as buildings; their only visible sign is an e-mail addressand when offices are involved, "hot-desking" is increasingly common".
- Handy includes tele-working in his conception of a VO, where he states that "the office is the home of our telephone", i.e. recognising that this someone's base is increasingly, becoming his or her mobile telephone.

Nootboom[39] provides the following list of characteristics of a VO[40]:

- Difference of location (interaction at a special distance)
- High degree of outsourcing
- High level of decentralisation and autonomy of organisational units
- Individualised responsibilities and incentives
- Highly distributed ownership

[36] In Fairchild 2004 pg xii

[37] Handy (1995)

[38] E.g. See footnote 35 above

[39] Nooteboom, 2003, quoting Child and Faulkner

[40] We would like to emphasise certain collection of items on Nooteboom's list may be considered sufficient for a VO, but are in no way necessary. For example, his low duration is on its own neither necessary nor sufficient for a VO.

- Unstable structure with high rates of entry and exit
- Low duration of ties
- Non-exclusiveness of membership, simultaneous membership of multiple networks
- Use of alliances rather than merger and acquisition
- Blurring boundaries of the firm, with forms of organisation between market and hierarchy
- Embeddedness in networks of complementary competencies

Lilley et al.[41] observe that VO have been advocated to have a profound democratising effect on organisational structures, leading to flatter or 'virtual' organisations built around open exchanges between dispersed groups of individuals with common interests. Geographical and hierarchical barriers could be overcome in this organisation of the future through widespread use of computerised conferencing and electronic messaging facilities. It would supersede face-to-face interaction but also replace traditional communications tools such as postal, fax and voice telephony.

But they also note that this scenario has not yet worked out, although new technologies are showing trends toward partial VO. They draw this out "through a focus on a set of communication technologies collectively known as groupware, which typically lie at the heart of what is seen in the VO".

Mary Hatch[42] describes a new form of organisation challenging the modernist ideals[43] of organisation. Moving away from hierarchical approaches, the networked organisation works as a network that replaces most, if not all, vertical communication and control relationships with lateral relationships. Thus the formal ties that bind the units of an organisation together are replaced by a partnership between several organisations. Networks seem most likely to form when organisations face rapid technological change, shortened product lifecycles and fragmented, specialised markets. In a network, required assets are distributed among several network partners such that it is not one single organisation within the network that produces products or services, but rather the network at large that is the producer or provider.

A network can be the result of massive outsourcing or of collaboration between small firms whose scale of operations would not allow them to compete in international markets by themselves. Outsourcing means that many of the activities of a once complex organisation are moved outside the organisation's boundary. Some of the suppliers will be spin-off units with the original organisation retaining only those activities for which it has a particular competence. All other required activities will b purchased from other organisations.

[41] Lilley et al. based on the views Hiltz and Turoff (1978)

[42] Hatch 1997, pg 191

[43] Some characteristics of modernist views are (1) the desire for unifying views (2) truth as "the one best way" (3) scientific basis in empiricism (4) that complete information would provide perfect knowledge (5) that everything worth while for an organisation can be measured (6) that complexity can be controlled and so on. (See Hatch 1997 pgs 34 – 51 and pg 191, Cilliers 1998, Linstead 2004 and Lincoln and Guba 1985 for further detail and references).

2.2.2 Characteristics of VO from VSO Report[44]

The researchers argued for the following charactersics of a VO.

- A set of business entities linked together
- Linkages occur across traditional business lines
- A VO creates a collaborative network
- The purpose of a VO is to create new products, processes or services and to enhance learning and market awareness
- A VO relationships can be temporary, medium term or even permanent
- The VO, while always in some sense a network, can consist of a single networked enterprise[45]

The report argues that VO can be "virtual" in multiple ways:

- Use of ICT to link resources and to enable collaboration
- Human capital structures, that enable expertise, capital and resources to be located as and when requited.
- Empowering middle management to contract or outsource specific business tasks when cost-justified.
- Enabling collaboration through decision support software, expert systems, self-learning embedded procedures, mentoring software, and critical path management.
- Database structures providing access to information without requiring replication and synchronisation.
- Customer experience. A VO can use technology to create highly personalised customer experiences based on customer knowledge and behaviour.

2.2.3 Terminology Commonly Used to Describe a VO

There are many terms used to denote certain aspects of what we would refer to as a VO. Each of these terms provides some insight into the nature of a VO, but none, in its own, provides a comprehensive view. The following terms were found in the VO literature:

- Smart organisation
- Collaborative networks
- Integrated supply chain
- Joint venture
- Alliances

[44] Source: VSO report

[45] We interpret this to mean a single legal entity (a traditional organisation) that becomes virtual by teli-working and outsourcing etc.

- Outsourcing
- Virtual office
- Brokering
- Consortium
- Integrator
- Boundaryless organisation
- Virtual management
- Networked organisation
- Spin offs
- Franchising
- Consortia

2.3 Dimensions of Analysis

2.3.1 Introduction

The nature of a VO can be discussed at a number of different levels or dimensions. These are introduced in this section and more detailed analysis given in subsequent sections. Understanding the different dimensions is important because various consequences for management and technologies flow from the forms chosen by a VO. But an important observation that we have gleaned from the literature is that a VO may take on more than one of these forms simultaneously or change forms through time. It is not a static classification.

No research has been found that provides theories on how these different dimensions can combine or what sense we can make of them.

2.3.2 Structure

Literature on VO demonstrate a diversity of organisational forms from simple mobile or tele-working to sophisticated joint ventures or large-scale outsourcing.

This diversity represents responses to different environmental factors and goals of the organisation concerned, but this diversity in structures rules out any unified solution to the management of VO.

2.3.3 Product

In some of the literature, VO are companies that make and market virtual products. While we do not gauge that exclusivity is involved in this type of VO, virtual providers, particularly of information services or certain segments of the consulting and publishing industries are strong contenders for organising virtually. Warner and Witzel[46] mention Reuters, which formed in the 1800s as a near VO even based on a modern understanding of VO. Their product was information delivered via the telegraph. We also cited many references indicating that the knowledge economy is placing more emphasis on knowledge as a product/service asset and in many cases, knowledge is a virtual product.

In reality, complex services and products will fit across many places of the product virtuality line.

2.3.4 Duration

Many authors emphasise the temporary nature of a VO. A VO forms to undertake a specific task or to achieve a specific objective and then dissolves. While this is true of many VO, we do not consider this a necessary condition. In fact, there is enough evidence in the case studies and literature to suggest that VO will form across a broad spectrum of the duration line – from very short-term to sufficiently long-term to be considered a going-concern[47].

[46] Warner and Witzel 2004 pg 36 and pgs 46-47

[47] A principle from accountancy that assumes businesses are not going to stop, but continue trading.

3 Taxonomy of VO Structures

3.1 Introduction

We have also found a corresponding diversity in the literature describing the nature or structure of a VO. We now present these different models, but we also note that the models described here are abstractions. No single author showed a determined bias toward a single model, although we did note that some authors favoured either one or two of the models presented here. In such cases, the preferences were not explicitly given (i.e. they did not necessarily argue for the virtues of their model over others) but their commitment to a given model is implied by their explanations of VO technologies, purpose and formation.

3.2 THINKCreative Definitions

In the THINKCreative project regional workshops, the following three types of VO organisational forms were identified[48].

3.2.1 Type A VO

Type A VO are based on "long-term partnerships of SMEs with one dominant partner (or a few dominant partners)." This type of arrangement is common in the automotive and clothing (fashion) industries and in the major supermarkets[49] where the domination of the sector by a single company takes the form of product and service specification, prices, the quantity of product or service provided and even capital and equipment[50].

Typically, organisations are brought into the VO because they are well established, well known and are capable of working to explicit contracts drawn by the dominant organisation. Type A is typical of outsourcing arrangements and where the individual participants may not be well known to the dominant organisation, they are more attractive to them if they already participate in well defined clusters called by THINKCreative "breeding environments". These breeding environments are very important to VO formation because they demonstrate a willingness to cooperate and an ability to participate and contribute[51]. They therefore provide an important source of potential collaborators for any group/individual wishing to form a VO (or to study VO)

3.2.2 Type B VO

Type B is oriented toward a project-based partnership where the network does not play a dominant role. It is usually organised as a democratic, quasi-stable structure of bodies with complementary capabilities.

[48] Afsarmanesh et al. 2004, pg 79 - 81

[49] Major European Supermarkets such as TESCO Carrefour certainly fit this model.

[50] As is the case, for example, of Nike. See Grabowski and Roberts, 1998.

[51] See Camarinha-Matos and Afsarmanesh, 2004 pg 9.

Decision-making in Type B organisations follows a similar pattern to those made in the ICT 6th Framework projects. This aims at consensus, based on work-packages and different organisations leading various components of the work-plan.

3.2.3 Type C VO

A type C VO is "based on temporary partnerships aimed by one organisation to explore short-term market opportunities, mostly amongst small to medium-sized enterpises (SMEs)." This type of VO, according to the authors, is typically governed by rules that are set-up by external bodies (such as governments, chambers of commerce, or by common traditions) and there is no resource (nor need) to fix these rules internally within such a VO.

Camarinha-Matos and Afsarmanesh acknowledge that in practice, VO often represent these forms in a hybrid manner, or have often evolved from one form to another. The world of VO is not static.[52]

3.3 Market Study Definitions

The following definitions represent the market study authors' consolidation of VO conceptions found in the literature. The taxonomy we suggest overlaps with the THINKCreative definitions above, except that we place less emphasis on the necessity for a VO to be grounded in a short-term or project-based mission. The taxonomy of VO types we will adopt are presented in the following sections.

3.3.1 VO1 – The TrustCoM Conception

The TrustCoM concept of a VO is presented in the TrustCoM proposal technical annex. The TrustCoM definition is effectively the "baseline" VO definition against which we will compare other to definitions:

"Formation of an independent entity comprising joint ownership (but can include additional participation) by its formation organisations to perform short-term or long-term goals. A key characteristic of VO is that they have sufficient brand presence to enable their customers to engage with the VO itself and not with one of more of the participating organisations."

We recognise that the definition given in this section may, in some areas, go beyond some conceptions of VO within the TrustCoM project. For example, the emphasis in the TrustCoM project is on the coming together of many organisations to form a new entity to perform task(s) or achieve goals. But our definition here explicitly includes tele-working, mobile working and outsourcing as optional components of a VO[53]

A graphical representation of the VO1 model is shown in Figure 3 below, where boxes represent organisations and ovals represent individual employees:

[52] Camarinha-Matos and Afsarmanesh 2004 pg 80.

[53] We include these for completeness – we desire for the study an all embracive conception. The TrustCoM model doesn't exclude these additional elements, but it is clear that these additional elements are of marginal concern for TrustCoM. However, we consider that such additional conceptions will exist in real-world examples of TrustCoM conceptions and these will impact ICT requirements.

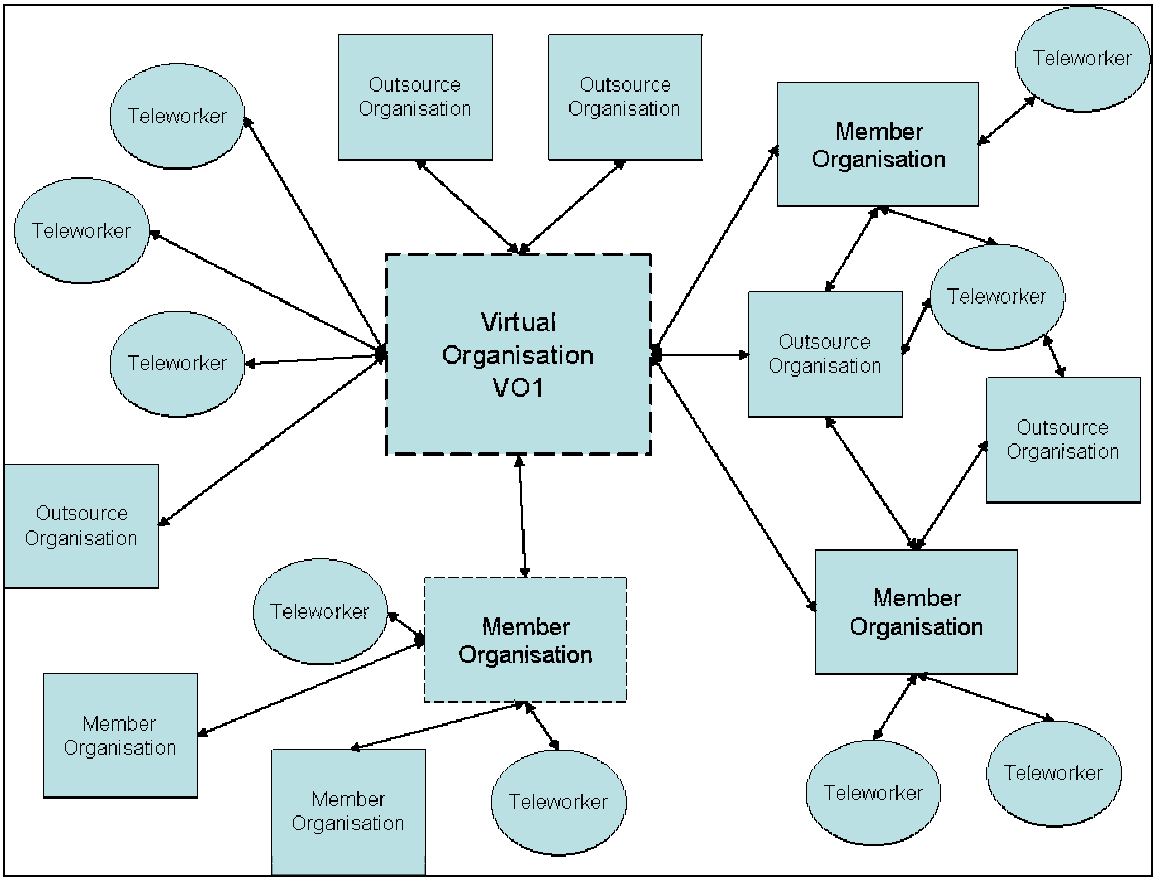

Figure 3: VO1 type VO

The following points can be noted about this model:

- It is the most complex of all the models described in the study.
- The VO in this model is created as a VO by a number of different contributors or member companies. The centre of decision-making is within these contributing companies, not within the VO itself.
- The VO is, however, marketed as an independently existing company in its own right. It is the place that customers go to and the place in which customers carry out their business transactions. It therefore differs significantly from the VO2 model (below) in which a single organisation decides to go virtual, but in most cases, the customers will still interact with the original company.
- No assumption is made about the composition of member organisations. In the diagram, one of the member organisations is itself virtual. The way people work inside the VO or the member organisations is not specified. In the diagram, there are teleworkers (our VO3 below) who work with their colleagues and/or customers and suppliers in virtual space.
- In addition to different types of member organisation, the model illustrates that the VO1 organisation can outsource operations and activities to an outsourcing organisation (i.e. one that is not a member of the VO itself).
- Critical to the success of a VO1 organisation is the trust built between the member organisations.

- Process integration and planning are also critical for VO1 success. The connections between these organisations may provide economies of scale or may reduce financial risk, but the connections also add complexity as the whole organisational machinery will require more detailed planning and control.
- An important ingredient of successful VO1 organisations is the contractual relationships defined between its members and by implication, the quality of the resulting contract. Just as important is the fact that situations may require the contractual processes to take place quickly, thereby adding pressure to successfully form and start operating the VO within the required timeframe.
- Such organisations may be linked together only temporarily in order to gain some competitive advantage, achieve a common goal, reduce risk or provide a basis for shared innovation (Granbowski and Roberts 1998). Granbowski and Roberts give as examples fire and emergency medical service units providing support in large-scale disasters, oil spill response teams and international oil exploration consortia.
- There are requirements for identity management for authentication purposes.
- The model illustrates complex organisational structures and processes that will require careful agreement./contractual and project/programme management, which ought to be strongly ICT supported and automated.
- The model dictates clear guidelines and ICT support for establishing, managing and enforcing breakdowns in member contractual performance.

3.3.2 VO2 – The Second Concept of VO - Outsourcing

In the outsourcing model, the organisation opts to surrender the act of performing selected activities and contracts these to an external organisation. Initially, outsourcing was confined to the organisation's "hygiene –factors". For example, the staff canteen is not a critical aspect of most organisations' core competencies or key business process activities, yet it is often a necessary employee service, so in many organisations such activities were the first to be outsourced to specialist organisations such as catering companies.

Over time, more aspects of an organisation became outsourced; including more fundamental process activities – in fact, business process reengineering (BPR) exponents would often recommend that only core-competences should remain internal. Examples of outsourcing vital business process elements include the following:

- A tax consulting firm outsources the translation of vital client documents – this often involves legal documents being translated into several languages. The process is critical, but the tax consulting firm believes that it is not within its core competency to manage the translation process itself. Key to such an outsourcing arrangement are carefully defined service level agreements (detailing confidentiality, document handling, security, translation times and costs) and suitable technology to secure documents passing via the web.
- An employment agency working with disabled people outsourced the tasks of coordinating field staff, prospective employees and their potential employers. This is an example of outsourcing the control of the organisation's primary business process.

Mary Hatch[54] goes as far as saying that "When all task activities are outsourced, you have a virtual organisation".

[54] Hatch 1997

A graphical representation of the outsourced model is shown in Figure 4 below:

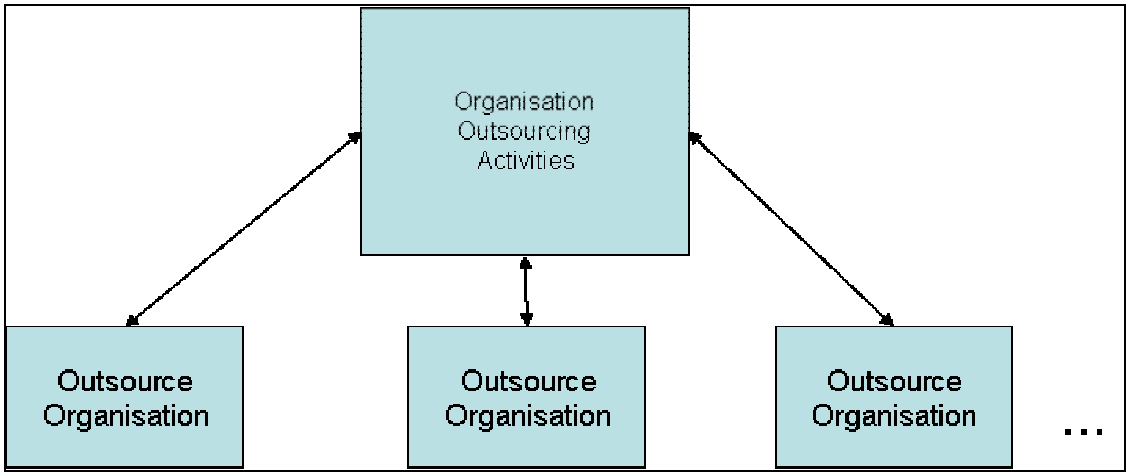

Figure 4: VO2 type VO

The following points can be noted about the outsourcing model:

- The organisation that outsources is still the centre of activity; hence it is not, in many respects, a genuine VO – the outsourced organisations work for the outsourcing organisation.
- The outsourcing organisation may in every other respect maintain traditional hierarchical structures and physical locations.
- The outsourced organisation may also in every other respect be a traditional brick and mortar organisation with traditional organisational structures.
- The outsource organisations can typically operate in a free market for their skills (hence why the industry supply chain is much more dynamic than if each of these outsourced tasks were performed in-house, duplicating resources, skills, learning and innovation).
- The model makes no assumptions about the nature of the product or service being delivered – i.e. whether this product or service is defined, delivered or merely exists in virtual or physical space, or combinations of the two.
- Outsourcing may or may not require tight process integration. When outsourcing occurs for critical process elements, then supply chain integration becomes critical. How sophisticated this needs to be will depend on the nature of the business process itself. A very complex process that relies on outsourcing in an intricate way will require a more sophisticated solution than simple outsourcing of e.g. raw materials or consumables.

3.3.3 VO3 – Teleworking

In the teleworking model, the organisation chooses to allow its employees to work away from centralised offices or locations. The degree of virtualness will depend on the nature of the organisation's work. This concept of the VO is widespread in the literature. An organisation becomes

virtual as it loses its reliance upon bricks and mortar locations in which people work together physically. For example, Stephen Fineman has the following to say about a VO[55]:

"We cannot leave daily for our office downtown (as there is no office). We cannot meet fellow workers at the water cooler, coffee room or canteen or stroll down the corridor to chat to our boss (these places don't exist). We cannot casually joke, flirt or grumble face-to-face. We cannot smell the grease of the machines or our associates' after-shave or perfume."

Obviously such a teleworking environment requires a new way to manage and motivate and this will involve a whole new set of technologies. But Fineman's model of a VO as virtual teams goes beyond VO3. He also includes the customer and supplier relationships where dialogues with customers in sales negotiations and suppliers in supply chain negotiations are also carried out in the virtual world.

A graphical representation of the teleworker model is shown in figure 4.

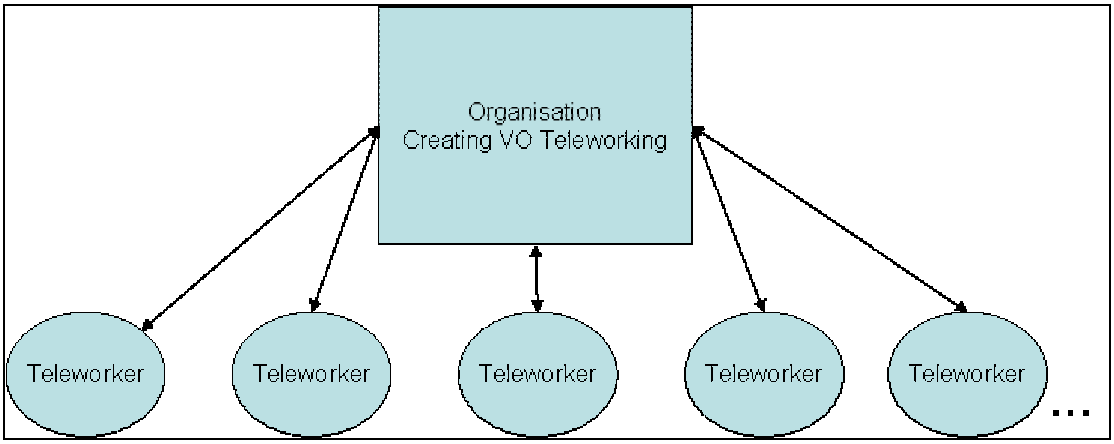

Figure 5: VO3 type VO

The following points can be noted about the teleworking model:

- The viewpoint is still single organisational centric (i.e. it is a VO2 model) so that the organisation makes choices about itself and the way in which its employees will work.
- The model makes no assumptions about the organisation's products or services. They may be traditional physical products, manufactured and distributed by the organisation, or it may manufacture and distribute its products using the outsourcing model.
- This model is quite common in e.g. professional services firms, where employees can easily work from home when they are not working at their client offices.
- The organisational/teleworker relationship here can be one of employer/employee, or, in many cases, the relationship is one of contractor, in which case the organisation is outsourcing.
- It is unlikely that an organisation would select all its activities for teleworking. Some activities lend themselves more to teleworking than others (help-desk work, professional services and sales work are examples of work or professions sometimes suitable for teleworking). In

[55] Fineman, Steven, "Understanding Emotion at Work", Sage, 2003

contrast, assembly line work, shop assistance and warehouse packing are examples that are not conducive to teleworking..

