**A"" Aalto University
School of Economics**

Matchmaking in Business Park Context: Case Technopolis

Information Systems Science

Master's thesis

Timo Norros

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Department of Information and Service Economy
Aalto University
School of Economics

1   ABSTRACT

PURPOSE OF THE STUDY: The purpose of the study was to find a working model to be able to efficiently help companies to find other companies through a half-automated matchmaking process. In addition, thrive on better matchmaking while exploiting the future possibilities provided by technological progression is the main standpoint of the thesis.

METHODOLOGY: The research method selected to study the topic is case study. The thesis relies strongly on three interlinking levels of frameworks: network theories, Virtual organization Breeding Environment (with strong emphasis on virtual organization creation) and Multi-Sided Platform Pattern. These levels reflect the organizational structure of the case company Technopolis and the related business ecosystem.

FINDINGS: It is concluded in the thesis that creating a half-automated matchmaking process is indeed possible, and accordingly a general model is created to fit Technopolis' needs. However, matching companies efficiently requires a supporting organizational structure, which among other assisting functions creates trust within the network members. Furthermore, as each industry has its specific characteristics, it is suggested that Technopolis concentrates on one branch of business with the proposed matchmaking model.

KEYWORDS: MATCHMAKING, VIRTUAL ORGANIZATION, BUSINESS PARK, TECHNOLOGY PARK, PARTNERING, SERVICE PLATFORM

1 TIIVISTELMÄ

TUTKIMUKSEN PÄÄMÄRÄ: Tutkielman päämääränä oli löytää malli, jonka avulla yrityksien on helpompi löytää toisia yrityksiä puoliautomaattisen välitysprosessin kautta. Lisäksi tutkielman yksi pääasiallisista lähtökohdista oli kartoittaa nykyteknologiaa hyödyntäviä ideoita, jotka parantavat nykyistä verkottumis- ja välitystoimintaa.

METODOLOGIA: Tutkielman metodologia perustuu tapaustutkimukseen. Tutkielma nojautuu vahvasti yhteenliitettyihin viitekehyksiin ja siinä liikutaan kolmella eri tasolla: verkosto-oppi, virtuaalisten organisaatioiden luomisympäristö (jossa keskitytään erityisesti itse virtuaalisen organisaation luomiseen) ja usean käyttäjän alustaan perustuva liiketoimintamalli. Nämä tasot vastaavat case-yritys Technopoliksen organisaatiorakennetta ja toimintaympäristöä.

TULOKSET: Tutkielmassa havaittiin, että puoliautomaattinen välitysprosessi on mahdollista toteuttaa käytännössä. Technopoliksen tarpeita vastaava yleinen malli on esitelty tutkielmassa. Tukeva organisaatiorakenne on edellytys tehokkaalle yritysten välitykselle ja virtuaalisen organisaation luomiselle. Organisaatiorakenne edesauttaa muun muassa luottamuksen syntymistä yritysverkoston jäsenten välille. Technopoliksen on syytä aluksi keskittyä esitellyn mallin käytännön toteutuksessa yhteen toimialaan kerrallaan, sillä jokainen ala poikkeaa merkittävästi toisistaan.

AVAINSANAT: VERKOTTUMINEN, VIRTUAALINEN ORGANISAATIO, YRITYSPUISTO, TEKNOLOGIAKESKUS, KUMPPANUUDET, PALVELULIIKETOIMINTAMALLI

2 FOREWORDS

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I am grateful for all the interviews that I conducted in June and July, which helped me to look the topic from different angles and deepen the insight on the subject. Special thanks also to Henri Ström for co-working on the database schema.

Lastly, I would like to thank my friends and family for helping me to reflect my ideas developed in the thesis process.

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GLOSSARY OF ABBREVIATIONS AND SPECIAL TERMINOLOGY

Business Services: Technopolis' services aimed at liberating customer company resources and cut costs

CO, Collaboration Opportunity: A call for collaboration initiated by a third party, usually a project

Development Services: Technopolis' services aimed at enhancing the customer company competitiveness and resources in order to prosper in international markets

Matchmaking: The process of helping companies to find other companies. It is also a business function of Technopolis Development Services

Operating Environment: Technopolis' unique mix of services bundled in a business and technology park environment

PI, Performance Indicator: A variable that assess the performance output of a network member

RBV, Resource-Based View: A framework to recognize the assets of a company

VBE, Virtual organization Breeding Environment: Framework to understand and systematize the management of an inter-organizational network

VO, Virtual Organization: A collaborative unit of organizations

4   INTRODUCTION

The introduction chapter begins the main chapters of the thesis. Firstly, the case company Technopolis and its business environment are explained. In the middle part the research objective, problem, questions and methodology are described. The last part reveals the structure of the thesis and brings additional validation for the chosen theories and frameworks.

4.1 Case Company: Technopolis Plc

This subchapter introduces the case company Technopolis Plc in order to present a necessary view of its business environment and to understand the context of this master's thesis. Technopolis Plc (hereafter, Technopolis *or* the company) is a public limited-liability company listed on the Helsinki Stock Exchange (TPS1V) and registered in Finland. The information of the company provided in this subchapter is based mainly on the official registration document that has been released on 13 May 2011 (Technopolis, 2011c).