- This form of VO may be of less interest to the TrustCoM consortium (it is the furthest from VO1) but many of the technologies discussed in reference to VO3 are applicable to many of the other VO models. It should also be noted that a VO1 organisation could still work with the VO3 model for cases in which the VO1 organisation employs staff.

3.3.4 VO4 – Free Market Network

In VO4, a VO is formed around a free market trading environment. This approach has been taken in many e-business market places. One notable example is the VO created by clothing retailer Benetton. It is comprised of hundreds of small clothing manufacturers and thousands of franchised sales outlets. The Benetton model shares some of the characteristics of VO2 (Benetton controls the network formation, even providing capital, equipment and training to firms joining the supply chain). Hatch (1997 pg 191, 192) describes the Benetton network as a network structure where "partners are linked by supplier-customer relationships that resemble a free market system". That is, goods are bought and sold between network partners just as they would be on the open market. In this way competitive pressures on the supplying partners keep downward pressure on prices. Also, the use of market mechanisms to coordinate activities eliminates much of the need for the vertical hierarchy of traditional organisations and this reduces administrative overhead.

There are constraints on this VO model, which are described in the barriers section below. In particular, such a "market model" can become distorted if one or more players can become dominant (as is often claimed by suppliers to leading European supermarkets).

3.3.5 VO5 – Free Market Mobile Working

In VO5 the emphasis shifts from the organisation to the worker. This situation has been referred to as the "Death of the Job" (Bridges 1995) and is also described in "Brand You" by Tom Peters (Peters 1999). On its own, the free market mobile working scenario would not be of particular importance for this study, which is chiefly organisation-centric, but the advent of freelancing mobile workers has largely coincided with the emergence of VO that want to employee them. The arrival of the "free marketplace employee" model has important implications for VO because, firstly it provides a market place for individuals to come and go as their skills are required and secondly, it creates special challenges for VO wishing to use this model. These challenges are discussed in the section on barriers below.

3.3.6 Impact of the Different Definitions

In analysing the current literature and the empirical research provided by the THINKCreative project, we make the following generalisations about the nature, structure and characterisation of VO.

- Apart from TrustCoM references, we did not see any reference to trust, security or technology as central considerations when forming VO. Technology is seen as an enabler, security as a necessity and trust as an important cultural enabler.
- The most common recurring themes for VO characterisation are: temporary alliances to fulfil goals or objectives; decentralisation, flattened hierarchies and dynamic and changeable structures. But the last point, for example, can mean ownership or non-ownership involvement (i.e. the organisations partaking in the VO may or may not own shares in the VO). The idea that a VO is a group of independent companies establishing a VO as a new independent company is not central to the understanding of VO in the literature. Of equal importance is the idea of outsourcing or mobile/tele- working (and the virtual office).

- We did not see any explicit empirical research on the lifecycle of VO formation or explicit examples of internal structure, but there is a significant amount of literature dedicated to the challenges of managing these various forms of VO. The following section, in examining some recent VO case studies, draws to the surface some of these challenges.
- The TrustCoM project makes no explicit reference of VO2 – VO5, but these are clearly seen as VO in the marketplace. There is a danger that the TrustCoM idea of a VO will be taken by the business community as a marginal conception. Care must be taken to position TrustCoM within the general market conceptions of VO. For example, the concept that an organisation "becomes" virtual is in effect meaningless within the TrustCoM project. For example, Mary Hatch's quote given earlier to the effect that an organisation becomes virtual once all its tasks are outsourced finds no place in the TrustCoM conception. While one may find some justification in thinking that the TrustCoM definition is a more mature or advanced version of a VO conceptualisation, the different concepts of VO reported here are in some senses mutually exclusive, which suggests that these concepts are in fact quite different, none being more legitimate than the other to the title of VO.

4 Case Studies of VO

Little is provided in the literature on case studies of VO, which is not surprising, given that this is a new and possibly experimental organisational form. However, we have sourced as many case studies as we have found from literature specifically providing such studies for research on VO.

The case studies are important because they provide important resource material for observing conditions relating to the questions we are addressing in the study. Thus where VO literature misses explicit discussion of questions of importance to the market study, the case studies provide empirical evidence for sources of insights that address answers to these questions.

The case studies have been placed in an appendix at the end of the study. The case studies presented there are arranged by level of detail. We present some mini case studies that are quick to read and easy to absorb. We follow this with more detailed case studies and finish with some in-depth studies. In the appendix section, we provide summaries of common themes running through the case studies and indicate implications for the TrustCoM project.

5 Beneficiaries and Impact of VO

5.1 Introduction

In this section, we summarise several sections of the Camarinha-Matos and Afsarmanesh publication of the THINKCreative project's development of potential industries, driving forces leading to VO and the impact VO is expected on firm's business processes. These themes are developed via the use of three case studies. We have included these case studies in this section because of their link to the themes developed here. In this section we also provide some interesting scenarios developed by the THINKCreative project that consider what a VO could be like in 2020. These scenarios are worth comparing with the vision established by TrustCoM. We also include results from the VSO study that also addresses the types of companies that will benefit

5.2 THINKCreative Case Studies

The following case studies are used by the THINKCreative project to develop scenarios for future VO.

5.2.1 "Virtuelle Fabrik" EUREGIO Bodensee

This consortium consists of 40 different SMEs in four different European regions and has its origin in the Bodensee region in Switzerland and Germany. The core competencies cover a wide area of the technologies used in manufacturing industries, whilst the focus is on the business segment of machine building.

The following describes how the consortium works. "Each partner can perform the acquisition of new orders, as they are completely independent in legal terms. Each order entails the establishment of a new cooperation process, in which not necessarily all members of the pool have to be involved." They continue to explain that the consortium reflects virtually all of the required expertise to serve their markets and as a result of their cooperation, potential competitors would need a considerable amount of resource and expertise to compete.

5.2.2 Projektwerk.de

Founded in 1999, Projektwerk.de is a VO that consists of about 4500 freelancers and small enterprises working in the area of information technologies. It is an Internet-based platform that "empowers freelances and small enterprises to publish their profile, submit bid invitations and search for cooperation." Projekwerk provides cooperation administration, professional support and helps in creating the cooperative organisational structure. They also administer the network of the founded cooperation organisation.

5.2.3 Infranet Partners

Infranet partners consisto f nie companies across the world. They offer solutions based on the Lon Works technology, which links sensors, actuators, controllers within a machine, a building or an industrial processes. Infranet, which was set up as a VO from the start, provides the expertise required to build up such a network as well as the implementation skills. This degree of specialisation and broad skill sets across the VO puts Ifranet Partners in a sound market position.

The consortium has access to markets world wide and would be very difficult for any individual organisation to replicate.

5.2.4 Nike

Nike and its association with its Asian suppliers is a typical representation of a supply-chain management network. This kind of VO can be found especially in the old economy, mainly because while products change, they do so in a constant manner[56]. Thus building quick and flexible project teams is less important than trying to reduce production costs. Nike has its competencies in marketing, design and production. But the main share of its production is based on a network of Asian suppliers. Only a small part of the products are produced in Nike's own factories. Nike manages the supply chain and decides on design and quality. The suppliers are independent and produce in the name of Nike. Nike sells these produced goods in its name. Even though production is a convenient way would be possible in Nike's own factories, this model has many advantages such as lower costs, scalable production capacity and reduction in risk investment. There are advantages for the suppliers too, with increased orders security and no costs in design and development.

This model can be found in many companies of the so-called old economy and was more or less established with the first outsourcing approaches.[57]

5.2.5 Cooperative Südburgenländische Handwerksbetriebe

This is a consortium of building industry actors formed in 1999 to build houses. It includes electricians, joiners, glaziers, architects and other manufacturers needed to build houses. The establishment of this VO has enabled customers to obtain their whole product range out of one hand which is really a VO of legally independent firms. Risk is split and shared over the shoulders of the whole network and allows a higher market presence.

5.3 Type of Organisations Benefiting from VO

The case studies undertaken by the THINKCreative project identified the following industrial sectors that seem to benefit from a transformation to VO.

5.3.1 Building Industry

The following features of the building industry make it attractive to VO:

- A large number of different specialisations are required in undertaking a construction project
- The actors need to work very collaboratively
- Communication between actors during the project is of high importance for the realisation of the construction plans
- Project management is of central concern to the building industry, but the project managers do not need to be in any sense owners of the project.

[56] Camarinha-Matos and Afsarmanesh 2004, pg 17

[57] Camarinha-Matos and Afsarmanesh 2004, pg 18

- Most SME firms involved in the building industry cannot serve all the requirements of a customer, but through a VO, is able to gain a market presence otherwise not possible. The Cooperative Südburgenländische Handwerksbetriebe in Austria (mentioned above) is a successful example.[58]

5.3.2 Traditional Manufacturing Industry

Alexakis et al.[59] indicate that there are only small differences between a working supply chain and the concept of a VO. They are:

- Differences in IT infrastructure
- Asymmetric dependency
- Lower communication level

Apart from an example provided in the automotive industry (which is heavily controlled by the main automotive manufacturer) no real examples are given. But they do indicate the need for more research on how different concepts of VO could benefit the traditional supply chain. They consider a "virtual marketplace" as a promising start.

5.3.3 Trade Organisations

A trade organisation is a special kind of supply chain containing wholesalers, producers, retailers, logistics, advertising and promotions. The potential for a VO here lies in the use of information technology to provide transparencies across the different actors which will add efficiencies and economies of scale into the market as well as provide a market place for buying and selling.

Alexakis et al. add "The transformation of trade networks into virtual organisations is a highly interesting field. Expected benefits are lower purchase prices, high market transparency, quick delivery of goods,, and high flexibility in the choice of business partners. We also expect positive effects for the customers, e.g. lower prices, better quality, and a bigger choice. Thus, customers as well as the organisations are expected to profit from the transformation"[60]

The VSO study considers that the set of companies emerging as VO in the marketplace to be a small set within Europe. In the VSO study, the researchers examined the activities of two small companies that started business as "virtual" companies. I-Know-Law[61] 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 the researchers 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 the researchers interviewed for this project that began business as a VO. Other businesses were transitioning from more traditional businesses to VO.

[58] Alexakis et al 2004. pg 19

[59] Alexakis et al 2004, pg 19

[60] Alexakis et al 2004. pg 20

[61] This case-study was examined in section 12.

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, the researchers 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 the researchers 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. The researchers 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.

A big challenge in interpreting the results from such case studies is whether they represent a suitable sample. But more importantly, the examples illustrate the different definition models and how these impact the type of organisation changing to a VO. In the Oestergaard example, the product is virtual (the provision of web-based applications used by their customers) but these services are set within a reasonably traditional B2B e-business application environment and traditional e-business supply chain management.

5.4 The Three Scenarios Developed by the THINKCreative Project[62]

5.4.1 Introduction

The scenarios developed in the THINKCreative project are useful as a potential benchmark where the industry is heading – it provides a basis for determining the driving forces that are shaping future business as well as indicating the impact on business processes.

The scenarios were developed over a two year research process, which involved literature research, review of engineering developments and the THINKCreative workshops. The researchers have been studying VO for almost a decade in a dedicated Centre of Competence at CeTIM, which involves industrial companies and researchers.[63] In them we are asked to imagine that the time is in the year 2020.

[62] Katzy et al 2004. Chap. 2.3

[63] Katzy et al 2004. pg 28

5.4.2 The Regional Cluster and Enterprise Network[64]

The first scenario maps out a scene where manufacturers in a region are networked into a regional cluster. In this market, few large manufacturing giants remain in existence and the majority of global firms focus mainly on product and service integration, world wide branding, marketing, and finance and strategy guidance.

Networks use brokers to take charge of order acquisition, network marketing and for the internal assembly of project teams to undertake the facilitation of orders. Key to the success of such a cluster is the information technology that provides information about product development and order requirements. It is called the virtual collaborative platform. It also provides the coordinating functions that enable project coordination and planning, materials procurement and management reporting. The reporting is a fundamental component of the system, because it provides performance data on the members, contains capability and experience records, and business intelligence reporting. The application also contains virtual meeting facilities required throughout the bid process and project execution. Despite these virtual facilities, various groups meet physically at periodically including an all members meeting twice a year.

The cluster provides its members with several advantages including market presence, reduced cost, a focus on core competencies, growth potential and economies of scale.

5.4.3 Professional Virtual Communities[65]

This scenario centres on Martin, a UI designer who left his company of employment to specialise in his core skill of designing screen interfaces in the area of ambient intelligence. Many of his colleagues also left their employment to work as independent knowledge workers.

Martin now works for several companies, or networks, because most of his customer companies work in networks. Martin has joined the local community for multimedia and virtual reality design, which works like a guild in former times. The guild members agree on minimum charge out rates and take a fee to pay for social security, training and to develop the rules of conduct for the profession.

The community also markets the members as a group, since the combined skills and competencies of the members provide them with larger project capabilities. The community leadership also define strategies, skills development, performance measurement and rating, and well-balanced cooperation and competition frameworks within the group. They have links outside the community into the global markets, as they are competing with other similar communities throughout Europe and the rest of the world.

Technology again plays a significant role in the functioning of the community. Martin gets his new projects through the portal of the community (although this does not exclude Martin from using his personal contacts, especially those close to his work).

As an example, Martin has seen one morning an interesting invitation for tender in the community's portal. This has been filtered by the intelligent agents set by Martin – he is keen to receive only relevant and interesting tenders. But Martin also instructs his system to extract other projects that may be of interested to his wider circle of friends. In this way, he can keep a close contact with this circle and keeps him up to date with the market.

[64] Katzy et al 2004. pgs 28 - 30

[65] Katzy et al 2004. pgs 31, 32

Martin can use the virtual meeting facilities to meet with the project manager to clarify details of the project. He can then ask some of his friends to join in for the proposal. The portal provides messaging and conferencing facilities together with electronic paper to help in the bidding process.

Once the project has initiated, more private and sophisticated facilities are provided by the portal, principally software to enable collective design and collaboration.

5.4.4 The Global Networked Firm[66]

In this scenario, two major communications companies have merged to form a global communications service and hardware provider. The company, Nokisco[67], despite its global size and presence has only 25% of its former workforce. This development started with outsourcing support functions such as accounting, human resources, logistics, facility management etc. But to keep up with technological developments and demand, Nokisco has worked in co-operation with a number of research institutions and universities. Production supply has subsequently been deployed externally. What is left internally is product definition, quality assurance, brand management, marketing, forecasting, new business development, supply chain management, supplier relationship management, and contract management. To support these tasks a number of sophisticated computing applications are necessary. This includes factory and supply chain automation, web-based order management, product documentation and sales training.

Since many processes and constellations are constantly changing, design, problem solving, and project management are however still human-dominated. But most work is performed in teams and outside these teams little formal hierarchy exists.

Nokisco is extremely powerful in the market, but there is still strong competition. The power of these organisations do, however, make them strong bargainers against local network suppliers and their global nature protects them from the local network suppliers ability to reach globally. But the importance of customer service, which is implemented at the local level, provides a counter balance to their scales of power.

5.5 Driving Forces Leading to Scenarios

This section summarises the factors that formed a basis for the scenarios described above. These are described as “weak signals” that indicate what is happening in the market. Katzy et al. emphasise that the scenarios were not defined by simple extrapolation from the past and indicate that the scenarios were developed from research resulting from material gathered in projects, the workshops and Delphi survey.

The drivers are important because they site the future into the changing patterns of the present. Katzy et al. is also significant for the areas of drivers where they believe more research is required (and hence, areas where they have insufficient information to make judgements).

5.5.1 Changing Attitudes Toward Work

Modern industrial work has been changing through the last century from manual based work toward knowledge based work. Previously, experts were employed to manage, direct and control the

[66] Katzy et al 2004. pgs 32 - 34

[67] A play of words on the companies Nokia and Cisco

workforce. Today, with the growing amount of knowledge work, supervision through command and control is having to give way to new approaches since knowledge workers are capable of planning their own work, and often are required to adjust their approaches and work style to individual problems.

Knowledge work is structured around smaller teams and is less hierarchical. Knowledge workers need more co-ordination support than control and they see change as opportunities not as instabilities.

5.5.2 Increasing Relevance of Specialisation and Expertise.

The economics of knowledge work or intellectual capital differs from industrial capital. Most importantly, economies of scale do not apply and innovation becomes a central driver to replace scale. Organisations centred on knowledge are recognising the importance of multiple relationships and shifting cooperation as sources of innovation. Organisations need special networking competences to build networks, to find a position in a network, or to create new contexts and constellations.

5.5.3 Reducing the Functions of Business Firms

A clear shift has taken place over the last 100 years from the firm being a social centre (providing education, social security, housing, medical services, sports, cultural events and so on) to being focussed far more on core business capabilities (with social functions being centred on local or governmental bases). Part of this trend is also concomitant with the fading ideal of life employment within an organisation.

5.5.4 Management Becoming a Service, Instead of a Position

Managerial capability will increasingly become a professional service to be provided under competitive conditions. Changes to the functions of business firms (previous point) will increasingly demand efficient, goal oriented coordination and management services, which can be an independent note in the network itself.

5.5.5 Globalisation

Katzy et al. find two main drivers at force within globalisation. Firstly, global sales and marketing necessitate cooperation at the local level for local access and regional service provision. Secondly, global access brings global competition requiring innovativeness and adaptability, which are important strengths of networks.

5.5.6 Additional Drivers That Are Not Given Detailed Analysis

Katzy et al. provide a short list of additional drivers with little additional comments. This is disappointing given that all of these points are important in establishing and managing a VO. For example, we could ask whether the employment, capital and regulatory frameworks in existence today are sufficiently suitable for the type of VO envisaged by the TrustCoM project. Throughout his writing on VO, Handy raises challenging and critical questions relating to each of these points, but we have not found in-depth empirical work that offers a roadmap to their solution.

- Willingness to work in the new environment[68]
- Availability of capital flows
- Regulatory support of governments, regulators and the EC.

The three additional drivers listed above raise more questions than answers and in the case of the second, Katzy raises the question of which organisational forms will become more attractive to capital investors.

5.5.7 Technology Drivers

Finally, Katzy et al. provides the important technology drivers for the networked organisation, but again, presents the driver question without sufficient answer. After listing some of the most common and useful technologies (communication support such as e-mail, fax, messaging, groupware) they state that "further research is necessary to identify the most important (technology) drivers"[69] (words in brackets not in original). They indicate that the real 'killer applications' are unknown.

5.6 Impact on Business Processes

The final section of Katzy et al. is a description of expected changes to business processes within the organisations represented in the scenarios.

5.6.1 Innovation, Product Development and Integration

Innovation is becoming an important aspect of business strategy and knowledge management. Innovation will become a core process within VO as the exchange of ideas and informal discussion is seen as vital components to successful innovation. Given the personal nature of such communication, it is believed that regions and clusters will remain important breeding grounds for innovation.

Product development, either large scale or smaller scale, will be provided by networks of organisations, outsourcing and VO1 VO, all supported by distributed data management.

5.6.2 Supply Chain Creation and Management

A number of situations are envisioned in supply chain management. Most manufacturing will be done within a network of production sites. While such configurations will be highly flexible, switching hurdles will make networks relatively stable. Expected switching hurdles are the cost and time taken to adjust processes, systems or organisations. Also, the time taken to build mutual trust, reliance and understanding will keep relationships relatively stable. High innovation and specialisation based processes will be driven by firms within the network, whereas highly standardised processes will be increasingly automated.

[68] Handy (various publications), Warner and Wiztel, Lilley et al., and Fineman provide a synopsis of this problem.

[69] Katzy et al. Pg 36

5.6.3 Manufacturing and Operation

There is a strong trend towards smaller and more flexible production units, even for traditionally large scale operations such as steel milling or car assembly. Production capacity can be sold to different customers.[70] This indicates a possibility of specialised production facilities that will ensure that much manufacturing will not be reduced to a commodity. The main differences being the opening up of otherwise traditionally closed or sheltered part of a company – its design, manufacturing and operations.

5.6.4 Service Operations

It is expected that service provision will remain a highly individualised and knowledge intensive activity, but wherever possible, services will be provided via remote services.[71]

5.6.5 Marketing

Brands will remain a vital marketing force and alignment to strong named brands by smaller networks of organisations an important strategic position. However for specialised products and services branding will be seen as less important.

5.6.6 Finance

Financing networks of organisations will require changes to the way in which funding is understood and managed in financial markets. Such schemes may require the input from regional development agencies or governments.

5.6.7 Coordination and Management

Katzy et al. summarise coordination management as dependent on the type of activity, but generalise by indicating common features such as it being less hierarchical, more self organising, involving consensus building approaches, network brokers, professional communities and network coaches. Project managers will play a vital role, but will have no direct control over the members – it becomes a support service to the network. These will be underwritten by the rules, standards and conditions agreed to by the network members themselves.[72]

[70] Katzy et al. provide an example of the Finnish Velmet plant, which produces the Porsche Boxter and Saab convertible on the same line.

[71] Examples given are machine supervision and maintenance and remote help desks.

[72] It will be seen that many of these changes are highly applicable to VO1 and VO2 organisations and less to VO3 and VO3, VO4 organisations.

5.7 Competitiveness of a VO[73]

The VSO report's conclusion was that VO are more competitive than non-VO. Indeed, the authors expect that many more European companies will take on VO features over time for the following reasons:

- **Labour.** A VO can engage human resources when they are needed, which will drive down labour costs. This model is a serious challenge to traditional European labour culture that values long-term labour contract commitments.
- **Capital**. VO carry no or little inventory. By using sophisticated enterprise resource planning ERP systems that use the Internet to traffic in real-time inventory information, a VO can market something it does not possess nor have title making them more competitive than a non-VO.[74]
- **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), VO are naturally more competitive because they can compose, dissolve, and recompose teams or technology capabilities with relative ease.
- **Business Processes**. VO will improve process efficiency in the production of goods and the execution of services**.**

5.8 Beneficiaries of a VO Environment[75]

The VSO study made particular emphasis on a benefits lead approach to determining the measures and to defining the stakeholders within a European VO environment. The following points were raised about beneficiaries:

- While initial benefits are likely to be both large and enduring, it is expected that VO organisations will become a necessity and not an option. Thus while beneficiaries will "even out", VO organisational approaches shift from being an aspiration to being normative.
- It is expected that the VO concept has wide applicability across most sectors of the economy. Thus stakeholders in VO implementation are widespread and numerous.
- The VSO study introduced the concept of winners and losers in the move to VO. Winners in the short term are likely to be those with high ICT skills, logistics suppliers, software providers and those areas that are already highly networked.
- Short term losers are those that cannot appropriate the value of VO, i.e. those without ICT skills and those firms from areas that are not strongly networked.
- 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 to settle down and their impact is not yet clear Being knowledge- and

[73] Source: VSO report

[74] Experience at Amazon may raise doubts about the universality of this point, where Amazon UK, for example, has invested in huge warehousing facilities to enable acceptable delivery times for popular titles to its UK customers.

[75] Source: VSO report

network-based, these activities are inherently difficult to measure and thus to assess. The researchers 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 VO domain as the well as outside of it.

5.9 Sizes of Companies Becoming VO

The results coming from THINKCreative and the other case studies indicate that organisations from a broad-spectrum of sizes are becoming VO. Of course size will impact the types of technologies available to the organisation and how it is used (and potentially the product or services on offer). The main reason for these differences is the affordability of software available. But then SME VO2 organisations frequently have the necessary technologies provided by the dominant organisation in the supply chain. And this situation could still be applicable for VO1 organisations.

The VSO findings are interesting, which are quoted here.

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, the researchers 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. “The researchers 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 Novo Nordisk 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 built around a website through which the selling of goods is facilitated.
- **I-know-Law,** a small company in the Netherlands[76], 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-Know-law uses is in-house and tailor-made.

[76] See case studies in section 12.

5.10 Lifecycle of VO Formation

5.10.1 VSO Concept of Lifecycle

The VSO project identified four stages towards becoming a VO that is similar in approach to the e-business maturity ladder frequently sited in EC documents. These stages are:

- **Stage 1**. 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, contractors, and technology capabilities are electronically catalogued.
- **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.

We are doubtful whether this perspective on the VO life-cycle is particularly useful. A number of criticisms have already been raised against the e-business maturity ladder and similar problems could be raised here. For example, that isolation is the initial phase is somewhat negative and overlooks those innovative organisations that adopt VO structures out of opportunity exploitation. A specific issue that can be directed to this particular model is to whether margins are the single most important factor motivating the VO life-cycle. It may instead by market penetration, new markets, or new business ventures. These issues make us wary of taking this lifecycle as a definitive model for the TrustCoM approach.

5.10.2 TrustCoM Concept of Lifecycle.

The TrustCoM project has identified 5 stages to the formation of VO. These are:[77]

- **Identification**. Discovery of potential trustworthy and reliable partners.
- **Formation**. Trust and contract establishment; security policy and consolidation based on contract.

[77] Claessens and Gueer-Pollmann 2004, pg 1209

- **Operation**. Membership and trust maintenance; autonomic security policy and deployment and enforcement; secure service orchestration.
- **Evolution**. Membership and security policy adaptation.
- **Dissolution**. Termination of trust relationships; maintenance of trust knowledge and reputation.

These elements are closely tied to the concept of VO adopted by the TrustCoM project, but does have an advantage of being operational in the sense that these phases can be used to frame ICT support for VO development. It misses a phase that addresses the business situation motivating the take up of VO approaches[78], which may impact the style of ICT support provided[79].

[78] There may be some doubt on this point. See Dimitrakos et al. 2004, pg 1199 for a slightly different interpretation of the VO Identification phase, which appears to make some allowance for "opportunity identification".

[79] But then it is recognised that many different features, such as industry type, business type, function (such as manufacturing) time durations and the like will also impact the ICT support required to support the VO lifecycle.

6 Technology Enablers for VO

6.1 Introduction

We conclude from our survey of the literature and research relating to VO technologies that current presentations provide insufficient detail and depth in their analyses. In particular, we found that researchers seldom provided links between the technologies in discussion with the relevant business problem being solved. The literature is, however, reasonably sensitive to the concept of VO under discussion. As an example, Fairchild in her book on VO technologies[80] structures her discussion on individuals, groups and corporate networks indicating VO3 4 and 5, VO2 and VO1 respectively. Unfortunately we consider that none of the technologies addressed in the book is presented in sufficient detail or depth to be of significant value to the TrustCoM project.

In the first part of this section we review the relevant sources we sited on technology for VO.

The only reference we located that considered technologies in depth is a TrustCoM deliverable entitled State of the Art. Chapter 6 of this document is dedicated to enabling technologies, which we review in the second part of this section. Chapter 6 of the State of Art document is directed to the technologies provided to the TrustCoM project by TrustCoM partners.[81] Given the authority of the organisations concerned with respect to global technology research and provision, we highly recommend the State of Art document as a definitive presentation of the whole area of VO technologies and their place in VO.

6.2 Technology Sited from Non TrustCoM References.

Our principle references for VO technologies are Warner and Witzel, Fairchild and Camarinha-Matos and Afsarmanesh.[82] These three sources are central to our presentation because they are all very recent (published this year) and because between them they balance empirical research[83] and theoretical study.[84]

Throughout the literature we sited, no discernible pattern of structure or taxonomy for discussing VO technologies was evident. But we did extract an organisation of the topic that would do justice to the information presented in the referenced works. Our proposed structure is: (1) Infrastructure, which identifies the technologies sitting below the business applications themselves. (2) Devices and interfaces which comprise what have traditionally being termed the computing peripherals such as terminals and printers but now days include a multitude of devices and computing artefacts. (3) Business applications, which include the core applications developed to support VO business processes, VO formation and management and to support the organisations legal requirements.

[80] Fairchild 2004

[81] In particular IBM, Microsoft and SAP.

[82] See Warner and Witzel 2004, Fairchild 2004 and Camarinha-Matos and Afsarmanesh 2004.

[83] Camarinha-Matos and Afsarmanesh is the publication of the THINKCreative project.

[84] Warner and Witzel use interesting models such as Boisot's Information Space model. See Boisot 1995.

Finally we indicate our conclusion that the current literature on VO technologies are piecemeal and fragmented, which has resulted in the topics presented also being incomplete.

6.2.1 Infrastructure

Infrastructure includes those software technologies that sit below the business application software. A number of infrastructure technologies have been identified as important for VO, which we present in this section without the imposition of any specific classification.

6.2.1.1 Inter-enterprise Application Integration Software[85]

Inter-enterprise collaboration requires information exchange and inter-application integration. Camarinha-Matos and Tschammer provide ebXML and ROSETTANET as examples of this type of infrastructure technology.[86] These standards provide a mechanism to enable parties to business transactions to communicate business documents in a semantically defined manner. In addition, they also provide formats that enable organisations to describe their businesses, products and services and therefore permit service discovery mechanisms.

6.2.1.2 Grid Computing[87]

While much current implementation of grid technologies is within large scientific projects, Grid technologies provide some important promises for VO supporting technologies based on the following contributions:

- Distributed resource management
- Single sign-on for users
- Grid security infrastructure

Camarinha-Matos et al. indicate four areas of VO requirements that can be supported by Grid technologies[88].

- General information and knowledge sharing
- Security to authenticate an organisation's use of resources via a single sign-on.
- Interoperability and legacy system integration[89]
- Collaborative environments
- Partner search
- Contract agreement and negotiation
- Distributed business process planning and scheduling

[85] Camarinha-Matos, Tschammer and Afsarmanesh, pgs 207 - 209

[86] Without providing any other examples

[87] Camarinha-Matos, Tschammer and Afsarmanesh, pgs 209, 210

[88] Unfortunately, the section on grid computing is very short and meagre on details. For a case study of the Virtual Laboratories, see Camarinha-Matos 2003

[89] We envisage this feature being particularly important to support business processes whose computer processing needs to be executed across multiple locations across different time periods.

- Dynamic performance assessment of remote jobs, mainly for resource management purposes.

Camarinha-Matos et al. do not explain how these VO enabling areas are to be achieved in the currently available Grid architectures and interfaces nor do they discuss research requirements needed to achieve these requirements.

6.2.1.3 Web Services[90]

Web Services is an extensive and complex area of technology and standards that has become a de facto framework for providing services for e-commerce and B2B.

The W3C defines a web service as "a software application identified by a URI, whose interfaces and bindings are capable of being defined, described, and discovered as XML artefacts. A web service supports direct interactions via Internet-based protocols".

Given the distributed and networked nature of VO and the requirement to integrate their computing resources, Web Services promises to become a vital component for VO technology support.

A number of standards are defined as part of the Web Services concept, which are described in detail in the State of Art document, chapter 5 and Chapter 6.2

6.2.1.4 Other Technologies Associated with Infrastructure[91]

We mention without detail some of the other technologies that fit into this category that are surveyed in the literature. We consider these technologies to be more mature and understood, therefore not requiring any discussion, but we do question the necessity of including these technologies in literature devoted to VO. The main reason for this judgment is that these technologies are foundational for all modern computing[92] and in themselves do not pose any particular challenges or opportunities for VO. The technologies discussed in the literature include:

- Hypertext
- The WWW, Intranets and Extranets
- EDI
- Telephone and wireless communication networks
- E-mail and fax
- Multi-media technologies
- TCP/IP
- OSI reference model
- LAN/WAN/MAN
- VPN

[90] Camarinha-Matos, Tschammer and Afsarmanesh, pgs 210 – 217 and Erl 2004

[91] A sample of references contained in this section: Fairchild 2004, Fineman 2003 and Warner and Witzel 2004. and the VSO study.

[92] We could wonder why the list did not include operating systems, for example.

6.2.2 Devices and Interfaces[93]

Devices and interfaces form a critical area of concern within information technology development and deployment. The subject is exceptionally large and broad and choices in all the different aspects of devices and interfaces are as important for VO software development as it is with any other business structure. Of particular importance for VO is mobile and pervasive computing.

6.2.2.1 Mobile Computing

Mobile computing provides support for coordination and collaboration, information access, retrieval and exchange and content access and delivery. The Wireless Word Research Forum (WWRF) is an important organisation working in the area of service architectures for future wireless systems including capabilities to model user preferences which can adapt to different situations in time.

These are supposed to support ambient-awareness, personalisation and adaptability. These are important considerations in many VO situations, especially for mobile and tele workers, whose work activities need to be integrated into back-office applications and where knowledge and information need to be delivered and shared on a need-to-know basis.

6.2.2.2 Pervasive Computing

The key goal for pervasive computing is secure anytime-anywhere device-any network-any access. It points to computing being completely available wherever we live, work or walk! A key aspect of pervasive computing is the "disappearance" of the underlying computing from the user's consciousness – that is, so that the computing devices themselves do not get in the way of the user.

The value for VO is very clear, but Camarinha-Matos et al. list a number of areas where important research and development challenges still exist – but they do provide good indications of the value of pervasive computing for VO. The list also provides an indication of where the technology is still not sufficiently mature to deliver off-the-shelf solutions to VO technology challenges and hence where deployment in these areas is still bleeding-edge.

[93] Camarinha-Matos, Tschammer and Afsarmanesh, pgs 218 - 222

The need to create effective smart spaces, bearing in mind that a smart space can be a room, a wide open area, a building, airport lounge or a café.[94]

The problem of context-awareness is acute in pervasive computing, especially the need to cope with the heterogeneity of levels of smartness of different environments when users move from one space to another.

New methods of authentication and security need to be developed. Camarinha-Matos et al. claim here that in pervasive environments, "access to trusted third parties and public/private key infrastructures does not seem to be the best approach".

Pro-activity in smart places requires new methods to capture user actions and to foresee user intensions.

Challenges with surrogate computing architectures needs to be addressed – especially when mobile devices need additional stationary processing power to support processing requirements.

Security and privacy issues need to be addressed, especially the need to balance personal privacy with trust in the infrastructure and then need for seamless pro-active systems behaviour.

There is a need to continue standards convergence

6.2.3 Business Applications[95]

Of critical importance for VO is the software written to support the business and working requirements. We have seen[96] more than one reference to an important barrier to successful VO operation being a simplistic approach to application software. VO are complex and while user interfaces, devices and ergonomic designs need to be highly usable, the underlying capabilities of VO software applications must address the complexities of the real world they are serving.

It is in the area of business applications that the different concepts of a VO have large implications as to the technologies used. Most of the technologies listed in this section require little comment. Possibly of more importance, are the application areas missing from our list. For example, we were unable to find substantial material covering collaborative organisational BP integration, VO formation, advanced inter-organisational project management applications and collaborative product design support software.

6.2.3.1 Group and Collaborative systems[97]

VO are supported by a number of collaborative systems that enable employees to work remotely from their offices, to permit cross boarder (and cross organisation) teams and document, information and knowledge sharing.

We list the following technologies without explanation – they are self explanatory and well understood in today's working environment. We make just one comment regarding the suitability of current applications to meet the requirements of the VO1 organisation. Many of the applications listed in this section have come from the knowledge management area, and have typically been

[94] It seems clear that any area can contain overlapping and interlocking smart spaces

[95] Sources: Fairchild 2004, Warner and Witzel 2004.

[96] References unfortunately lost

[97] Fairchild 2004, chap. 2

designed for and deployed across single organisations with limited cross organisational exposure in the form of Extranet portals. Many of the applications extend aspects of personal meetings or advance beyond, and hence replace, telephones. But further product analysis is required to determine how far these products go to meet genuine VO1 organisational requirements[98].

Conferencing systems used to provide asynchronous or synchronous interaction for learning, presenting and meeting, and include video capabilities, white-boarding, group decision support and discussion support. Important (or at least useful) features include integration with mail, calendaring and scheduling applications. Co-authoring and argumentation systems, which include content management, document management, content versioning and translation management applications. Authoring applications are important whenever multiple teams of authors are involved in producing large quantities of quality documentation or design specifications. They become more vital when authoring teams cross geographical and organisational boundaries.

Email has become one of the most widely used software products in the world, and is often considered vital for modern organisations. Despite recent problems with spam and virus infection, email is likely to continue as an important communication tool in VO. Today, e-mail includes non-text formats such as the creation, storage and exchange and management of voice, fax, paging, video and other multi-media objects.

Calendaring and scheduling applications. These are in common use by individuals, but may be synchronised with large teams and groups of users. Synchronisation with portable and mobile devices has also become an important aspect of diary/calendar applications, but it is our understanding that inter-organisational diary and task scheduling is very difficult to achieve. Shared access to diaries has been made possible via Internet applications such as Yahoo. Yahoo diaries also synchronise with Outlook, Organiser and other diary applications.

Information repositories and digital libraries. When integrated with suitable content and document management applications, information repositories enable information sharing within and across organisations. Implementing information repositories across organisational boundaries and especially when multiple languages are involved is a massive challenge. In particular, indexing and cataloguing are important but challenging tasks.

Of growing importance for collaborative systems is the idea of groupware applications where the applications listed in this section are integrated with each other, multi-user and integrated into ERP, CRM and Business Intelligence applications.

6.2.3.2 Supply Chain Integration

Supply chain integration is a vital aspect of VO1 and VO2 VO, VO1 being the most demanding kind where integration extends beyond B2B to genuine inter-organisational connection centred from the VO itself. Of special significance for SCI applications is cross organisational optimisation. Whereas the business process engineering community have provided techniques for optimising the supply chain from a single organisational perspective, much more research is required to extend this discipline into genuine multiple-organisational optimisation. New forms of supply chain software will be required (potentially using technologies such as Grid and P2P) to enable organisations to easily enter a supply grid and leave again quickly (if required). But in this environment, suitable automated contract creation and support will be essential.[99]

Barriers to the formation and successful management of VO

[98] See Sage et al. appendix 6 for a detailed analysis of KM product vendors and their applications.

[99] We know from other projects that even simple requirements such as product and service catalogue aggregation is an extremely complex and largely unsolved challenge.

All the literature we sited exhibited widespread coverage of the barriers to the formation and successful management of VO – often expressed in the form of challenges. Unfortunately very little in this area has been presented systematically, often relegated to passing comments.

6.3 Technology Outlined in the State of Art Document

The TrustCoM project deliverable "State of Art Evaluation" provides a detailed description of technologies that will enable VO. Much of the discussion in this document is highly technical but its authors have been very careful to provide relevant connections between the technologies and the business challenges they can be put to use.

Chapter 5 of the State of Art document details the architecture of Web Services technologies supporting Collaborative Business Processes. It examines five Web Services specifications deemed to have considerable impact on VO. These are "the Web Services Transaction, Web Services Coordination, the Web Service Choreography Interface (WSCI), Business Process Management Language (BPML) and Business Process Execution Language for Web Services (BPEL4WS) BPEL4WS (or alternatively WSCI/BPML combination)". These specifications are then described in detail throughout the rest of chapter 5. The key business issue being addressed by these specifications is the integration of "a wide array of customer, vendor, and business-partner applications" – an obvious requirement for VO. The importance of Web Services standards specifications is that VOs that are formed rapidly need instant IT connection at the application level; developing and maintaining proprietary interfaces would be completely unacceptable in these circumstances.

Chapter 6 of the State of Art document provides a detailed analysis of enabling technologies. The first section describes web service technologies in terms of the web services specification stack. In this way the underlying infrastructure technologies for inter-organisational computing is laid bare. Figure 5 below presents the web services specification stack as illustrated in section 6.2.2 of the State of Art document. The figure provides a good illustration of the infrastructure technologies needed and how they fit together.

The second section deals with Grid technologies. The introduction is this section provides an extremely succinct outline of the use of Grid technologies for VO. "*Grid computing enables the virtualisation of different kinds of resources such as computing, data and network resources. These resources are provided under certain conditions to members of a virtual organisation. These resources can be combined to build a dynamic application e.g. by the definition of cross organisational workflows consuming and using the resources offered. So the vision of having a virtual computing system, as defined at the beginning of Grid computing has been extended to a virtual IT infrastructure concept including resources on all levels from network up to the application layer. Additionally the increased number of participants in such settings imposed new requirements on management for such complex systems*" Of key importance for TrustCoM is the commercialisation of Grid technologies. Originally introduced for university and research computing requirements, Grid technologies are moving toward commercial applications. The section outlines the various architectures, elements and research requirements for commercial use and importantly how Grid services enhance Web services.

The next section is devoted to semantic and ontology technology. This subject had not been addressed by any of the other literature on VO technology sited for the study. Of interest to the area of VO is its use in web services for service discovery and providing a degree of interoperable semantics for trust, security, and policy and negotiation management where interoperability at the semantics level and inference capabilities around ontological commitments are required.

The final section in this chapter introduces the various tools and platforms the TrustCoM consortium partners are to introduce into the TrustCoM project. This section is out of scope for the market study, although quite interesting from the point f view of gauging the technologies currently under offer from these vendors for the VO world.

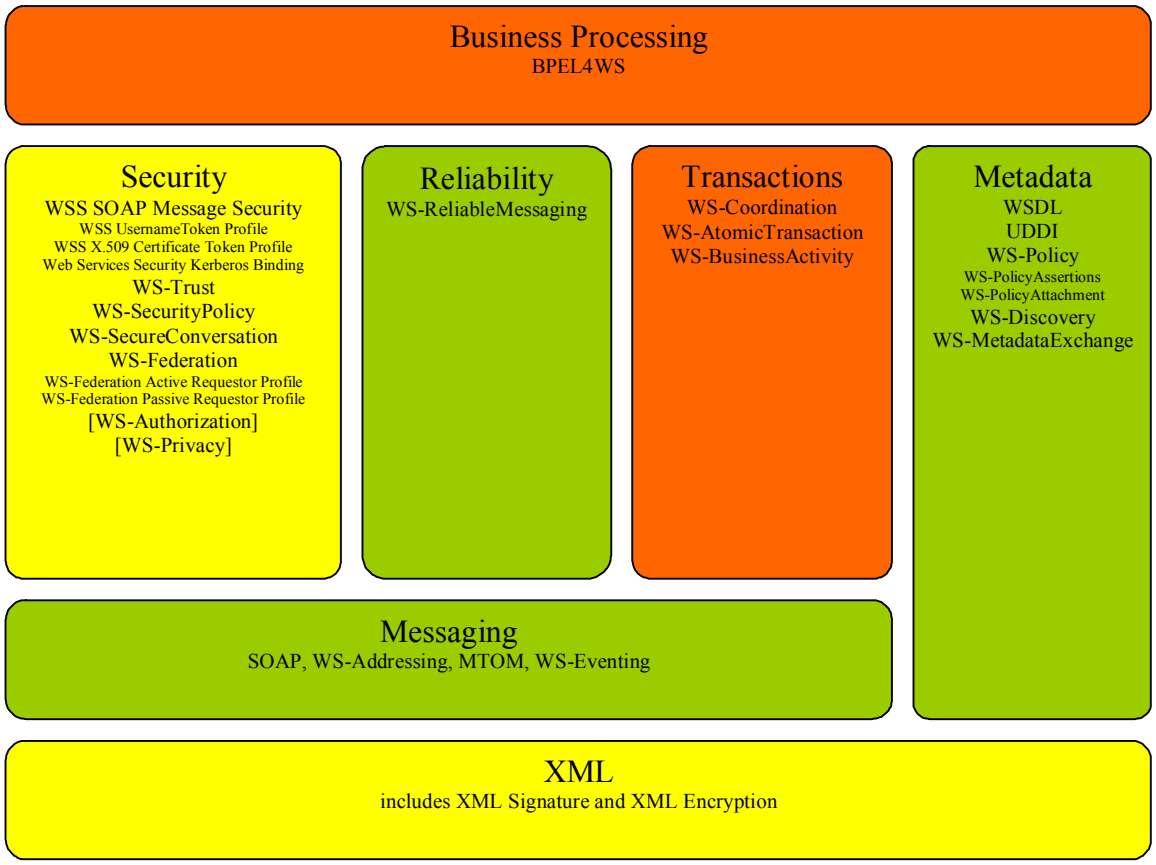

Figure 5: The Web Services framework specifications “stack”

7 Barriers

7.1 Barriers Represented in General Literature

We make an initial foray into barriers with a selection of barriers and challenges represented in the general literature, providing specific references where possible.

- Technology requirements in VO, especially VO1 and VO2 are very complex and more than one reference to the dangers of an over simplification of the requirements has been sited. A common explanation of the source of this problem is the complexity of networks and the concomitant issue of enabling individuals to communicate and work across geographically dispersed areas.
- IT integration standards are still in their infancy when considering the complexities of business process integration, and there is concern over the proliferation of standards and uncertainty over which ones will survive or dominate.
- Traditional ideas of management and leadership as control and mastery of uncertainty is still widespread and competitive concerns by such management is seen as a barrier to companies entering VO forms[100]
- The lack of sufficient language support is seen as undermining the capability afforded by the information infrastructure to facilitate global communications[101].
- Unrealistic views of the firm[102], in particular, modernist views such as the view that suggests that complete or perfect information is a substitute for knowledge, that meetings are purposefully created sites for the exchange of information by perfectly rational human beings. But in practice, participants struggle to establish their own version of past events. They guard against their own accountability and decisions often guided by discussion outside the agenda items and pre-determined before the meeting. Mary Hatch[103] considers that the advent of the VO is itself a challenge to modernist organisational perspectives.
- Fineman[104] stresses the emotional aspects of the VO and how this will challenge management and those who work in them. An important challenge, according to Fineman, is to enable the feeling of non-virtuality using modern technologies and new leadership and HRM styles. He states "we do meet in cyberspace, which is an allusion of place where actual people meet, chat, do business. It is where they live out their own life dramas – loves and hates, ambitions and anxieties[105]", but it is not clear that our technology can yet enable this effect. He raises the challenge of how we are to manage those we cannot see in the

[100] Lynne et al.

[101] O'Hagan and Ashworth, pg 127

[102] Lilley et al.

[103] Hatch 1997

[104] Fineman 2003

[105] Fineman adds an interesting example of a problem faced today by many global organisations. Who has to get up early or in the middle of the night for the regular conference calls? In a global organisation known by the authors, it was the Australians who had repeatedly to get up in the middle of the night to attend calls.

flesh. While the technology may help, he claims that "Trust becomes highly relevant as does good faith, goodwill and feelings of cooperativeness[106]" but these are huge management challenges.

- The challenge of trust requires a major shift in management thinking and acting. It is claimed[107] that modern organisations are built on the opposite of trust - control and monitoring. New forms of cyber control may run against the whole ethos required to make VO successful.
- Fineman also raises the issue of negotiation[108] writing "Face-to-face negotiations are steadily giving way to virtual negotiations. Like any negotiation, some friction is almost inevitable, given that each party is defending their own interest and where there is friction, flames are not far off. E-mail negotiation over considerable distances with strangers, misses the traditional social lubricants – getting to know your opponent, breaking the ice, small talk, background chat, rapport building. Micheal Morris and his colleagues call this the schmooze factor. E-mail communication offers little room for schmooze although they have plenty of capability for detail (such as setting out the full context of a negotiators position and desires). E-mail can be more harsh than intended, without feedback or physical gestures to provide cues to meaning. The problem is that normal means to measure and judge ones statements can be lost in the context vacuum"
- VO, as fluid organisations, suffer the risk of interest conflicts amongst members. In fact Grabowski and Roberts report conflict of interests amongst consortia members of the Chevron Caspian Sea Consortium. Members of the consortium were members of other competing consortia

7.2 Barriers Reported in the THINKCreative Project

Barriers reported in the THINKCreative project results[109] are outlined here in this separate section because unlike our other sources, their results are based on significant case studies, a Delphi research project and a workshops held across Europe, representing one of the few empirical findings we have been able to source for the study.

But they indicate that many research areas are still incomplete and requiring further research. A general impression we have gained from the project deliverable is that many of the key questions relating to VO remain as questions without answers.

In chapter two and three of Camarinha-Matos and Afsarmanesh, a number of case studies are introduced as best practice for VO. The cases include "Virtuelle Fabric" EUREGIO Bodensee (an organisation of about 40 different SMEs) Projecktwert.de (4500 freelancers) Ifranet Partners (nine companies across the world) and Nike. They then introduce a number of scenarios for 2020, a large collection of cases (but not real world case studies) and a large number of challenges (barriers) resulting from a series of regional workshops held across Europe.

[106] See the next point and the section on trust in the study.

[107] See section dedicated to trust in this study

[108] Fineman 2003. It is not clear in context whether his analysis is restricted to salesman/customer negotiations or whether VO consortium negotiations are to be included.

[109] Alexakis et al. 2004

We summarise a list of barriers to the formation and management of VO raised during the THINKCreative case studies, Delphi study and workshops and presented over these two mentioned chapters:

- A high requirement for the necessity of intensive communication between the partners. The "Virtuelle Fabrik" EUEGIO Bodensee project used a tool called Webcorp. The area of project management is explicitly mentioned as a major communication requirement.[110]
- The Projectwert.de reported problems of little trust in new partners as well as problems resulting from regional differences.[111]
- Cultural and language problems were the biggest difficulties reported by the Infranet Partners VO, which is manifest in communication problems. In this VO, physical meetings are held about every two months.[112]
- The Nike VO illustrates two problems associated with this type of VO (the authors link this type of VO with the outsourcing trend, and hence as occurring as part of the "so called old economy"). The first is a barrier for the supplier. It means having a strong dependency on Nike and the loss of freedom this entails. Additionally, if the Nike contract is lost, then the contributing firm is vulnerable to failure. The second barrier is a problem for Nike: quality control. Given the brand strength of Nike, outsourcing manufacturing is highly risky and the management of quality is very complex. Despite this, the authors report that this type of VO arrangement is becoming very popular amongst clothing manufacturers.
- Organisations founded on modernist principles are risk overt and more comfortable with conventional project processes.[113] But increasingly, the most successful companies will be those that can operate on the basis of openness, trust, mutual support and empowered team members. But this places a challenge to contractual arrangements, which must align the client's objectives with the interests of all the parties, who need to co-operate so as to achieve those objectives. Project risks need to be fully understood and managed by those most capable of doing so[114].
- Selecting partners that strengthen the whole VO is a challenge, especially as the new style of organisations may necessitate leaving the organisations traditional partners. This is difficult as it is not always possible to determine how open and trustworthy a new partner is likely to be. In a VO, partners need to be able to collaborate, shire information and knowledge and take key responsibilities in areas of core competency. When these basic trust elements fail, the VO must be ready to re-structure and remove problem partners. In this manner, VO are always likely to be dynamic, but this is also seen as a motivation for partners to provide maximum dedication.[115]
- Cashflow problems are a common inhibitor of progress. With the emphasis on temporary relationships in THINKCreative (not a factor we have included as a necessary component of our VO characterisations) fast track projects are the common project types envisaged. But fast track projects and frequent changes associated with VO issues the challenge of

[110] Alexakis et al. 2004, pg 16

[111] Alexakis et al. 2004, pg 17

[112] Alexakis et al. 2004, pg 17

[113] Alexakis et al. 2004, pg 22

[114] Alexakis et al. 2004, pg 22, 23

[115] Alexakis et al. 2004, pg 23

ensuring that sufficient funding is available to the project to quickly engage in its work. Many such projects, especially in the IT area are very expensive, making investment in this type of VO very risky, especially if the organisations involved are SMEs.[116]

- Communication problems are seen as a major barrier. In this context, the problem relates to the need to communicate across multiple organisations, integrate communication systems where organisations may have different cultures, structures, leadership approaches and communication politics. This problem necessitates the introduction of communication guidelines for the VO that may compromise policies in place by various VO member organisations.[117]
- In concentrating on core competencies, a VO member organisation is putting itself at risk of loosing competence in other areas.[118]
- Regional distance places a pressure on keeping all network partners into the network. It is easy for single partners to get isolated from the network, requiring intensive effort in developing and keeping the "togetherness-feeling".[119]
- VO are in danger of having low acceptance unless it can create a reliable and identifiable central contact point that will provide a genuine identity for the VO to the outside world.[120]
- Legal responsibilities should be clear within the VO and made simple to communicate to customers and non-member suppliers. For example, "if the VO acquires an order, the customer needs to know about the legal consequences as it is a matter of fact that legal security helps to build up external trust"[121]
- VO change the nature of employment and therefore the requirements for employment law. But VO also change the manner in which people work and handle information, which raises questions about handling intellectual property rights. Who owns the information assets of a VO?[122]
- Financing of networked organisations has no precedent in current funding arrangements and may require special attention from regional development organisations or governments.[123]

7.3 Barriers Reported in the VSO Study[124]

The barriers to VO 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

[116] Alexakis et al. 2004, pg 23

[117] Alexakis et al. 2004, pg 24

[118] Alexakis et al. 2004, pg 24

[119] Alexakis et al. 2004, pg 24

[120] Alexakis et al. 2004, pg 25

[121] Alexakis et al. 2004, pg 24

[122] Alexakis et al. 2004, pg 25

[123] Katzy et al. Pg 38

[124] Source: VSO report

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 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.

The barriers likely to be encountered in VO operation in Europe is presented in the following table taken from the VSO study.

Barriers and Obstacles to VO 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 weigh heavily 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 VO
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	Access to broadband and spectrum could block or inhibit certain applications. An installed base in older technology could inhibit the larger	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

Barriers and Obstacles to VO 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
	participate in VO. Anti-spam laws could hurt some small businesses	companies. They may wish to seek tax relief for long-term investments.		VO.
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.

Table 1 Barriers and Obstacles to VO Operations in Europe

It has been observed in the literature that the VO 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 the well matched to the U.S. system. Similarly, the Asian emphasis on quality and inventory reduction means that some parts of Asia are also the well adapted to the VO model. It is not clear that the European cultural system is consistent in all places with the VO model. The stage 4 VO 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 VO 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

8 Understanding Trust in the Context of VO

8.1 Introduction

Trust is a pervasive concern in everything we do in life. Aspects of trust often change in the organisational context because of the introduction of legal obligation.

Creating promises and obligations in a virtual environment places interesting pressures on the VO. The normal situation of face-to-face interactions, i.e. the handshake or the role of experience in judging partner is missing in virtual situations. However, we aim to show in this section that in many ways, legal obligation in the form of a contract can cut across trust even in a non-virtual world and that traditional understanding of trust need not necessarily be bypassed in VO.

In this section, we summarise our findings in the literature dealing with trust and trust within the VO. The first section "Trust in and between organisations" is a general discussion adapted from a British Standards Institute publication on managing culture and knowledge. In it, various dimensions of trust are presented along with implications for VO. The second section summarises additional literature on the subject of trust while the third introduces work dedicated to trust in the context of VO.

To summarise, our findings indicate the following features of trust are important in an organisational context:

- Trust is earned not commanded; it is therefore established or destroyed in time and through human interaction.
- Trust is always set within a social context.
- Trust must be genuine – it is not possible to fake trust.
- Trust cannot be equated with legal obligation embodied in contracts, although legal obligations are clearly part of the social context of commercial trust.

8.2 Trust in and between Organisations[125]

A dominant view in management literature about trust is that it can be seen as an attitude of one individual towards another, based on perceptions, beliefs, and attributions to that other person. Trust has been found to enhance knowledge sharing through exchange of more accurate, relevant and complete information about problems, and may enhance the quality of information that is exchanged.

Dimensions of trust tend to include the following: competence, openness, concern and reliability. Trust is also typically behaviour-based

- Identity based – I trust you because of your role or position - e.g. as a doctor
- Reciprocity based – I engage in trust behaviour because I believe you will too
- Elicitative Trust – By engaging in acts of trust I will elicit trust from the other person

[125] Adapted from "Managing Culture and Knowledge – a guide to good practice", N.Allan et al, British Standards Institution, 2003

- Compensatory trust – Predicated on the belief that some, but not all, will fail to engage in the needed behaviour and therefore I must take a lead.
- Moralistic Trust – I will act in a trustworthy way irrespective of what others do.

Respectful treatment over long periods of time can lead to the positive by-product of high levels of trust in an organisation. The question then arises: can VO, which are often characterised by speed, distance and general "virtuality", really expect to engender sufficient trust? Perhaps the following mini-case offers a way out?

> **Mini-case:** *A global Automobile company had allowed, or actively encouraged, a relationship to develop with its dealerships that was based on fear. The dealerships were driven by a need to compete against each other, creating a culture of coercion. Directors realised this was weakening their company but this was a style they were competent in managing. The company committed to a series of initiatives with its senior management and dealerships. They changed the way that decisions were made, to be more equitable for both manufacturers and dealers. Directors of both the manufacturers and the dealerships attended road shows together, demonstrating visibly that they were prepared to work together 'hand in hand'. Top management made it clear that they required help from everyone in order to change from the existing safe 'command and control' culture: a culture that they had developed and understood well. To support this they embarked on a series of communications, team working and trust building initiatives. Language changed from 'old way' to 'new deal'. The manufacturer – dealership culture changed from an individualist coercive culture to a more collaborative trust based/partnering knowledge sharing culture.*

8.2.1 Values Aspects of Trust

A clear understanding and communicating of values also often have a significant impact on trust, e.g.

- **Leadership Values**. What happens when there is a mismatch between the things the boss says and his or her actual behaviour? People do not expect perfection, but they recognise when leaders are not sincere or open. If executive and line leaders do not provide an atmosphere of trust and authenticity, then genuine change cannot move forward.
- **Fear and Anxiety.** "This stuff is ----". The blanks represent the fact that everyone expresses their fear and anxiety with a different form of defensiveness. How do you deal with the concerns of team members about exposure, vulnerability and inadequacy, triggered by the conflicts between increasing levels of candour and openness and low levels of trust? This is one of the most frequently faced challenges and the most difficult to overcome – and very likely to be exacerbated in a VO situation in which people have not been given sufficient "face-time" with one another at an inter-organisational level.

8.2.2 Behavioural Aspects of Trust

If you are not a member of an organisation (and feel cast as an 'outsider'), nor known to the other people in the organisation, you should be aware that people may tell you what they think you want to hear, but actually often try and second guess you by behaving differently. Be careful therefore to be clear in establishing trust with other people in the organisation and where appropriate tackle issues like anonymity and even in some cases (e.g. call centres) the use of recording devices, at the outset. Are VO typically aware of such subtleties?

It is sometimes suggested that the best present decisions and actions are those taken with a deep sense of the past and a long view of the future. Judgements are needed. Codified and uncodified knowledge needs constant rebalancing. Collective tacit knowledge grows when trust and familiarity comes from working together. The collective memory and judgement of the organisation depends on highly professional operators on the front line, supported by central information, knowledge and intelligence which fosters individual decision making but not individualism. In other words: another major challenge for VO!

- In a nutshell? The depth, breadth and length of retention of the knowledge often imply that deliberation, slowness and reflection all have a key role to play in developing organisational capacity for effective judgement and action. It has been suggested[126] that two and only two cultures operate in human groups: guardian cultures and commercial cultures. The values of each around speed and slowness are almost exactly, and irreconcilably opposed:
- A "guardian culture" is slow. It is stable, defensive, conservative. It resists change and is governed by ritual, pattern and habit. It conserves and protects, it respects the past and protects the future, taking a long-term view. It tends to be risk averse.
- A "trader culture" is fast. It is opportunistic, pioneering, entrepreneurial. It will regard rules as provisional, to be worked round. It exploits and develops. Loyalty is local, strong with the local tribe rather than the institution. It works in a transient temporary time frame, tolerates risk, sees failure as necessary for learning.

Can one therefore assume that VO will almost invariably manifest a trader culture? If so, what happens if some of the member organisations are characterised by guardian cultures? The trouble is that these cultures often find it impossible to work with, or to understand each other, and that the trader culture is often introduced into guardian organisations with no sense of the incompatibility of the two. Worse, the guardians are often derided for their need to hang on to the old, by the traders who are eager to drive forward.

- Cultural change programmes which are introduced into such organisations too often lurch uneasily from trader to guardian and back, espousing markets, commoditisation, news, simultaneity, instantaneity, at the same time as talking story, narrative, values, trust, reflection. Worse, there is a kind of groupspeak hypocrisy at work. The espoused values of the cultural project will almost certainly be couched in guardian language - long, slow, reflective, trust, community, yet the activities, which actually take place will frequently be more pertinent to the trader values.
- Knowledge that people hold in their heads – their experience and skill which enables them to do what they do – can be considered 'adult' knowledge. It is therefore usually transferred between 'adult' communities - people who recognise each other as peers – and speak a common language. The trick here is to improve the transfer of this knowledge between age groups and peer groups. Does the geographical and linguistic background of VO member organisations therefore play a key role in that VO chances of success? Table 2 suggests some possible ways of addressing such challenges:

[126] "Systems of Survival : A Dialogue on the Moral Foundations of Commerce and Politics", Jane Jacobs, Vintage, 1994

Friction	*Knowledge Transfer*
Lack of trust	Build relationships and trust through face-to-face meetings
Different cultures, vocabularies, frames of reference	Create common ground through education, discussion, publications, teaming, job rotation
Lack of time and meeting places; narrow idea of productive work	Establish times and places for knowledge transfers: fairs, talk rooms, conference reports
Status and rewards go to knowledge owners	Evaluate performance and provide incentives based on sharing
Lack of absorptive capacity in recipients	Educate employees for flexibility; provide time for learning; hire for openness to ideas
Belief that knowledge is prerogative of particular groups, not-invented-here syndrome	Encourage non-hierarchical approach to knowledge; quality of ideas more important than status of source
Intolerance for mistakes or need for help	Accept and reward creative errors and collaboration; no loss of status from not knowing everything

Table 2 Practical methods of transfer to reduce friction

Dimensions of trustworthy behaviour that a VO should try to embed include the following:

- Behavioural consistency
- Behavioural integrity
- Sharing and delegation of control
- Communication
- Demonstration of concern.

A recent study[127] concluded that there was a 'critical combination' of trust and knowledge sharing. The study was based on data from a two-part survey of 138 people in three companies - a division of a US pharmaceutical company, a division of a British Bank and a large group within a Canadian oil and gas company. The authors concluded the following:

> *"The results from our study point to two specific types of trust that are instrumental in the knowledge-sharing process: benevolence-based trust and competence-based trust. When most people think about trust, they are typically talking of its benevolence-based form – in which an individual will not intentionally harm another when given the opportunity to do so. However, another type of trust that plays an important role in knowledge sharing is competence-based trust. Competence-based trust describes a relationship in which an individual believes that another person is knowledgeable about a certain area. Either type of trust can exist independently. For example, I can trust that a co-worker knows the information I need (competence), but I may not trust that he will be forthcoming when I need it (benevolence). Conversely, there may be other people who I am confident will assist me (benevolence), but that do not possess the knowledge or skill that I require (competence). Overall, we*

[127] "Trust and Knowledge Sharing – a critical combination", Institute of Knowledge Based Organisations", D.Levin et al, 2002

found that knowledge exchange was more effective when the knowledge recipient viewed the knowledge source as being both benevolent and competent. Fostering knowledge sharing is more than simply putting people together in a conference room or sending them on experimental learning programmes. It is about creating an environment in which people are able to discern whether their colleagues are both knowledgeable and willing to extend their knowledge to the benefit of others. Without building a sense of competence- and benevolence-based trust between the knowledge seekers and sources, firms will find it difficult to take advantage of perhaps their most valuable resource – employee know-how."

If such challenges confront unitary organisations, then they will probably confront VO even more strongly.

At the heart of an organisation's ability to implement successfully lie three cultural pre-requisites that it must possess or develop – credibility, authority and trust. The successful combination of these qualities should mean that:

- People in the organisation know that when you say something will happen, it will
- People in the organisation know that when you say something will not happen, it will not do
- People accept that you have the necessary judgement, skill and insight to be able to choose correctly between what should and should not happen
- People accept that you have the necessary backing, levers of influence, resources and if necessary weapons at your disposal to ensure certainty of chosen outcome, once determined;
- When you obtain agreement or commitment from them to deliver something, they know they have to deliver it.

These are probably all issues that should be considered during the formation of a VO. However, bear in mind that developing this culture of credibility, authority and trust does not happen overnight. Consistency of action cannot be demonstrated until a range of incidents and activities have presented themselves and have been resolved consistently. Also, bear in mind, that in order for this culture to become embedded across the range of people and units involved in a VO, then actions have to be visible at all.

8.2.3 Psychological Aspects of Trust

Trust is a psychological state, comprising the intention to accept vulnerability (often inherent in VO), and based upon positive expectations of the intentions or behaviour of another. Psychological contracts are classified as transactional and relational:

- Transactional involve specific money-based exchanges
- Relational are more open-ended, both money-based and other factors e.g. loyalty, security etc
- Psychological contracts are recognised as operating under two premises
- Agency Theory: A principle-agent relationship exists when one party contracts another party to perform a task involving delegation of decision making in exchange for compensation
- Social Exchange Theory: One individual voluntarily provides benefit to another, invoking an obligation on the other party to reciprocate.
- Agency theory would appear, at first sight, to be more likely in a VO situation

8.2.4 Economic aspects of trust

Economically, trust causes reduced opportunism and consequently lower cost. Therefore, institutionalised distrust - e.g. inspection, policing etc. – tends to be an expensive, culturally damaging and time consuming process. The aggregate level of trust and control, will determine confidence in partner cooperation – a fundamental key to the success of a VO. Conversely, deployment of too many formal control mechanisms will tend to undermine levels of trust among partners.

8.3 What is Trust in a Business Context?

This section presents further sources on the nature of organisational trust. We have included these further references as they illustrate common themes found in the literature on trust that are of relevance in the discussion of VO.

Stohr and Nicherson (2003, pg 227) describe trust in a business context as "the willingness of one party to be vulnerable to the actions of another party based on an expectation that the firm will perform a particular action of importance for them". They add, for the VO, the additional problematic that such trust is "independent of the customer's ability to monitor and control them. It is emotional, hard to justify the investment (soft not hard) and many people do not trust the technology, especially in the hands of businesses"..

When assessing the nature of trust in a VO, we must therefore outline important points about trust in any business situation. It will be clear that the challenges are significant for VO, although not insurmountable[128].

Yolande Chan (2003, pg 350) recognises that trust takes time and care – it is something that is earned from which "intrusion permissive" and "intrusion enabling" arrangements (often associated with virtual arrangements) preclude trust. Bibbs and Kourdi (2004) in their book "Trust Matters", chapter 12, provide thirteen important points - that underlie all aspects of trust relationships - which we summarise below:

- Absolute – no such thing as partial trust – it is either/or – it exists or it doesn't.
- Self trust is a critical actor in the creation of trust. Distrust is often a projection of absent self-trust. Others won't trust you if you do not trust yourself.
- Waiting for people to prove their trust does not work. It is not "can I trust them" but "I will trust them" and trust can only be earned not given – if you trust people, they usually live up to it[129].
- Trust can take a long time to build, but can be destroyed in an instant. One small act can destroy it.
- You cannot create trust if you view it as a means to an end – this is building it cynically and you are unlikely to succeed. People who succeed in building trust care about relationships, make and keep commitments and value honesty and integrity.

[128] It will be seen that more emphasis will need to be placed on the traditional foundations of trust, and that requires both time, repetition (found to be previously trustworthy possibly via referral) and physical contact.

[129] This point may seem a little optimistic, which it probably is. In business relationships contracts are created to insure against misfired trust, something that happens frequently enough to warrant the need for contracts. But the point is well taken, that contracts do not create trust.

- You cannot create trust without respected values – values of integrity and honesty are the basis for all trusting relationships and high-trust cultures.
- Trust is often invisible – often only becoming visible when it is lost or abused in some way.
- Trust requires commitment and does not just happen. It requires commitment, personal responsibility and vigilance.
- Trust relies on reciprocal relationships. It centres on the cycle of "giving and getting" interactions. Well-balanced people get psychological satisfaction from being trusted, and as they are trusted more, so their trustworthiness grows.
- Trust opens up possibilities that can never exist without it. Without it, organisations can never be totally efficient, creative and successful because trust allows people to try new things, disagree with others and say what they want to say.
- Trust is time-sensitive – it takes time to develop, but is like water – it goes everywhere and poor trust in one area will become corrosive elsewhere.
- Understanding your personal motivations and behaviour important in developing trustworthiness.
- Avoid substitutes for trust. Avoid thinking that contracts and documents are a substitute for the genuine thing. They may serve a purpose, but that is not creating trust – they can actually jeopardise it[130].

8.4 The Nature of Trust in VO

Our final section on trust summarises three papers written specifically on the subject of trust and VO.

Fineman (2003) describes a keytrust problem is the fact that in a VO people have nowhere to meet, none of the physical contact that typically generates and nurtures trust. Can the solution to this trust problem be in creating virtual places to replace the physical ones? How technology should play a role in the management of a VO is a key issue to be discussed in the enablers and barriers section of this report, but this solution is primarily aimed at our VO3 and VO5 models, i.e. where management of an organisation running on a mobile or teleworker model needs to motivate and manage employees and employees themselves need to learn to trust their virtual colleagues.

But Charles Handy is not so optimistic. Trust is central to a VO and trust dynamics are not as simple as it may seem (Handy 1995). In this paper, Handy first off explains that the office, "which is, at heart, an interpretative library geared to a particular purpose, and more and more of our economic activity is a churning of information, ideas, and intelligence in all their infinite variety" is an invitation to virtuality. Interestingly, the library has been one of the early adopters of the virtual structures. The challenge, as Handy sees it, is how do you manage an organisation you don't see, and whose employees you do not come into physical contact with in their day to day work. Handy's response to this dilemma is trust! But there lies the challenge. Handy explains through a number of different examples that the whole basis of organisational theory and practice in the past has been to circumvent the fact that you can't trust people. Instead of trust, our modern organisational structures are based on control. As Handy describes "Trust is the heart of the matter. That seems obvious and trite, yet most of our organisations tend to be arranged on the assumption that people cannot be trusted or relied on, even in tiny matters. Oversight systems are set up to prevent anyone from doing

[130] This last point is important for TrustCoM – contracts do not create trust, but may in fact erode or jeopardise it.

the wrong thing, whether by accident or design". He then summarises with "If we are to enjoy the efficiencies and other benefits of the virtual organisation, we will have to rediscover how to run organisations based more on trust than on control. Virtuality requires trust to make it work: Technology on its own is not enough".

How does one go about designing an organisation based on trust? Handy gives us some useful guidance, firstly mentioning that it would be foolhardy to trust someone you don't know or whom you have not had the chance to observe in action over time and secondly, noting the common practice of experience gaining by moving people around an organisation as much and as fast as possible is quite contra to the establishment of trust[131]. He then raises a number of specific points in relation to trust and their implications for VO.

- Trust needs boundaries. Unlimited trust is, in practice, unrealistic. But since trust ultimately means confidence in someone's competence and commitment to a goal, control should be seen as an assessment of the job after it is done. But the tasks at hand should be as self contained as possible, which goes against the reductionist tendencies of modern management[132].
- Trust demands learning and the organisation, if it is to be based on trust, requires a learning culture, which in turn places special significance on recruitment and placement.
- Trust is tough. Most organisations built on trust relationships need to set clear goals and to be able to act on those areas not performing. In Handy's words "When trust proves to be misplaced--not because people are deceitful or malicious but because they do not live up to expectations or cannot be relied on to do what is needed--then those people have to go. Where you cannot trust, you have to become a checker once more, with all the systems of control that involves". There is a warning as well, for those who will place trust in just a few – the trusties of an organisation. This model is also likely to sink into an organisation of the inner core related in a purely contractual way to the outsiders. The implications for TrustCoM is clear – once again, we are led to recognise that contractual relationships, important as they may be, are counter to trust.
- Trust needs bonding. This is a complex affair, and part of it is to ensure that all the individual groups within a VO can work together to support the whole. And while corporate mission statements may help, they are insufficient in themselves when teams are dispersed. It is necessary for a high degree of personal bonding by those in leadership – and this takes physical contact. Fineman (pg 70) exhorts managers in VO to also apply new technologies to ensure continual personal contact. Some of the solutions given are: Fostering on-line chat, virtual "management by walking around" (using phone, chat, virtual conferences, etc.) and encouraging connections and trust amongst team. This point indicates the requirements for sophisticated groupware, to be discussed in the technology section.
- Trust needs touch – your virtual teams cannot work in virtual space all the time. As Handy says, "Paradoxically, the more virtual an organisation becomes, the more its people need to meet in person".
- Trust requires leaders. While good trust-based teams need little external management, they do need a multiplicity of leaders. Handy provides an example from an English rowing team.

[131] An interesting conflict exists here between trust and innovation based on social complexity. Social complexity theory claims that dynamic social interaction and such change are vital elements in the innovation process.

[132] An implication for TrustCoM may be that the boundaries set for trust in this project are very limited but well defined around the area of authentication and authorisation. But then allowance must be given for the other areas of trust if it is expected that organisations are to form commercial relationships of a VO nature.

> It is worth quoting this in detail. “I once teased an English audience by comparing a team of Englishmen to a rowing crew on the river--eight men going backward as fast as they can without talking to each other, steered by the one person who can't row! I thought it quite witty at the time, but I was corrected after the session by one of the participants, who had once been an Olympic oarsman. ‘How do you think we could go backward so fast without communicating, steered by this little fellow in the stern, if we didn't know each other very well, didn't have total confidence to do our jobs and a shared commitment--almost a passion--for the same goal? It is the perfect formula for a team.’” The rower then went on to make some pertinent points about rowing teams. Firstly, they don’t need managing (he gave the exception as the office administrator for the team). But they do have a lot of leaders. “"When we are racing, it is the little chap who is steering, because he is the only one who can see where we are going. But there is also the stroke, who sets the standard for all of us. He is a leader, too, in a way. But off the river, it's the captain of the crew, who selects us, bonds us together, builds our commitment to our goal and our dedication. Lastly, in training, there is our coach, who is undoubtedly the main influence on our work.”

While Handy’s comments are particularly applicable to VO3 and V04 organisations, similar challenges will arise but will likely to be more complex, in VO1 and VO2 organisations. The main reason for the additional complexity is that VO1 and VO2 represents inter-organisational trust, which means inter-trust in the people behind each organisation. The stakes are much higher, but the trust principles are still applicable. The real challenge for any organisation working within VO3 and VO5 (which, remember, is not incompatible with an organisation being in VO1) is how to promote buy-in from “employees” in such trust-focussed organisations.

Finally, Grabowski and Roberts (1998) in their study on risk mitigation in VO recognise four processes that need to be managed well in order to reduce risk. These are (1) organisational design and structure (2) communication (3) culture and (4) trust. They lament the lack of research undertaken on VO risk mitigation and surmise that VO share similar risk structures to highly reliability organisation (see www.highreliability.org). Referencing Handy 1995, McAllister 1995) they declare that “trust amongst organisational members is critical for VO. Without trust, commitment to the goals of the organisation can waver, as members perceive the alliance as weak or disintegrating, fractured by misunderstanding or mistrust.” They suggest that trust “permits a VO to focus on its mission, unfettered by doubts about other members’ roles, responsibilities and resources, and that with trust, synergistic efforts in interorganisational missions are possible. Accordingly, they claim that trust brings the following to a VO:

- Leverages the ability and willingness to learn.
- Contributes toward strengthening linkages among members organisations.
- Helps to forge organisational structures resembling alliances and not hierarchies. Such structures are critical to dampening risk propensities.

But to enable trust, Grabowski and Roberts note that a VO needs to:

- Ensure that the organisation is designed around reasonably small teams that can interact and therefore build trust.
- Develop mission statements that reinforce the reason for the VO and its aims, goals and culture. Mission statements should be open-ended and enable periodic revision or development.
- Provide clearly defined responsibilities and performance goals for all in the organisation.[133]

[133] One could refer back to Handy’s observation that trust is tough. But this cannot be done without clearly defined responsibilities and performance goals.

- Recognise that trust can wear thin with time, especially as informal groups form within the organisation that can in turn spurn individuals or other groups.[134] Their conclusion being that the management of trust is just as vital as the management of the organisational structure and communication linkages.[135]

[134] Grabowski and Roberts mention a virtual project call the SmartBridge project, which was a consortium of large companies working in oil exploration. They claim (Grabowski was working in the consortium) that as the VO matured, the strength of the linkages between some of the members actually faded.

[135] But they do not provide any further advice. This paper does contain a section outlining a number of points for a research agenda on VO and risk mitigation. They state that "while trust has long been a major issue in the organisational literature, there is little systematic research on its place in VO. They then suggest that research needs to be undertaken to (1) understand the activities VO undertake to build trust (such as training, encouraging interpersonal interaction, and increasing interorganisational linkages). (2) How VO engage in activities that encourage shared commitment. (3) To understand how firms with good risk mitigation histories seem to have higher interpersonal trust than those organisations what do not.

9 Macro Effects

9.1 Contribution to EU Competitiveness[136]

The VSO report concludes that VO will contribute to EU competitiveness, with a caveat on the culture of labour. VO 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 VO are three key factors:

- **Data Portability**. The inherent portability of business information, as it is flows across geographic boundaries over the Internet using common protocols;
- **Open Bidding**. The ease with which a company can tender open-bid contracts and requests for proposal (based on product specifications) to any subcontractor that can meet specifications, no matter where that subcontractor exists geographically;
- **Lower 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 VO to follow low-cost labour to its cheapest location. Further, information portability allows VO to pit suppliers against one another in ways that would have been impossible before the Internet. Today, enterprising VO in and out of the EU are vigorously and favourably competing against all EU companies (VO and non-VO). For the EU to achieve global competitiveness, it should consider incorporating VO principles, if only because competitors have embraced those principles and, as the researchers 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-VO

9.2 Should VO Be Stimulated?[137]

The VSO report concludes that VO should be stimulated, in these five ways:

- **Connectivity**. Persistent, pervasive, high-quality, low-cost, broadband Internet connectivity is an imperative to growing VO. 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-VO companies should be provided with tutorial-form models, seminars, testimonials, and case studies of how successful VO operate, with business-process road maps provided so non-VO can begin making transitions to VO practices
- **Increased Equity Values**. The supply chain has been an early leader in VO modelling because of the rewards in equity values that companies realise when they are not carrying

[136] Source: VSO report

[137] Source: VSO report

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 e.g. in business journals, EU organisations need to become aware of the correlation between VO 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.

- **Labour**. Long-term, even lifetime, commitment of employment to an employee or union members may be contrary to VO practices. In model VO, labour is cost-allocated for every hour it is carried on the organisation's books. VO may need freedom from traditional labour practices to expand, contract, or outsource their labour pools in response to actual demand. Restricting organisations by requiring that they carry dormant or non-cost-allocated labour may enable the competition to sprint past them. If VO 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 VO compete globally, so the problem of high-cost labour or long-term commitment to labour will continue to be an issue.
- **Tax Policy**. Since VO depend on virtual inventory[138] 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 VO formation existing within labour or tax laws. More than 95 % said "no" to the existence of barriers.)

9.3 The Role of Government and Law in VO[139]

The VSO report concludes that governments can help facilitate VO 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 VSO's poll had very clear ideas about the ways in which government can help with VO formation and implementation. These ideas emerged from the case studies, as well:

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

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

[138] This point is only applicable if the product dimension is a virtual product or the organisation runs using virtual inventory. Of course, this is not a necessary requirement for a VO, which may stock physical inventory.

[139] Source: VSO report

- Create or help foster the creation of "entry software" for small and medium-sized businesses to aid them in joining the 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 by using the VO business model (rather than transition from an old economy model), since the researchers 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 VO (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 VO business model.

VO are (groups of) organisations that operate across traditional business lines—they are not typically co-located 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 the researchers have not found all the cases the researchers examined to be globally linked. The researchers are focusing within this study on companies that operate in Europe, and the researchers found that physical distance of partners is a consideration for these companies.

Smart organisations are ones that use information being created within the virtual value system to enhance operations. 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 organisation have 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 European Commission publication's own "New methods of work and electronic commerce"[140] 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 a networked economy and are mileposts 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."

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 VO 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

In addition, the fact that the VO are enabled by the information infrastructure requires policy attention. The infrastructure and its capacities will need careful scrutiny to examine the extent to

[140] European Commission, Directorate General Information Society (2001), "New Methods of Work and Electronic Commerce. Overview of Activities." December 2001

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.

9.4 VO and the Law

Fairchild[141] devotes several pages to VO and the law. She begins by emphasising that in terms of law, de facto organisations do not have any independent existence other than to those who are its members. That is, each member is responsible in terms of obligations. She claims that "save for certain anti-racketeering and (tax) fraud statutes and for competition policy, virtual organisations have seldom been the subject of legal scrutiny"[142].

Fairchild does not address the legal issue in terms of specific legal situations in specific countries, but addresses her concerns in general terms as a foundation for determining the issues to be managed. She groups her issues in the following way:

9.4.1 The Concept of Undertaking

The European competition law regards organisations as an "undertaking" regardless of legal status or ownership. This maybe a useful approach to define the legal obligations and responsibilities of a VO and Fairchild provides some cases where this may be applicable.

9.4.2 The Issue of Applicable Law and Jurisdiction

Any contract to be enforced has to have a home and be applicable under the law of a particular location. Contracts can reflect this by stating which jurisdiction the contract is to be interpreted and enforced by. It is, however, possible to nominate different location for applicable law and jurisdiction.

Using an arbitration clause may be a suitable alternative than specifying a jurisdictional clause. There are many arbitration organisations both national and international and many different ways of specifying how arbitration will occur.

9.4.3 Taxation Consequences

Taxation normally applies to the place deemed to be the organisations permanent residence. This is of course quite complex in a globally linked VO and double taxation agreements must also be considered. VAT complications can also impact the creation of transactions within the VO, particularly if some members are outside the EU.

9.4.4 Who Is Representing a VO

Company law normally deals with this for a traditional organisation, of which details will vary from country to country. But this is an issue for a VO where no such laws apply. For example, if someone appears to a third party to be acting as a manager for the whole, then it is likely that that person will

[141] Fairchild 2004, pgs 124 - 129

[142] Fairchild 2004, pg 124

be liable for that appearance. And the only way to remedy this is to create contracts, agreements and disclaimers, all quite complex.

10 Size and Positioning

10.1 Introduction

In this section we provide indicators to the potential size of the VO market and the place of TrustCoM's in it.

Because this is secondary research, we draw heavily on the research results of others that have been made available in the public domain on the web or through other published EC project reports.

We also face another challenge in this aspect of the research. The type of VO we envisage in TrustCoM, like that of the Virtual Smart Organization (VSO) in the VSO report, is an emerging organizational form in its early stages of appearance. The studies we have sited on the subject of market trends having acknowledged this problem look for indirect metrics to forecast the VO market. Understandably these focus on ICT penetration of various types.

We quote from the VSO report. "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"[143]. A little further, the VSO report acknowledges that the metrics they need are not fully developed. That data collected "cannot be taken to be more than indicative and anecdotal"[144] that will provide them with a sense of what is going on.

This is followed by an analysis of information sources on VSOs. The VSO project hit similar problems to our desk research in that many of the commercially available reports available from Gartner, IDC and Datamonitor while were interesting, "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"[145]. In fact, the report that seemed reasonably useful on claiming research in VO market size was $5,000 US to purchase.

With these problems in mind we examined various indirect measures, such as ICT penetration, ICT market size, developments in ICT sophistication supporting (wherever data was available):

- Purchasing
- Sales
- Procurement
- Design
- Distribution and logistics

These organisational activities are supported by investments in ICT technologies such as:

- eProcurement with SRM
- Production

[143] VSO report, page 27

[144] VSO report, page 29

[145] VSO report, page 29

- CRM
- Collaboration
- ERP
- Distributed CAD

10.1.1 TrustCom Positioning and Areas of Contribution

TrustCom is currently positioned in multiple areas, and is contributing to framework technology, methodologies and tools for secure Virtual Organizations. TrustCom is applying the models, framework and standards for two scenarios. The positioning is done based on the various elements of TrustCom activities. In the figure below, we show the various areas where TrustCom activities are providing new technology or making contributions in terms of technology or concepts or framework.

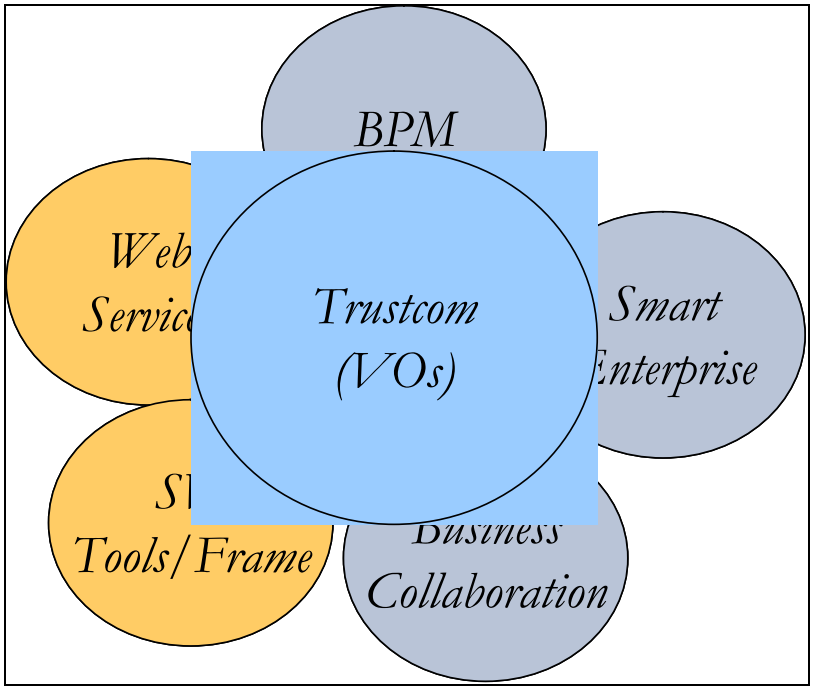

Figure 6: TrustCom Areas of Contirbution

The two main technology areas that TrustCom is making a contribution are the following:

- Web Services technology and standards for security and trust
- Tools and framework for enabling the interoperability and integration of business components and processes.

The three main areas from the Services side where TrustCom plays are the following:

- Business Process Management
- Smart Enterprise Solutions (for VO management)

- Collaborative Business Processes

10.1.2 The VSO dimensions

The VSO study defined two dimensions used in its study of the market prospects for VSOs. The first, the virtual dimension attempts to measure the degree of virtualness of an organisation. The second, the smart dimension attempts to gauge this against organisational activities seen as conducive to VOs. The measures of virtualness are[146]:

- Intranet usage
- Internet website
- Online selling of goods
- Order triggers an electronic process
- SCM use
- Exchange documents with suppliers
- Extranet usage
- LAN usage
- EDI usage
- Number of IT maintenance peple per 1000

The project also defined a smart index based on :

- Online orders automatically processed
- Online channels index
- Collaboration index
- Use of CRM
- Use of KM

What we think is missing off this list are indicators that reference process integration, trust and security. These are essential elements in maturing toward VO and similar collaborative arrangements. It is in these areas that we believe place TrustCoM in visionary category of the magic quadrant and will be an essential path toward leader status.

Although no actual size indicators are given within the VSO project, attempts were made to provide indications of growth within industry and region groups. The EC THINKCreative project is also important in this respect. Again while not providing actual estimates of size, the research in this project provided a roadmap for achieving higher levels of virtual enterprise. Both studies highlighted barriers to VO success.

We summarise the VSO, THINKCreative and other survey findings in the next section.

[146] VSO Report, page xxii

10.2 Indicators

10.2.1 VSO findings

The VSO report provides us with some interesting metrics to gauge VO trends based on region and industry.

We refer the reader to the VSO report itself for an in-depth presentation. For copyright reasons, we can only provide a summary.

The VSO study focused on various ICT related statistics in an attempt to provide comparative data that could support their research. The important results can be summarized as follows:

- The EU lags behind the USA and Japan in ICT investment and penetration.
- Within the EU, the Scandinavian countries are ahead of other EU countries in ICT investment, use and penetration.
- The rankings do not change significantly with size of firm
- Industry trends are similar across countries. These are summarized in the next list.
- Countries that were lagging in ICT penetration (Mexico, Greece are examples) in the early 90s are now catching up in terms of accelerating growth in ICT penetration at considerably faster rates than those that were ahead in the early 90s.
- The USA is considerably ahead in its percentage (of total economy) investment in software compared with the UK, Germany, France or the rest of the EU, while relative percentages in software investment through each decade since the 1980s has remained unchanged.
- Scandinavian countries lead the world in terms of buying and selling over the Internet.

Industry trends are also useful. We have already mentioned that industry trends are similar (but not identical) across countries. The rankings in ICT penetration are:

1. Retail
2. Transport
3. Manufacturing
4. Wholesale Trade

The picture is slightly different when the rankings are made by the Smart Index (defined in the previous section). In this ranking, the order is reasonably preserved when ranked by average company size:

1. Telecom
2. Electrical
3. Finance
4. Insurance
5. Transport
6. Chemicals

The retail industry is at number 10 in the ranking, although when adjusted for average company size, retail comes in at 8.

Unfortunately it is difficult to compare the two lists because their industry characterizations are different. One result that is interesting is that the study found a correlation between the smart index and the virtual index. The relation is a linear increasing function with slope 0.84.

The analysis of the detailed quantified data is given in the VSO report, with its major conclusion being that the virtual smart organization concept has wide applicability, across most sectors of the economy[147]. VOs will affect us all and will have a major impact on the ICT industry, particularly as the current software market and related areas of process management and organizational understanding needs to mature in its recognition of VO as an emerging organizational form[148].

Our final material drawn from the VSO study in this section is the "VSO "Phases Towards Virtual Operations".[149] The phases are similar in concept to the eBusiness maturity ladder adopted in many EC studies. The phases are:

- Stage 1, Isolation. This is traditional in four walls firm operating as an independent organization whose IT is entirely internal.
- Stage 2, Initiation. The first stage towards electronic linkages are made by processing client orders through email, or the Web (replacing paper).
- Stage 3, Infection. Software is introduced to help collaboration and inventory management along a virtual value system.
- Stage 4, Integration. Here 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.

In TrustCoM, we would add ERP system integration, trust and security. Maybe we would call a stage 5 "organizational integration", because it enables the formation of truly virtual organizations, which are able to form and dissolve on the basis of agreed and shared objectives. Such organizations require sophisticated automated legal frameworks and more tightly integrated system integration (because the assumption of an enterprise centric view disappears).

10.2.2 THINKCreative Findings

The last two chapters Camarinha-Matos and Afsarmanesh are devoted to outlining a roadmap for advanced virtual organizations. In the first, the roadmap methodology is carefully explained. This chapter is followed by a strategic roadmap outlining the baseline, vision and roadmap required to create the necessary environment (economically, politically, culturally, technologically and organizationally)

While this report does not provide us with metrics on market size, it does indicate effort and focus shared by TrustCoM and hence an indication of where TrustCoM will fit within a collaboration magic quadrant.

The following focus areas were built into the THINKCreative roadmap, for which details pertaining to TrustCoM will be listed in section 10.3 below.[150]

[147] VSO report, page 40

[148] See the Magic Quadrant in section 0

[149] VSO report, page xx

[150] Camarinha-Matos and Afsarmanesh page 292

- Socio-economic environment. This focus covers:
  - employment attitudes,
  - community bonding (how do you get virtual people to belong to a community)
  - life maintenance (training, learning, social security)
  - organizational support mechanisms (provision of VO setup services, VO development regionally and internationally)
  - Comprehensive and transparent legal framework (specially in the case of institutional collaboration)
  - regional assets and cultural identity preserved, well founded understanding of the socio-economic processes and developments in the context of networked economies.
- Vision for the VO management focus area, which covers:
  - an understanding of VO formation
  - understanding of strategy development
  - mechanisms of leadership and ownership
  - short term collaboration mechanisms.
- Vision for the support services areas, which covers:
  - membership rules, rights, responsibilities and business interoperability
  - VO creation framework (different ways of creating VOs)
  - support for the coordination of distributed activities,
  - risk assessment, mechanisms for post-cooperation IPRs and liabilities.
- Visions for ICT infrastructure, which covers:
  - architectures and horizontal infrastructure, support for federated information and resources management, plug and play to be extended to inter-organizational services, full e-transaction security and privacy.
- Vision for the formal models and theory, which covers:
  - models of effectiveness, decision making, learning, organizational structure and behavior
  - configuration, management, coordination, member behavior, discipline specific formal models, models of interoperability

It is reasonably clear from the vision statements above, that TrustCoM is an innovative leader in establishing not only research into many of the vision areas, but also leading in the sense of proving frameworks and working software support.

10.2.3 Market Size estimates

The IT services market is expected to grow considerably over the next few years. With current spending is in the region of $570 billion (2003) Gartner is expecting a growth to around $750 billion in 2008[151]. If we correlate IT services expenditure with trends in VO growth we can envisage considerable investment in ICT services focused on those elements outlined in the ThinkCreative VO roadmap. The VSO "phases to a virtual organization" is a useful tool here. Sufficient trends are noticeable in software utilization to see that organizations are pushing the boundaries along the maturity path. Organizational theory is also maturing to meet the new organizational forms as is the ERP, CRM, SRM including eProcurement software and product lifecycle management software industry. So we expect significant shares of the IT services market being spent on aspects of applications that increasingly support collaborative work.

Gartner is expecting growth in the areas of system integration, core outsourcing connectivity and process management over the next 3 years. And each of these areas is strongly correlated to the virtualization trend.

Of we estimate that about 10% of IT investment will be in technologies leading to or supporting the evolution or phases to VO, then the market for VO investment in 2008 will be approximately $75 billion. Provided sufficient support is given at the governmental and European wide level[152] the investment in the higher phases of the VO maturity stages will grow. Given that TrustCoMs primary target is providing the frameworks for enabling this growth, and that its partners form influential software product vendors, research institutions and major industry partners, a high expectation is being placed on the influence of TrustCoM to stimulate growth in VO maturity.

When these indicators are considered with the conclusions of the VSO report that ICT investment is strongly correlated across different countries within various industry sectors, we can expect a very broad market in VO organizations and supporting ICT, consulting and legal support.

10.3 Magic Quadrant

10.3.1 Introduction

We begin the magic quadrant section with a quadrant produced by Gartner for the Enterprise Collaboration market.[153] It will be seen that no organizations are represented in the leaders quadrant. The products represented in the quadrant do not address (in any serious, complete and visionary manner) the focus areas discussed in the THINKCreative roadmap (section 10.2.2 above).

[151] Gartner Dataquest Alert, November 2004.

[152] See the VSO report, ThinkCreative publication and enablers and barriers in section 6 and 7 in this study. For example, legal frameworks need to change in order to better support the legal status of a truly virtual organization.

[153] Obtained from "Java Forum Stuttgart 2003" Ivo Totev, SAP AG., www.jfs2003.de/folien/B6_Totev_SAP.ppt

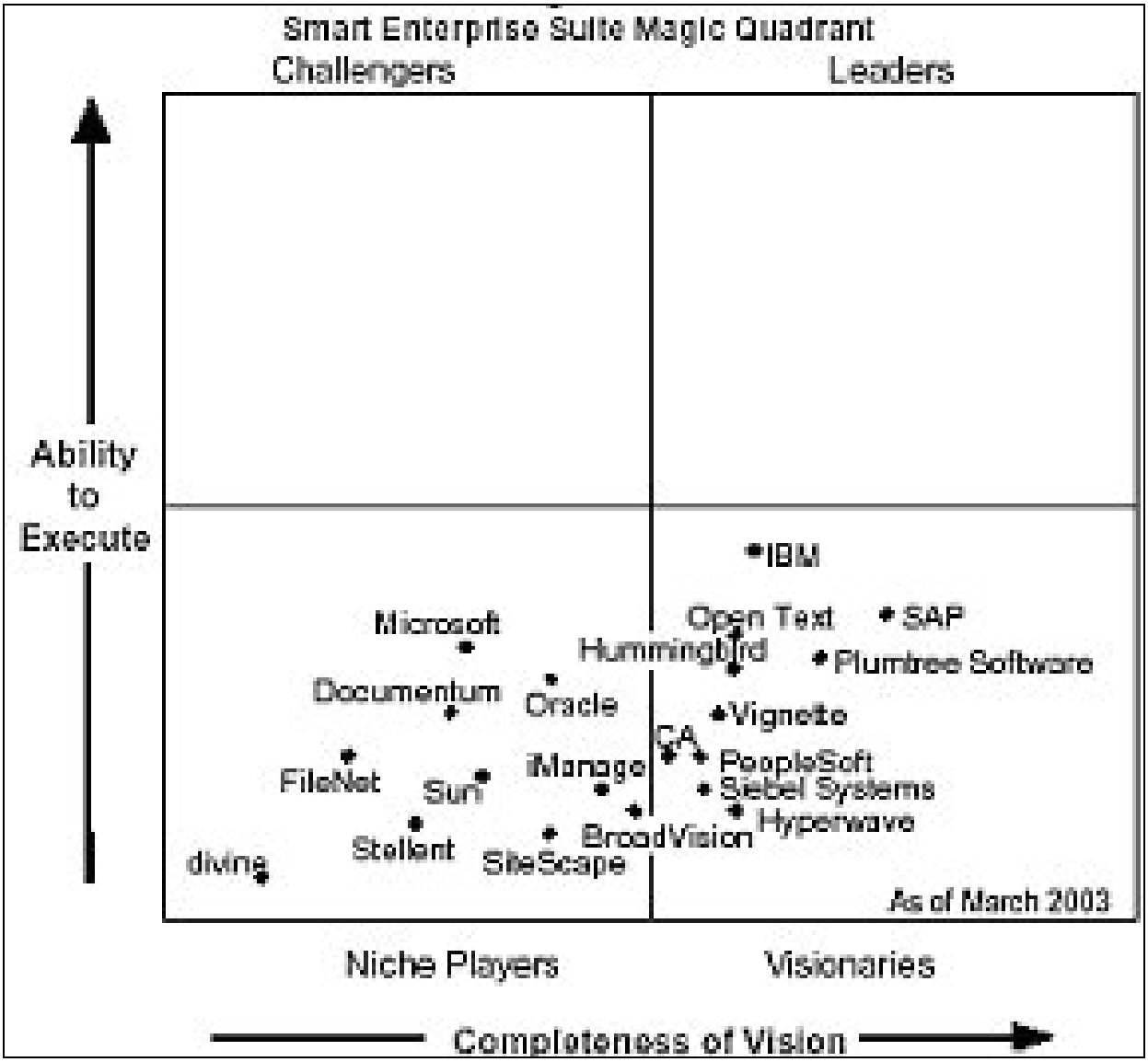

Figure 7 – Gartner Magic Quadrant for Enterprise Collaboraton Market

Where does TrustCoM fit within the magic quadrant? TrustCoM addresses many of the areas outlined in the THINKCreative roadmap. In particular, TrustCoM is contributing (in many cases, to a significant scale) to the following Visionary aspects:

- Comprehensive and transparent legal framework, especially in the case of institutional obligation.
- Understanding of strategy development and value creation
- Defined organizational principles for seamless flow of responsibility, ownership, knowledge and benefits along the VO life cycle and across VO boundaries.
- Mechanisms and institutions to foster long / short term collaboration with the aid of soft and hard incentive schemes.
- Management of breeding environments (e.g. definition, behaviour, membership, rules, rights, responsibilities, business interoperability)
- VO creation framework

- VO management including the coordination and management of highly distributed activities
- Risk management, assessment tools, performance measuring and mechanisms for learning and experience collection.
- Technology independent reference architecture for horizontal infrastructure
- Provide support for federated information and resources management
- Flexible control mechanisms supporting the implementation of a large variety of behaviours
- Plug-and-play concept extended to inter-organization services
- Secure and trustworthy collaborative business process models following a top-down process definition and deployment approach
- "Configure yourself" philosophy
- The VO research area recognised as a scientific discipline
- Generic modelling of the VO (structure and behaviour) as a top-down approach.
- Generic modelling of the VO members' behaviour
- Discipline-specific formal models are created
- The establishment of a formal foundation to guarantee VOs effectiveness, better decision-making, incremental learning from past experience and minimized operating problems via clear commitments
- Models Interoperability

Of the 29 focus areas identified by the THINKCreative project, 20 are explicitly recognised as important components of the TrustCoM work packages. Given the makeup of the TrustCoM consortium, the commitment to deliver actual frameworks and foundation software places TrustCoM as a project and as a concept into the leadership position[154]. We present the modified quadrant as follows:

[154] What this means in practice is that the organisations that exploit TrustCoM through the exploitation work stream and beyond, will become the leadership organisations. What in effect TrustCoM is doing, is providing the agenda for what matters for being placed into the leadership quadrant and providing the means for getting there.

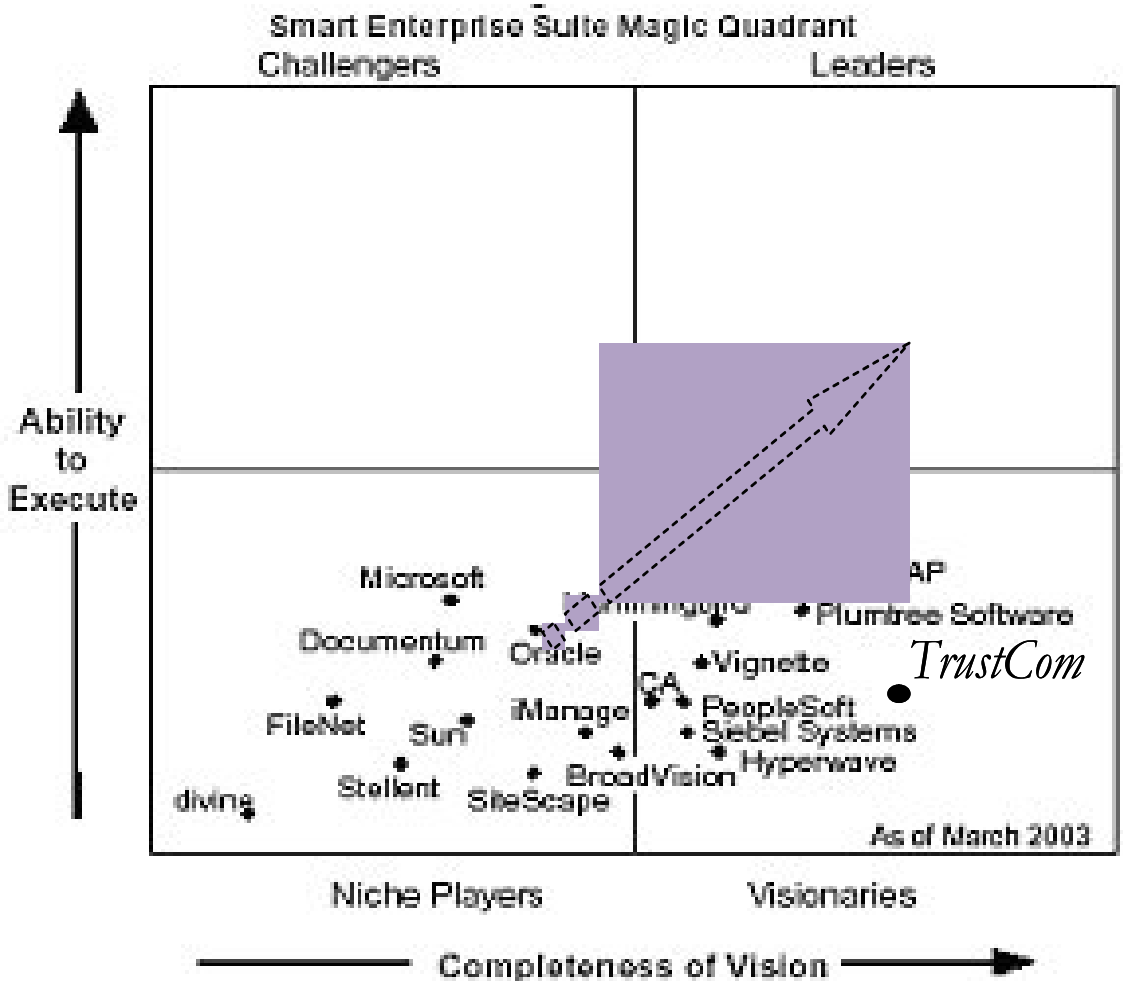

Figure 8 - TrustCoM position in quadrant

11 SWOT analysis of the TrustCoM Project

As a conclusion of the studies developed in the previous chapters, a SWOT analysis has been built to highlight the potential risks and benefits of the current virtual and collaborative environment in which TrustCoM results would operate.

By using the SWOT analysis, the Consortium will have the opportunity to conceive and better understand the reality that envelops the TrustCoM project. This well-organized and easy-visual tool compiles the most relevant economic and technical characteristics identified in the reports studied, contains the most important distinctive attributes of the project that must be considered and also includes the conclusions, visions, and interpretations by the side and experience of the partners of the Consortium.

The SWOT analysis is an easy way to gather the most important internal and external advantages and disadvantages that affect or would potentially influence to the project:

- On the one hand, strengths and weaknesses reflect the current state of the technology developed in the project.
- On the other hand, opportunities and threats summarize the external advantages and barriers that exist in the market, in particular regarding European Virtual Organizations (economical aspects, legal issues, public roles…

The present exercise will provide the basis for comparing expectations with real outcomes provided by the technology.

11.1 Strengths and weaknesses

Strengths	Weaknesses
- Standards and technology are being adopted and generalized. - TrustCoM addresses new requirements needed by scalable, and self-adaptable business solutions for dynamic VO's (See 1.4). - TrustCoM provides a generic VO approach covering the needs of different business segments like collaborative engineering and aggregated service provisioning (See 1.5). - Novel business models for interoperability - Market value for Industrial systems and sectors which cover Aerospace, Electronics, Automotive, Petroleum and others, where the size of the market for the software is hundreds of millions of Euros. - Research efforts to provide an ICT environment for VO lifecycle support (Chapter) - Future intentions to test and adapt the results in SME's. - A first framework integrating the trust, security and contract management related processes - Trustcom Consortium is participated by strong partners for the research and trial phases. These companies are characterized by having a good position in the IT market.	- Initial investments and keeping software and technological infrastructure require high costs. - Need of additional work and efforts to extend the current business solutions. - Requires high efforts in positioning the Trustcom vision of the VO concept, in order not to be marginalized by the market. - Need on focusing on providing the thought leadership, and core technology enablers through standards driven software. - Ensuring standardization of the VO framework components requires high efforts. - Alignment with other industry specific standards such as RosettaNet is needed. TrustCoM needs to consider a complex set of emerging standards and specifications like Web Services specifications - The market value for adhoc-collaboration amongst smaller businesses is not easily available or computable (see 1.5). -

11.2 Opportunities and threats

Opportunities	Threats
- Opportunity for concentration and consolidation due to economic slowdown - Penetration of ICT technology into any kind of companies. Increase of net based technologies implemented into companies. - Product and service quality are still of concern, support for quality standards. - Need to speed up processes - Need of flexibility, reactive systems and high quality standard. - According to VOmap studies, in 2015 most enterprises will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations in response to fast changing market conditions. VO seen as the most promising business model of the 21st century. - The current Web Services only addresses the fundamental issues, but not in a VO environment. - Trust causes reduced opportunism and consequently lower cost. (See 8.2) - Demand for advanced manageability and scalability increases[155] - Benefits of Virtual organizations: ▪ VO's are naturally more competitive because they can compose, dissolve, and recompose teams or technology capabilities with relative ease. ▪ Through Virtual organizations, specific budget expenditures for collaborative environments get lower. ▪ A VO can engage human resources when they are needed, which will drive down labour costs. - SME's can benefit greatly from VO, because there is an increasing need to broaden their markets to improve their competitiveness. - European, national and regional bodies are and get even stronger involved in developing and supporting VO's. [156*]. - As Vomap project mentions, there is a need of establishing a meta-model for VO, in order to establish first basic homogenization" of the concept, to avoid the ambiguity and incorrectness of the terminology developed, and need to create a new focus of attention in terms of structure (topology), flows, relationships, roles, etc. - Situation of the market, according to Garner reports[157]: ▪ Currently, the IT services market revenue in Western Europe is $192,764 millions, and it is predicted that this number will increase to $224,113 in 2008(an annual growing rate of 4.6%). There is a growing trend of development of tools supporting network and virtual organizations ▪ The worldwide growth in services based on all	- Lack of corporate vision. Generally, managers resist on assuming high investments in complex technologies. - Concerns about the effectiveness of virtual organizational systems. - VAT complications can also impact the creation of transactions within the VO - Need of more governmental initiatives to implement VO technology and culture into company's structure. - Market is still immature and lacks transparency ▪ Missing information: Few reference market models. . ▪ Lack of information on usage of Virtual models ▪ The existing studies did not focus on trust, security and reputation mechanisms and technology for enabling VO's ▪ Studies provided tremendous definitions and value behind virtual organizations. No single concept. ▪ Difficulty to find best-practices. ▪ Lack of research on ROI tasks and competitors positioning ▪ There are not many results on dynamic ontology evolution in distributed (and evolving) networks [*]. - Technical and Economical requirements: ▪ Inadequate technical infrastructures in most of the companies ▪ Nowadays, Vo's technologies means high set-up costs. Significant investment required to develop concepts, tools and methods for virtual organizations [*]. ▪ SME's have economical difficulties gaining access to VO technologies

[155] **IdeaByte** IT Trends 2003: Database Management System

[156] * Vomap project, Camarinha-Matos and Afsarmanesh "Collaborative Networked Organizations" Kluwer

[157] Garner Dataquest. IT Services Forecast Update: Reaffirming Modest Growth. Kathryn Hale, Robert de Souza, Ellie Babaie, Twiggy Lo and Rika Narisawa

connectivity platforms is expected to reach 8.3% in 2008.

- Interenterprise communication continues to be a major driver because users are increasingly less able to manage and optimize their communications infrastructure using in-house resources.
- It is envisage that VO will contribute to increased European organizational competitiveness.
- In the future, virtual organizations should find a supporting and adapted environment for their operations*.

12 Conclusions

In this document we provided a detailed market study on Secure and Trusted Virtual Organizations and the enabling open technologies for the European Business Environment. The market study document addressed the most fundamental question, which is the following: what is the market value of the Virtual Organization models (as envisioned by TrustCoM) and technologies for enabling trusted and secure business collaboration over the Internet in Europe and elsewhere? In addition, the market study also addressed the following: Will the VO model of collaboration, interaction and sharing between businesses provide better profitability, efficiency and reduced costs?

There is no single concept of a VO and this is not because the various concepts are competing or contradictory, but because the factors contributing to an interest in VO and those making it possible are acting on the diversity of organisational already existing and their products and services.

These factors are contributing toward a movement away from various traditional organisational activities in terms of products, knowledge, organisational form and the establishment of new organisational types.

In this market study we have surveyed some key aspects of VO. Currently, many different conceptions of VO are being discussed and at times, these different concepts are being mixed and confused in the literature. One key feature of this study has been to separate out five different definitions that provide a framework for discussing VO requirements, barriers, challenges and impact.

The more “traditional” concepts of VO are tele-working, outsourcing and independent services. A majority of the VO literature and research appears to be devoted to these forms of VO, leaving the most challenging approach with more questions than answers. The more challenging definition of a VO is a virtual organisation formed by a number of other organisations to achieve a goal in such a way that the VO itself may be short lived, be dynamic and flexible in its structures and ownership and still become a customer facing brand (even if the customer is another business and not a consumer). The TrustCoM project is, however, addressing the issues facing of this more challenging definition and in a radically practical way. TrustCoM has set out to not only research the issues, but to provide solutions that will work. But is the TrustCoM conception on a tangent? While the majority of literature is dedicated to the simpler forms of VO, the TrustCoM definition is given sufficient attention in the literature to satisfy us that it is one of the most important areas of VO organisation for the future. But we recognise that many issues need solutions and for many of them, the TrustCoM project will be a leader in providing these solutions.

The underlying report contains optimistic conclusions regarding the TrustCoM consortiums approach to ICT issues for VO. We consider that the consortium is ahead of other research and literature dedicated to ICT support for VO, where we consider other sources to be rather incomplete or very weak. The TrustCoM efforts to provide an ICT environment for VO lifecycle support is of particular importance.

We do raise specific concerns regarding some of the softer or social issues, which are quite acute in the case of VO. Organisations are human institutions and while ICT support and legal frameworks are vital for their success, these are not sufficient on their own. Various barriers and issues of trust presented in the study will provide the TrustCoM consortium with indications as to which of these areas need attention. Given the technical nature of the TrustCoM project, we are not sure as to how these issues should be addressed, but we are confident of their importance.

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14 Appendix – Case Studies

The case studies presented in this section are sourced from different sources as indicated in each section.

14.1 Mini Case studies

These mini case studies are very short, but they do illustrate a diversity of structures, size, make up, product/service, duration and VO conceptualisation.

14.1.1 SEIU - Trade Union as a VO[158]

One of the largest unions in the US is taking its organising drive to the Internet, creating a VO that isn't tied to a work site or dependent on employer recognition. The Service Employees International Union's (SEIU) new affiliate, PurpleOcean.org, is described as a radical new way to think about organised labour and was inspired by a weblog about the labour movement, its future and its challenges. The virtual union idea came next, with a goal of 1 million people to support SEIU's campaigns.

14.1.2 Regional Alliance as a VO[159]

In the US, the Roanoke region of Virginia said that its member organisations have made progress in 19 of 23 initiatives identified in 2002 to transform the area from a declining manufacturing economy to a "knowledge-based" economy. Officials cited the creation of venture capital funds as the most significant accomplishment. The alliance was funded by the state legislature through the regional competitiveness program. A committee is looking into finding other sources of funding, potentially from local businesses, grants and existing organisations, but it appears that the alliance, operating as a VO that unites local governments and economic development organisations, needs little money to operate.

14.1.3 ING Bank - Banking/VO Uses of Technology[160]

ING Bank is about to switch its corporate data network to a secure system that uses Internet protocols without being connected to the public Internet. Its head of technology said rapid growth necessitated the move “we have to virtualise our organisation across 2,500 miles of the US. To have a VO with one heartbeat across the country." Its new system, a "peerless IP" network should help ING Direct's three call centres, which are housed in the data centres. The end-user experience is said to be much better and the faster network provides extra backup in case of a computer crash or similar event.

[158] Detroit Free Press, 23 June 2004

[159] Roanoke Times & World News, 6 August 2004

[160] American Banker, Vol. 169, No. 149, 4 August 2004

14.1.4 DidTheyReadIt – A Technology SME Operating as a VO[161]

Alastair Rampell, a 23 year-old Harvard graduate achieved overnight notoriety in May 2004 with the release of his latest product, an e-mail monitoring service called DidTheyReadIt, which allows users to track the e-mails they send, alerting them when a message is opened by its recipient and even reporting on how long the recipient looked at it, and offering a rough geographical guess about where he/she is located. His company, Rampell Software, is a VO that employs about 10 people.

14.1.5 Alcatel – A High-Tech Company Turning itself into a VO[162]

Alcatel is reportedly transitioning into a VO through product supply chain automation. A recent study focuses on supply chain automation and collaboration within the European high-tech industry, looking in-depth at steps that have been taken to achieve supply chain collaboration with downstream flows at Alcatel.

14.1.6 I-Know-Law

This 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.

14.1.7 The Soar Group

This is a VO engaged in research and design of general purpose artificial intelligence architecture. Soar[163] is an architecture for a general intelligence system that learns about possible solutions to problems as it solves them and thus continuously improves its capability to solve similar problems. As this system was being developed, Soar also became a tool for studying the theoretical construct of cognition (Newell, 1990). Soar has been used for a wide range of tasks -- from creating music to problem-solving in space-related projects by NASA.

As is the case with other VO, the Soar group has no single shared physical setting. Since its inception in 1982, the Soar group has spread to several universities and corporations nationally and internationally. Members collaborate in a variety of research domains including cognition, natural language understanding, and robotics. Most collaborative projects include corporate as well as academic participants.

Like many virtual organisations, the Soar group communicates extensively by email to share information and coordinate tasks. Members use the Soar group for ideas, feedback, support, and stimulation. Information exchange through email can take various forms. For example, a member can inform the group through email when he or she finds a bug or discovers new requirements. Additionally, members can post a problem on a bulletin board with the expectation of receiving feedback from other members. Someone else who may have encountered this bug or problem may respond with a solution.

[161] The Boston Globe, 5 July 2004

[162] Using AI in Electronic Commerce, Virtual Organisations, & Enterprise Knowledge Management to Reengineer the Corporation, papers from the AAAI Workshop

[163] www.ascusc.org

14.1.8 AT&T

AT&T reduced commuting and increased its use of home offices, which allowed its sales force to spend 15% - 20% more time with customers, thus establishing an area of its business as VO3 VO.

14.1.9 Compaq Computer Corporation

Compaq Computer Corporation moved its sales force into home offices and recorded a drop in sales and administrative expenses (from 23% to 12% of revenue), partly due to this change.

14.1.10 Perkin-Elmer

Scientific equipment manufacturer **Perkin-Elmer** based 300 sales and customer service representatives in their homes, which allowed the firm to close 35 branch offices

14.2 Longer Case Studies

14.2.1 Mayflower Group - HR Consortium as a VO[164]

As long ago as 1971, IBM and Sears invited 18 select organisations with internal survey programmes to a meeting in Washington, D.C., at the Mayflower Hotel, with hopes or swapping knowledge. What emerged was the new Mayflower Group, a consortium of companies that share, compare and learn from each other's survey data. The Mayflower Group, primarily a VO but incorporated in Delaware, has a bank of information on more than 60 questions touching on topics such as job satisfaction, training, reward and recognition, quality, group and teamwork functioning, diversity and empowerment. Members must submit information on at least 18 of these items once every two years; in return, a normative database, most used for benchmarking, is provided annually in a summary report.

Currently in the group are 42 companies that employ more than 3 million employees globally. Most of them are included in Fortune's "Most Admired Companies in America." Each member company receives a detailed report every year, compiled by a third party vendor. Members can also request customised reports, e.g.:

3M has been a Mayflower member since 1988. 3M wanted to see how it compared to other Baldridge (quality) recipients within the Mayflower group. So 3M's manager of talent management ordered a subset of information on the six other companies in the group that had won a Baldridge. Although she knew the six companies, she was unable to identify what data belonged to what company in the report. In order to receive the report, she first had to go through Mayflower, which made sure 3M was not trying to get information it was not supposed to have. There are a lot of checks and balances in place through the committee structure; anonymity of all members on any report is always protected and maintained, and this is essential for participation and the long-term success of the group.

Corning, likewise, has capitalised on the customised reports. As a technology company, Coming continually wants to know how it stacks up against the other 15 companies in its industry within Mayflower, specifically how its scientists compare to other scientists. The report Corning got back

[164] Training Magazine, 1 Aug, 2004.

contained confidential information on scientists at the technology companies in Mayflower. The slicing and dicing of information also provides the ability to better understand international employees. The location, region and culture is often much more critical in shaping people's attitudes than even what company they're in. Now Corning can compare its employees in France to other companies' employees in France, and provide this information to its managers, which is often more helpful and telling than U.S.-based data.

The Mayflower Group meets in a Congress-like fashion twice a year. It is in these meetings that much of the group's work is completed, even though subcommittees accomplish significant work between these meetings. The last day is the learning day, dedicated to learning about a variety of topics. Mayflower caps its membership at 50 companies. Over the years, this number has increased, but part of the reason the group works so well is its intimacy. And yet fresh information and new ideas are also important.

It's a very inexpensive, flexible and powerful source of information about all things related to human resources, say a Mayflower member. “Most would say they joined for the norms, but over time why do we stay? We stay because of the learning and sharing. We have people from the big three auto companies who sit in the same room and share candidly on their company's programmes - and these are competitors. But the culture has been set, from the founders back in the early '70s, that this was a professional network, and we act as professionals. We trust each other to share all of our dirty laundry, help each other and then learn from each other."

This case study offers some interesting insight into cultural aspects of VO. The culture of this VO has been evolving for 30 years. Is this a key to its success and if so, what does this say for the “quickly form, quickly disband” VO model? Some of the other case studies presented below show how quickly VO can form and become successful, but these cases, such as the technology SME and human resource management cases discussed below, operate either as a mobile working VO or sell virtual products. In other words, they are not operating as VO1 or VO2 models.

14.2.2 Technology One Alliance - Human Resource Management in VO[165]

A recent study found that “real” VO include the Technology One Alliance among BankOne, AT&T, and IBM, the networks between Walmart and its vendors, Merck's virtual HR activities, and Lucent's virtual product development team composed of 500 engineers operating over 13 time zones.

The HR manager in a VO takes on more differing roles than does the traditional HR manager. The VO HR manager must be a coach delivering feedback to self-managed teams, an architect of work flows using computer technology, a designer and deliverer of innovative HR programs to fit the VO, and a facilitator of teamwork in self-managed teams. The basic HR functions in a VO look the same as in the traditional organisation, but the techniques are sometimes radically different. For example, in the VO, electronic performance monitoring and online chat sessions are job analysis methods:

- Recruiting occurs through Internet job boards.
- Hiring involves electronic resumes, online testing, and online interviewing.
- Training focuses upon electronic learning (e-learning) capability, communities of learning, and the use of learning portals.
- Performance management involves maintaining individual technological skill mixes and evaluating virtual team performance.

[165] Human Resource Management in VO, summer 2004, The University of Louisiana at Lafayette, Lafayette, LA.

- Even pay systems need new forms because of the new types of work structures-virtual teams, alliances, and networks-and the changing perception of pay equity within these structures.

The self-managed team is one of the building blocks of these organisations. Team members must possess or be trainable on traits conducive to operating in the VO: communication skills, cultural sensitivity, networking ability, tolerance for ambiguity, and interpersonal adaptability. Finally, virtual negotiation is unique. Negotiation in traditional organisations is face-to-face, but virtual negotiation occurs largely through e-mail, which, on the one hand, has a greater propensity for norms of "taking turns" (e.g., waiting for an e-mail reply); but, on the other hand, there is a greater tendency for lack of inhibition, which may allow for rude and compulsive behaviour, like "flaming". Moreover, there is a greater tendency toward message misinterpretation in virtual negotiation e-mails that lack the nonverbal information richness of face-to-face interaction.

Furthermore, how will onslaughts of viruses, worms, hackers, and equipment breakdowns affect VO? In the traditional organisation, there are backup communication systems to the computer, such as faxes, phone messages, and even walking over to someone and talking face-to-face. What is the alternative to the much centralised role of the computer if it malfunctions in the VO?

14.2.3 Global Recycle

Global Recycle[166] is a company that started its business as a "virtual" company. Global Recycle is an online trading exchange for producers, consumers and traders of scrap, recycled and secondary materials. It is focused on providing an exchange that allows users to locate compatible buyers and sellers and engage in direct negotiations as quickly as possible. It provides negotiating members with the flexibility of using their online negotiation system.

Its email system will also keep members up to speed with live or daily email notifications for new requests for quote (RFQs) posted on the trading exchange within their selected categories of interest. This will allow members to see all RFQs as soon as they are posted and instantly decide whether they wish to open a negotiation. They are always amazed at how quickly and how many responses members get to their postings on the trading exchange. About 80% of RFQs posted on the trading exchange get responses from interested companies within the first 24 hours of being posted. Even the rarest and strangest postings solicit responses from interested buyers and suppliers.

Upon registering, users will be requested to provide their identity, full contact information, payment details and to select their categories of interest and email preferences. If Global Recycle is offering a trial period at the time, then the payment details are not requested until the end of the trial period. The application is reviewed by Global Recycle and if all the correct information is provided then the membership is activated. When users' membership is activated they will receive an email confirming their User ID, Password and hints & tips on how best to use the exchange.

To get started on the trading exchange, there are two paths users can take. The first is to post their own RFQ onto the trading exchange and wait for other members to open negotiations with them, and the second path is to browse the trading exchange and open negotiations with other members.

When users post an RFQ it is recommended that they provide as much information as possible. It is interesting to note that about 80% of RFQs posted get replies within the first 24 hours of being posted.

[166] www.globalrecycle.net

Once a user has posted an RFQ, it will become visible on the trading exchange and all members who have selected the same categories of interest will get email notifications that he has posted an RFQ. At this stage user's RFQ is anonymous and his identity is protected. From links within the RFQ notification emails or from the trading exchange itself, any member can decide to open negotiations with him/her. Their online negotiation system uses email notifications to make him/her aware of a response from another member. When a member opens a negotiation with the user and a response is posted, an email is sent to notify him/her.

In the past Global Recycle has focused on providing a tool that allows users to find compatible buyers and sellers, to communicate quickly and to keep track of their postings and negotiations. Global Recycle does not get involved in the transaction itself and leaves the negotiating members to make these arrangements themselves

14.2.4 Cavendish Management Resources (CMR)

This company provides a wide range of consultancy and management support services in addition to investment funds for SMEs sses seeking expansion.

The experiences of CMR's founder when working at a senior board level within blue-chip companies in the United Kingdom, Europe, and the United States, had led him to believe that many SMEs had great difficulty in accessing the financial and management support needed to realise future growth potential. In particular, he noted that SMEs with a turnover in the range of around €1.51–€500 million generally exhibited two expansion handicaps. Firstly, they were often undercapitalised. Secondly, they were also often under managed, with a particular lack of management expertise appropriate for the progression of innovative projects with extremely high growth potential. There was therefore the problem that some exceedingly promising opportunities within the SME sector were not being realised. An opening therefore existed for a consultancy organisation prepared to offer a complete range of developmental, strategic and financial management skills targeted towards the SME sector.

To provide management services to its clients, CMR draws upon the expertise of around 150 members who have gained business experience across a wide range of industry sectors. All members are former senior managers and executives who have now opted to offer their professional skills within CMR's broad virtual network. However, no member is actually a CMR employee, nor do they have access to an office or any other physical resource. Indeed, CMR's geographic base is limited to a single co-ordinating office in Harley Street, London, which employs a small number of secretarial staff. Despite these apparent constraints, CMR remains a flourishing and expanding business enterprise

Every CMR member has to be running their own limited liability company before being entitled to join the organisation. In essence, this makes CMR a wide portfolio of sole traders and small-firm owner-managers. The company is therefore an example of a VO staffed by portfolio people, as all members are free to trade individually and within other networks in addition to operating as members of CMR. The limited company membership restriction is in place to ease contractual difficulties, and specifically to simplify arrangements for the payment of members as free agents rather than as employees.

In order to provide coherent client service, as well as to maintain effective communications across the organisation, most CMR members utilise increasingly advanced computing and communications systems. In addition to the use of "basic" e-mail communications facilities, at the time of writing there were plans for a CMR bulletin board upon the Internet to replace part of the current programme of regular newsletters. The executive skills database was also being upgraded , to be made available to each region on disk or via network linkages as appropriate. Given the prominence of computer technology adoption in much of the virtual organisational literature, it is perhaps interesting to note that, whilst most CMR members use computers and network links to help them work more effectively, CMR as a model of virtual organisation was not constituted around new developments in computing technologies per se. Rather, the primary driving force behind CMR's innovative structure related to its adoption of a new worker-organisation relationship. Therefore, whilst CMR may be

thriving as a child of the “information age”, it was most definitely not new information technologies which led to the conception of its current strategies and organisational form.

Regardless of the role played within their work by computing and communications systems, there is still the need for CMR members to engage in face-to-face meetings with either clients or other members on a regular basis. With only limited office/meeting room availability in London, this may at first appear to present a problem. However in practice it does not, as members simply use hotels. Often lobbies suffice for meetings, as these offer tables which members may occupy for several hours in return for the. For longer or larger meetings, actual conference rooms are booked. Either way, the cost is minimal compared to the upkeep of dedicated company meeting facilities. What's more, some clients have even been noted to thank CMR members for “going to the trouble of meeting them in their airport hotel”. Aside from CMR, an increasing number of other organisations are now using hotel lobbies and conference rooms — public houses, coffee shops and motorway service stations — as locations for business meetings. As more and more people come to work as portfolio free agents, the demand for convenient, quality meeting spaces looks set to rapidly increase.

Clearly CMR and its members offer a certain type of management and financial service within a particular market sector. However successful CMR becomes, it would therefore be premature to suggest that, in future, the vast majority of portfolio people will be working for identical modes of virtual organisation. There is a limit, after all, to the percentage of the workforce who may labour as management and finance consultants. This said, the existence of CMR does prove that patterns of VO are already more than mere theoretical speculation. We may also draw lessons from the CMR case concerning the working relationships likely to be exhibited within a wider variety of virtual organisational structures.

Probably the most common concern voiced by those sceptical of any organisational arrangement involving homeworking relates to the potential lack of control available over remote personnel. To put it bluntly, worries are raised concerning the supervision of people “whom managers cannot see”. Or as Charles Handy argues, “the trust is the rub” (1995: 212). However, by looking to the case of CMR, we may quickly conclude that the above fears are based upon traditional and now outdated notions of worker-organisation relationship. Indeed, the CMR case effectively demonstrates that the “rub of trust” causality may in future be turned on its head.

Key to this conclusion is an analysis of CMR's policy of charging individuals a monthly fee in order to allow them to remain members of its virtual organisational collective. By doing so, CMR is dramatically altering the traditional worker-organisation relationship. Consequently, the organisation does not have to worry about whether or not its “out of sight” members are pulling their weight. Indeed, concerns are more likely to flow in the opposite direction, with members having to trust the organisation to be providing them with value in return for their monthly fee.

Whilst many people — many current employees — may balk at the prospect of having to pay for organisational affiliation (effectively to have to pay for their job), such an arrangement may in some senses be seen as beneficial in both directions. From the organisation's perspective, by having members pay a fee to work through them, labour monitoring costs may be substantially reduced. The overall cost effectiveness of the business may therefore be improved. From an individual standpoint, flexibilities and fresh opportunities may also become available — with members of CMR, for example, being free to trade inside and outside of the organisation as they so choose. Additionally, with a free agent mentality having already been bred into a significant proportion of the population by those who have allowed them to buy out of the welfare state, it may only be a matter of time before quite a few portfolio individuals come to expect to purchase their own job on their own terms. Many people have already accepted the need to pay for private pensions, private medical care, private education for their children, and private old-age nursing provision. Is it therefore not likely that such portfolio-minded individuals will seek to purchase a similar control and flexibility over the work-command relationship which will govern a far larger proportion of their lives?

Whatever the causalities, CMR's model of a virtual collective into which individual members non-exclusively buy-in seems likely to be mirrored across other organisations in the future. As this occurs, and more “virtual organisations” proliferate, an increasing number of traditional notions of the

work-command relationship — of trust, of employee control, and of dedicated organisational allegiance — will be forced to evolve. Knowledge and information (and in time pure imagination) may indeed become the raw materials which in future will add most value. However, the structures and management philosophies of many a Future Organisation will be driven by the flexibilities and the economies of transforming labour markets, rather than by abstract collections of meaning derived from raw data patterns. Or to put it another way, the structure and management philosophies of most future virtual organisations will be determined not by the consensual hallucinations of cyberspace, but rather by the flesh-soul-and-coin realities of human and economic necessity.

14.2.5 OAC

The aim of OAC is to provide a very high quality service without the overheads of traditional firms, though operating in an effective teleworking environment, As web as its 30 employees the company also works with a number of contractors and associates.

The communications technology required to run an international teleworking consulting business is of crucial importance. Although it was posible to operate as a virtual company before the implementation of broadband, OAC saw the benefits that broadband could bring in further improving the efficiency of their VO.

OAC uses a range of broadband technologies across its organisation, depending on which is the most suitable for each location. At the end of the spectrum , for their most remote staff, they provide connectivity by satellite. At the other end of the spectrum, for staff who live close to a modern telephone exchange, ADSL broadband provides the connectivity.

The company describes its communications structure and business model as a bicycle wheel where the hub is the centre of the virtual company and the spokes connect each of its consultants to the centre. Broadband allows continuous connection for everybody

We are able to provide secure connectivity to clients and associates, so that they effectively become part of OAC's working system. Bradband takes away operating cnstrait. The benefit of broadband to OAC intemrs of reduced costs is clear. "It is much cheaper than other

OAC wished to meet the challenge of providing staff and potential members of staff with communications that would enable them to work effectively as part of the OAC team from rural and more distant locations. The use of the broadband has enabled them to address this challenge and has had a considerable impact on the business and its future. It also enables the company to employ people who have specific expertise but wish to retain certain lifestyle flexibilities such as living nin a remote area. It was difficult for such people to communicate affectively prior to broadband.

OAC views broadband as the first "step change" in communications technologies since the introduction of ISDN

14.2.6 Nokia

The company NOKIA[167] has created the M2M as a support to companies to implement virtuality into its structure. The term M2M, "machine-to-machine", M2M refers to systems that let machines communicate with management systems or with people using compatible mobile terminals. These machines can be home appliances, industrial pumps, vehicles, photocopiers, vending machines, or

[167] www.nokia.com

utility meters. M2M solutions are created for increasing the competitiveness of a company through more efficient processes.

By using GSM technology, M2M allows to connect companies, systems and devices from all business areas- Communication technologies, hardware integration, customer care…More concrete examples are the following ones: Monitoring elevator in shopping centers, checking the temperature in swimming pools, locating trucks on the highways and tracking the use of office photocopiers. M2M opportunities can be found in almost any industry or application segment:: remote metering and monitoring; in-vehicle applications, public traffic services, industrial applications, security and surveillance, sales and payments, fleet management, telemedicine, public services. M2M solutions are created in collaboration, by combining the competencies of several players. In this way M2M business has potential that may be explored by several different parties

Companies like Enermet, or the Brookstone Equipment company or Viescomm has experienced the profits of using M2M solutions into its structure. An M2M solution may benefit a company by enhancing its own business processes or by enabling it to offer new services to its customers. For example, companies offering maintenance services may optimize their operations by having information on machines' service needs and locations. Manufacturers may gain better understanding of their product performance and possible needs for improvement through an M2M solution.

14.2.7 BAE Systems

BAE Systems has reach into international markets as a prime contractor and systems integrator in the air, land, sea and space defense market sectors. Committed to growing the business as a whole while delivering increasingly high-value products to customers, BAE Systems has embarked on an exciting transformation in order to capitalize on the opportunities afforded by Internet technology. e-Business will enable BAE Systems to improve its business processes and drive costs out of the lifecycle and extended supply chain.

Exostar is a key component of BAE Systems overall e-Business strategy. BAE Systems and other leading companies in the global aerospace and defense industry are using Exostar to transform their supply chains and collaborative design environments. Exostar is the leading provider of integrated supply-chain solutions to the aerospace and defense (A&D) industry. Its mission is to create an improved way of doing business through an internet-enabled, secure marketplace that increases the efficiency of transactions and enhances collaboration across the supply chain and product life cycle. Thanks to this organisation, BAES has improved its processes, reduced its costs, and worked closer to its customers and suppliers.

To meet the demands of today's increasingly complex product development, manufacturing and support projects, BAE SYSTEMS needs increasingly to be able to work in close collaboration with partners, suppliers and customers. e-Collaboration is the term being used by BAE SYSTEMS to describe the bringing together of People, Processes and Information to work together in an harmonized way, throughout the product lifecycle (that is from concept and analysis, through design and development, manufacture, operational in-service and finally disposal), and supported by appropriate information systems. BAE Systems is currently introducing Exostar's ForumPass and other web-based services on several key projects. ForumPass provides project teams spanning multiple locations and organisations with a powerful tool to improve collaboration. Projects can significantly reduce travel, save time and improve information management, all helping to reduce cost and improve project team performance

14.2.8 Fife Direct

Fife Direct is a virtual organisation created to increase access to employment, to boost learning and skills development, to promote business start-ups and company growth, to promote community participation, to contribute to the e-government and modernizing government agendas. This website brings a diverse range of socially useful information and services into a cost-effective delivery

mechanism via a single website. Fife Direct is the first website in Scotland to bring job vacancies online.

Organisations involved have taken significant steps up the learning curve, and over 200 frontline staff have received training in using the web as an essential resource for providing opportunities for their clients, some of whom are amongst the most socially disadvantaged in Europe. In the longer term it is anticipated that Fife Direct will include more transactional functions (such as filling in application forms online or ordering/paying for publications online etc). It is also hoped that more community groups will establish a web presence via Fife Direct, and that areas not presently covered such as housing and health will also be incorporated

14.2.9 Hewlett-Packard Swiss

The case of Hewlett-Packard Swiss is considered an example of the first level of a virtual organisation. After its reorganisation in 1993, the company showed the following structure:

- The management became a coordinator of interfaces between the members of the organisation. Therefore its primary purpose is to coordinate collaboration and arrangement of teams.
- Management understood itself as a service center for the operating teams that provides resources and management-skills.
- The most important prerequisite was trust in the organisation members. As a consequence attendance at the workplace was not controlled. Further more, the majority of the employees had the possibility to log themselves into the corporations network from home and felt free to do their work when and whenever they want to.

One purpose of this reorganisation was the creation of the “Hewlett-Packard Village Community” as an idea for a highly integrated enterprise coordinated by a common culture and language.

14.2.10 PUMA AG

After the situation of crisis that involved German in the nineties, PUMA AG reorganised its structure. It followed 3 key strategies:

- Outsourcing and concentration at the core competences. For that purpose, the value chain was permanently analyzed for “make or buy” decision.
- Reducing the hierarchy to 3 levels and domination of teamwork and process organisation.
- Building a network partnerships, which was controlled by a small headquarter of only 180 employees by using modern information and communication systems.

Today the number of departments is reduced to the following four: design, marketing, management information systems and administration. For all other tasks, like distribution, PUMA works together with changing suppliers to get the very best conditions for a specific order. These enterprises are highly integrated by use of modern IT. The only distinguishing feature for an ideal form of a second level of a virtual organisation is the hierarchical structure of the corporation with a clear leadership of PUMA.

14.3 Detailed Case Studies

The following case studies are given in more depth, detailing their use of ICT, contributors, beneficiaries, background to the organisation, objectives of the VO, non ICT resources, activities, outputs and results, lesions and conclusions.

14.3.1 SYNERGY Catalogue (Slovakia)

14.3.1.1 Type and Use of ICT

There are three groups of ICTs corresponding to the Synergy Catalogue[168] intermediary business model. The intermediary SYNERGY -VCG i.e. the Catalogue operating company uses the ISDN Internet connection. The first group of beneficiaries, the advisory firms maintaining their offering in Catalogue, are using different types of Internet connections such as dial-up, ISDN or DSL. The second group of beneficiaries, the Catalogue visitors, are also using different types of IT infrastructure for connecting to Internet. The all beneficiaries are required to have basic ICT skills: user level knowledge of using a web browser and e-mail.

14.3.1.2 Main Contributors

The main contributor to Catalogue is the professional staff of operating company, skilled IT specialists and programmers. The advisory firms, maintaining their information on Catalogue pages, form the main contributor - info-providing group.

14.3.1.3 Main Beneficiaries

There are two groups of beneficiaries. The first group consists from managers, shareholders, investors, State administration officials, students and all those searching information related to Slovak advisory market. The second group of beneficiaries consists from advisory, consulting firm advertising their offerings on Synergy advisory portal.

14.3.1.4 Background

The advisory market in Slovakia had been coming out of its early development stage in 2000. Slovak economy was considered as an emerging economy and eEconomy was perceived as an emerging term for managers in Slovakia. Many organisations and managers perceived eCommerce as an important area expected to have important impact on their own businesses. Among managers, there was a lot of confusion related to the eCommerce issues such as opportunities and threats, eCommerce applicability, strategic approach and implementation. There were many advisory firms in the regions offering different types of advisory services, including global and international investment, traditional, management consulting and IT firms. The offering of advisory firms was fragmented, unstructured and not fully understood by the organisations interested in undertaking major changes in their organisations. It was apparent that an e-intermediary between managers and advisory firms was missing.

14.3.1.5 Objectives

The objectives of the service have been the following:

[168] www.beep-eu.org

- To pro provide managers, shareholders, investors and others with the virtual service allowing them to access the information on advisory firms, services and products available in Slovakia
- To provide advisory firms with opportunity to on-line maintain their offerings for clients in Slovakia
- To cover the four main areas of advisory services: Investment advisory services, Traditional (audit, tax, law) services, Business Consulting services and eEconomy related advisory services
- To offer clients three searching scenarios through advisory firms, services and areas
- To become the major facilitator and contributor of consulting market and eEconomy in Slovakia
- To contribute to the transparency of Slovak advisory market, to fight the potential corruption and to equal opportunities for all advisory service providers

14.3.1.6 Resources (apart from ICT)

At the beginning the company had 2 university graduate employees. The company is self-financed by the registration fees of professional service providers (Synergy Catalogue), by the provisions from the advisers' fee (Synergy Advisory Office) and by the registration fees of investors (Synergy Incubator). At present, the company has 5 employees.

14.3.1.7 Activities

The activities could be grouped as follows:

- The advisory market analysis in Slovakia;
- The definition of the scope of advisory services, main categories and searching scenarios;
- The identification of customers' segments;
- The design of e-intermediary business model and main business processes;
- The establishment of business relations with virtual partners i.e. advisory firms interested in advertising in Catalogue;
- The establishment of consensus on the breakdown of all advisory service areas in two sub-categories;
- The establishment of Synergy Board, the group of 7 advisory service firms representatives;
- The design of virtual application, its programming and implementation.
- At present, each registered advisory firms is presented on Catalogue through its own three web pages: Information, Offering and Contact page. These pages contain information aggregating the information from their own websites.

14.3.1.8 Outputs and Results

Synergy Catalogue is the only virtual space on advisory market in Slovakia. The application was launched in October 2000 providing a market place for e-commerce support with a level of quality assurance.

14.3.1.9 Lessons

The three years' operation of Catalogue has been the opportunity to understand the business behavior of different types of advisory firms and to test their commitment to the development of virtual services

The basic lessons learned are the following:

- The dissemination of information related to the specific offerings of advisory firms is very sensitive;
- The declared support and promotion of internal utilization of external virtual services in advisory firms is very limited;
- The advisory firms don't welcome virtual intermediaries in their own business;
- The advisory firms are not always ready to expand the amount of virtual information related to their offerings, which would go behind the usual general marketing information;
- The support of professional associations, grouping advisory firms in specific advisory areas, is vital;
- The clients appreciate the possibilities to search the information, compare the offerings of different firms and to contact the selected firm through Catalogue;
- The marketing cost is the main component of the virtual business cost map.

14.3.1.10 Conclusions

Conclusions for the case study are:

- The operation of virtual services such as Catalogue has to be supported by professional advisory firms' associations;
- The structure of intermediary aggregated information should be proposed in close cooperation with both groups of beneficiaries, clients and advisory firms;
- The value added of intermediary information consists in its easy immediate comparative possibilities of different offerings;
- The success of e-intermediary business models depends on the deep knowledge of both sides and professional image and reputation of the intermediary.

14.3.2 AUTOLINKKI (Finland)

14.3.2.1 Type and Use of ICT

EDI, integration to operative software, networks, internet

14.3.2.2 Main Contributors

The service provider, software houses , the Association of Car Part Wholesalers

14.3.2.3 Main Beneficiaries

National wholesalers , local wholesalers

14.3.2.4 Background

Autolinkki[169] is the biggest and the oldest B2B e-business system in Finland, initiated in 1995 by the Association of Car Part Wholesalers, working within the Association of Finnish Technical Traders. The Association of Car Part Wholesalers is formed by the eight national wholesalers importing and selling non-brand car parts. Competition with the brand-specific wholesalers led the free car part wholesalers to the idea of improving the efficiency of business transactions with the local car spare parts dealers (about 1,000 companies, with turnover varying from € 15,000 to 5 M, selling to garages and to consumers).

14.3.2.5 Objectives

The strategic goal of the Autolinkki project was to strengthen the competitive status of free wholesalers against the strong brand wholesalers. Although the Autolinkki wholesalers have the same competitive goal, their customers tend to be loyal to the main supplier and no big risk was seen in offering an open marketplace. As the average order size tends to be small, this leads to high transaction costs and big inventories for wholesalers. The basic idea was to develop a system to facilitate electronic orders, as wholesalers needed to reduce the cost in their sales order process.

14.3.2.6 Resources (apart from ICT)

Wholesalers (8), dealers (200), telecommunication operators (1), software providers (5), supported by the Association of Car Part Dealers in co-operation with the Association of Finnish Technical Traders, worked together and built an optimal solution for the industry.

The EDI service provider, in addition to providing data transmission and value added services, was able to build and offer complete series of readymade modules for the programmers to use. The service provider also acts as one contact point to both dealers and wholesalers thus removing the need for many-to-many data connections.

14.3.2.7 Activities

Almost all the big and medium sized dealers use some kind of software for their inventory, purchases and sales control. As traditional EDI connections and integration can be complex, costly, slow to build up, a 'light' EDI solution was chosen as common solution for all users and software providers. In this way programmers needed not to learn EDIFACT standard nor data transmission techniques, both often not known to a programmer of proprietary software. Initial implementation was order, next instant reply for orders, balance inquiry, and later on e-invoices. Recently a Web-based ordering system has been added. Product information service is based on the Autolinkki database (500,000 entries, divided per distributors); online update is available but is not used widely, because of slow data communication lines.

14.3.2.8 Outputs and Results

All the main wholesalers in the industry offer the possibility to order electronically through the Autolinkki system, meaning near to 100% coverage of the supplier companies. Among the big dealers, 100% coverage can also be estimated. Of the medium size dealers, about 50 percent use the electronic ordering, while the small ones usually use terminal based ordering and not EDI. As the terminal based ordering is not offered discounts, only 10% of all small dealers are using the system.

[169] www.beep-eu.org

14.3.2.9 Conclusions

The main conclusions of the case study are:

- it is possible to offers SME's good eSolution, but it requires a lot of cooperation
- the solutions for SME's must be simple (=not technical)
- there often is a need for a special attraction (as the discount in the Autolinkki case) for the SME's to change their behaviour/routines
- A well developed common language between big wholesalers, their small clients, software houses and EDI service providers was a key element in the success of the project.

Some other aspects related to the environment's conditions can explain the success of the case. These factors can also be called critical assumptions

The existing EDI infrastructure is well established in Finland. EDI solutions have been used over twenty years, the first years' use based on national standards. The international EDIFACT message standards have been applied for 15 years. Thus, there was an established and tested technical infrastructure as well as experience in building EDI applications, that both could be utilised in the Autolinkki development. In the Finnish EDI community, it is typical to use EDI service providers' services as they are specialised in both data transmission facilities and EDIFACT-standards. This infrastructure formed a strong basis for this kind of an industry wide system.

On the other hand, the old, existing infrastructure can also be seen as a hindrance to implementing new technologies such as the Internet in Autolinkki. Web-based solutions have only recently been added to the system, although in many other industries extranets have been available for years.

The integration of data communication in the proprietary software was an essential factor, the transaction volumes (15%/85%) showing strong evidence of the usefulness of the feature.

Further, a standardised product coding system is not available for the industry. Different code systems form an obstacle to effective use in many EDI solutions. From the past experience it can be argued that the standardisation of product codes is a long process. As one of the wholesalers stated: 'We would not have Autolinkki working today if we had first started to standardise product codes.' In order to solve this barrier, the facility of mapping wholesalers' product codes in the application was an essential part of the system from the beginning.

The development of Autolinkki in a network, a joint operation of wholesalers and technical developers, offers benefits to all parties. With the help of the network and a common service it was possible to build extensive connections to wholesalers, a feature essential to the dealers.

Dealers can contact all wholesalers through one service and have replacements in their orders from another one, if their main supplier is not capable to fulfil the order. On the other hand, one system for the eight wholesalers lowered the development cost for all of them. The involvement of dealers' software providers was crucial in order to build the necessary connections from the proprietary applications. The EDI service provider, in addition to providing data transmission and value added services, was able to build and offer complete series of readymade modules for the programmers to use. The service provider also acts as one contact point to both dealers and wholesalers thus removing the need for many-to-many data connections.

One important success factor especially from the developer's point of view, is the tight project organisation with a strong managing group. The managing group held regularly meetings in order to develop the application, and the practice still continues. The group consists of technology experts ad well as business people and forms a network in itself.

The way of conducting business in the car part industry is very straightforward. Products are standardised and do not need customisation. Further, the way of conducting business does not require negotiations or meetings. Some of the industry wide EDI projects failed because of people wanting to negotiate on discounts and terms before each and every deal. However, new Web-based solutions can meet these requirements – at least to some extent. Better product information with

pictures and colours can reduce the need for negotiations. The discussions still needed can be moved to the Internet forum or email.

Dealers are usually loyal to their main wholesaler and have just one alternative supplier in case the main supplier cannot deliver the product or products needed. A fact, that made co-operation between the competing wholesalers a lot more comfortable. In a sense, Autolinkki offered only the technical solution to the already established partnership.

Regrettably, EDI is famous for its complicity and high costs. Both problems were taken into consideration when building Autolinkki, and were tried to be solved to the extent possible.

Co-operation with software providers and standardised Light EDI connections lowered the technical barriers. The rate for a dealer in using the system is 100 Euro per month, a moderate fee for using EDI. SMEs need readymade solutions not only because they are technically easy to implement, but also because of the lower cost.

Marketing and promotion are important questions in building up the user base. The software houses acted as an efficient channel of information, or even as salesmen, of the EDI-system towards their customer base – a fact not to be underestimated. The work of the Association of Technical Traders in information delivery was of utmost importance. The Association organised seminars and printed and sent marketing material to their membership.

14.3.3 Pannon Automotive Cluster (Hungary)

14.3.3.1 Type and Use of ICT

The website of the cluster serves on the one hand marketing and PR goals. On the other hand, it enables its members to co-operate, share ideas and documents etc.

14.3.3.2 Main Contributors

The main contributors of the cluster are the West Pannon Regional Development Council and the Hungarian Ministry of Economics. Among the Founders one can find the biggest players of the Hungarian automotive industry, such as Audi, Opel, Suzuki, as well as a research institute, a bank etc.

14.3.3.3 Main Beneficiaries

The main beneficiaries of the cluster are its members.

14.3.3.4 Background

The cluster-oriented approach has recently become one of the most successful instruments of (regional) development policy in industrial countries.

The Pannon Automotive Cluster[170] was among the first Hungarian clusters to be established. It is located in the West Pannon Region of Hungary, a region which attracted many automotive SMEs (aspiring to become suppliers) to settle down because of the proximity of some multinational companies. These SMEs soon realized that rivalry did not lead to success. Without co-operation, the majority of these SMEs could not hope for supplier status.

[170] www.beep-eu.org

14.3.3.5 Objectives

The primary objective of the cluster is to enable its members to become efficient suppliers of large integrator companies.

It also aims at: fostering the creation of co-operative networks of enterprises; accelerating the establishment of new supplier links; supporting investment projects to improve competitiveness; encouraging innovation; encouraging foreign automotive ventures to settle down in the region.

14.3.3.6 Resources (apart from ICT)

The Hungarian Ministry of Economics granted 50 million HUF (appr. 205 000 EUR) to the Cluster.

14.3.3.7 Activities

The cluster provides the following services: assistance in project foundation; provision of information; communication services; consultancy; training; organisation of events, workshops and conferences; marketing and PR activities; stimulation of e-business.

14.3.3.8 Outputs and Results

18 January, 2003, the Pannon Automotive Cluster had 62 members, including manufacturers, service providers, universities, banks etc.

The cluster has developed its website, which is not only a marketing tool but also the workplace of its members.

In order to strengthen its position internationally, the cluster has started to develop its foreign relationships by participating in international supply chain conferences, business clubs etc. It also signed an agreement with the Austrian AC Oberösterreich and AC ViennaRegion clusters, as well as with the German AMZ supply network.

The cluster has joined an Interreg III A and a Phare CBC project.

It has organised several professional events to enhance the innovation potential of its members.

It has organised several trainings.

14.3.3.9 Conclusions

In the beginning, the key success factor was that the needs of businesses and government were in perfect match. The government actively supported the creation of clusters, because this kind of network-based co-operation of businesses was known to be an efficient instrument of development policies. This initial "leap of faith" on the part of the Regional Government primed the project and facilitated successful contacts, partnerships and background research. Government support also had a great role in convincing universities, banks, service providers and consultants to join the cluster. Thus adding considerable value.

The commitment of the three main automotive manufacturers was also vital

In addition, the bottom-up approach ensured the interest and commitment of businesses. Therefore, the cluster has been organised on a voluntary basis, or in other words on mutual benefits. Those that participated most fully found that there were major benefits which made the effort worthwhile. It is not cost-effective to try and force small companies to participate, it needs to be voluntary as the companies will have to want to invest in training and upskilling if they are to succeed.

The involvement of organisation other than manufacturers of the automotive industry resulted in the emergence of a proper environment for innovation and development. In this environment, manufacturers can realise the full potential of networking.

Another key success factor is that the autonomy of cluster members is not affected. It means that member companies can decide freely, on a case-by-case basis whether they participate in a specific project. Therefore, these ad-hoc partnerships are based on mutual benefits.

14.3.4 Spednet - A Comprehensive Service for Transport SMEs (Hungary)

These days, logistics have penetrated into the activities of all enterprises. The fast and efficient solution to logistics problems has a great impact on the performance of companies. Delivery costs might be significant for some firms, therefore optimising logistics processes is crucial. To optimise business processes it is very important that enterprises have up-to-date, real-time information.

The most efficient and economical way to gather information today is through the internet. Apart from searching the web for information, internet offers also opportunities to create partnerships, do business online, keep in touch with clients, boost marketing etc.

In the logistics industry, network economy is emerging at a great place. On the one hand, the physical movement of goods cannot be separated from the flow of information. Consequently, the use of ICTs is indispensable for the efficiency of logistics companies. On the other hand, more and more companies are offering web enhanced services and mobile solutions, like track-and-trace, price checking, document printing etc. Internet solutions for customers make logistics easier and more comfortable. At the same time, they also make business processes simpler, cheaper, less time-consuming, therefore more efficient. This holds especially true for SMEs.

Today, when clients' wants and needs are growing while they permanently ask for lower prices, the optimisation of logistics is crucial. Companies cannot afford half-load or trucks returning empty.

As far as consigners are concerned, they require faster and faster solutions at reasonable prices.

14.3.4.1 Objective

The logistics industry is highly dependent on information. Nowadays, the most efficient way of giving or getting information is through the internet. For SMEs it is crucial to get information as fast as possible, otherwise they cannot stay competitive. Their competitiveness is also in danger due to the coming EU-accession of Hungary. Without the integration of ICTs into their everyday business processes Hungarian logistics SMEs are not likely to face the competition of either multinational or EU logistics companies.

The main objective of Spednet was to provide ICT-enabled services for SMEs which help them to enhance their position and improve their business processes. Although the main target group of Spednet is the SME sector, the portal aimed at embracing the whole logistics industry.

While designing Spednet services, emphasis was not only on providing logistics-specific information, but also on creating opportunities for partnering. An important part of the site aimed at providing information about the changes EU-accession is likely to bring about, thereby helping the preparation of Hungarian logistics companies for EU regulation and competition.

The planned services targeted not only managers but also those employees who handle the operational part of the work at any point of the logistics chain.

Therefore, the overall purpose of creating Spednet was to develop a comprehensive portal addressing the whole logistics industry. Services were designed in a way that helps companies go digital.

14.3.4.2 Activities

Prior to the creation of the Spednet portal a survey has been conducted among Hungarian logistics service providers in order to investigate their market situation compared to their European counterparts and to find out future trends in the industry. After the survey, the test version of Spednet was created in a way that made development of the site fast and easy. Due to its modular structure Spednet was able to adapt to the wants and needs of the fast changing logistics industry.

The aim of the test phase was to find out whether actors of the logistics chain are interested in information, e-commerce and other web-enabled services. It also had promotional purposes, because it intended to raise the interest of potential users.

The test phase of Spednet was more successful than expected. In a relatively short period of time many companies have registered for Spednet services, including a large number of SMEs. Registered members were not only satisfied with Spednet, but they were asked for more services. Therefore, developers started to think of enriching the service palette and targeting the whole logistics industry, while still focusing on the needs of SMEs. Nevertheless, the most urging need was to make Spednet self-supporting.

To make Spednet self-supporting in the future, it was very important to develop its portal services. To this end, the general, logistics-related information module had to be enriched. As a result, today Spednet provides national and international news services in the field of logistics and economy. The news section is updated regularly, and an archive is available where articles can be browsed. News also includes weather info and petrol prices. Apart from articles, transportation agreements and regulations are also accessible on the home page. Special information modules on EU-accession (the changes it is expected to bring about), quality management, harbours and doing business on the internet are to enrich the information services of the site. All these services are offered for free, so they ensure that Spednet is visited by a large number of logistics companies. As a result, many advertisers have become interested in placing their online advertisements on the site, which finally made Spednet self-supporting.

Another important module of Spednet is the database. This database contains general and business information about logistics companies. The database covers the whole logistics chain (complex logistics service providers, freight forwarders, carriers, shipping agents, express couriers, customs agencies, warehouses etc.) and can be browsed by several ways. For registered companies this modules links to their own website.

As far as e-commerce is concerned, Spednet offers two services: NetTruck and SpedSMS.

NetTruck is the most efficient way to arrange for freights. Users only have to upload information on truck capacity or carriage and the online systems immediately informs prospective partners about one's free capacity (offer) or demand. Nevertheless, NetTruck is not a traditional freight exchange. Although this is truly a virtual marketplace, one's offer or demand is only shown for those who have been selected before. Users have the opportunity to determine a list of preferred (reliable) partners with which they intend to work. Due to this setting (filter) one's input hits only targeted partners

NetTruck made operational activities much easier. By using this module, those arranging for freights only have to fill in a standard form specifying the offer or the demand and then submit it to the previously selected partners. It only takes 2 minutes and partners see the incoming offer and they can immediately react to it. Without NetTruck, organising transport is a time- and money-consuming process, because one has to make a lot of phone calls to find available partners.

SpedSMS is an SMS-based logistics service offered by Spednet. It gives the opportunity for haulers to inform their partners about their free truck capacity just on the way. The hauler only has to send an SMS to the Spednet centre and Spednet immediately informs the preferred partners about the free capacity and the location of the truck. In this way, haulers can increase the utilisation of their trucks and they may avoid returning empty.

14.3.4.3 Output and Results

Owing to the use of Spednet, member companies:- have become more accessible for their target market,

- are well-informed about news and changes related to their profession,
- have more satisfied clients due to the more efficient and much quicker information flow,
- could save money and time by optimising business processes (by making freight arrangement easier and faster),

- could find more business partners,
- could increase the efficiency of sales people (for instance they do not have to make phone calls to find an available freight forwarder, but thanks to NetTruck service all they have to do is to fill in a standard form and the offer gets immediately to the preferred partners),
- could improve its marketing activity (for instance their website is more frequently visited).

To sum it up, Spednet offers flexibility, efficiency, cost-effectiveness and professionalism by offering a wide range of services for the whole logistics industry. With its web-based services Spednet has greatly contributed to the upskilling of logistics SMEs. Not only it keeps them up-to-date about industrial news and information about EU-accession, but also it helps them to acquire the ICT skills and competences necessary to stay competitive and to get familiar with the emerging knowledge or network economy.

14.3.4.4 Lessons and Conclusions

From business point of view, the success of Spednet was due to the fact that developers have recognised that portal functions and services were necessary to make the site self-supporting. The industrial and economic news section, the information service about the changes EU-accession is expected to bring about, the weather forecast, the information on petrol prices etc. contributed to the popularity of the site. As a result, even those companies which were not interested in the e-commerce services of Spednet started visiting the site on a regular basis. Consequently, Spednet sold well for advertisers. Moreover, even those companies which only visited the information section of Spednet got familiar with the advantages internet offers, and step-by-step they started using e-commerce services as well

Another important business consideration was the launch of the test version of the site. This version offered only a limited number of services in an easy-to-use way. Therefore, the site did not seem complicated for the initial users. Furthermore, the follow-up in the sales process of Spednet services was very important. The sales force of Spednet not only sold the right to access Spednet services, but they also put great emphasis on familiarising people with how, why and what to use the services for. As a result the sales process helped users get rid of their 'ICT reluctance'. By having more and more ease in doing business online thans to the assistance of sales users have become more and more interested in the services of Spednet.

What made the NetTruck service very successful in the short-term was the filter by which users could sort out those companies which they were ready to do business with. In other words NetTruck offers a closed-circuit system in which information only flows to the previously selected companies. Thus, NetTruck is not a public freight exchange where offers and demands are open for each member. NetTruck offers confidentiality for its users. Users do not have to deal with the offer of those companies they do not think reliable.