Technopolis offers modern facilities in form of business parks in major cities of Finland (Espoo, Helsinki, Jyväskylä, Kuopio, Lappeenranta, Oulu, Tampere and Vantaa) and in Russia and Estonia (St. Petersburg and Tallinn). In addition to facilities, the company service concept combines also wide range of business services and development services, which are targeted to meet the needs and operational environment of knowledge-intensive expert companies, high-technology service providers and organizations in the public sector. To distinguish itself from traditional business parks offering only limited business services, Technopolis calls its facilities combined with wide rage of services as operating environments. Hereafter, when discussing of business parks in general the term business park is used, and when speaking of Technopolis' facilities they are referred as operating environments. In the end of year 2010 about 20.000 people and over 1.300 customer companies worked in

Technopolis premises. The company premises are principally designed for office, product development and service operation requirements.

Instead of only providing flexible and versatile operating environments, part of Technopolis official strategy is to provide added value to their customer companies through specializing in innovation environments and innovation services, which are combined into one general service concept. The company mission is to support the growth and success of their customer companies and organizations through their exclusive service concept.

Figure 1 – Technopolis Strategy and Concept

4.1.1 Technopolis Services

Technopolis service concept is three-fold: 1. *Premises* 2. *Business Services* 3. *Development services*. The premises have the smallest role in this thesis. It is important to note the company promise that the premises are flexible enough to adjust the changing needs of the customers. Despite their small role, the premises bundle up physically the service concept and are the main source of direct income for Technopolis.

The services that fall under the second category, Business Services, consist of value added services that are aimed at liberating customer company resources and cut costs. Consequently, these services allow Technopolis' customers to concentrate on their core business and to increase the flexibility of their

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operations. The services are produced by Technopolis together with their partners. The Business Services are illustrated in the following figure:
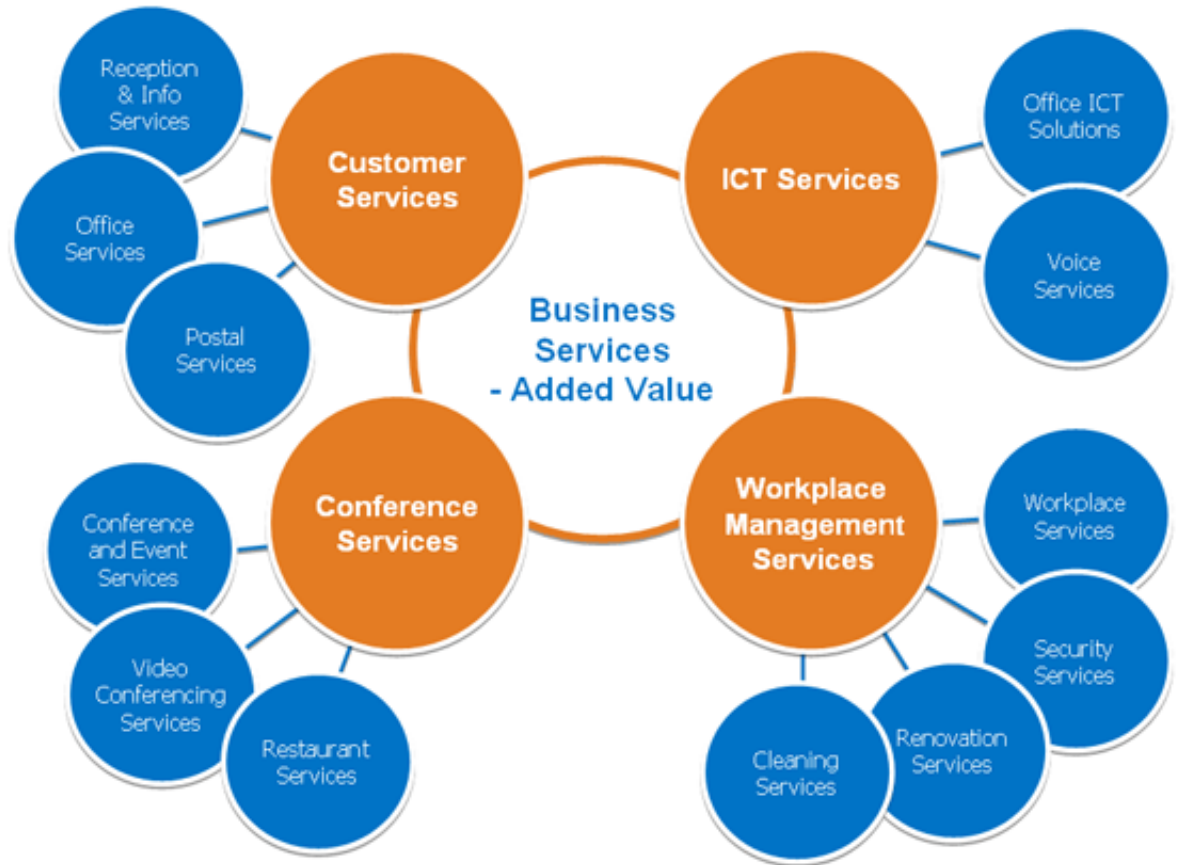
Figure 2 - Technopolis Business Services

The third category of Technopolis service concept is Development Services, which assist customer companies to enhance their competitiveness and resources in order to prosper in international markets. The services are designed to companies in all stages, from small startups to already established international players. Bridging high-tech companies in the different points of their lifecycle, and finding them customers, partners and financiers, is in the heart of the operations. The recent expansion to Russian and Estonian markets further promotes this aim. The main service areas are *Fundraising Services*, *Strategic Matchmaking*, *innovation Services*, and *Technopolis Online* investment database. The whole areas of Development Services is clarified in the following figure:
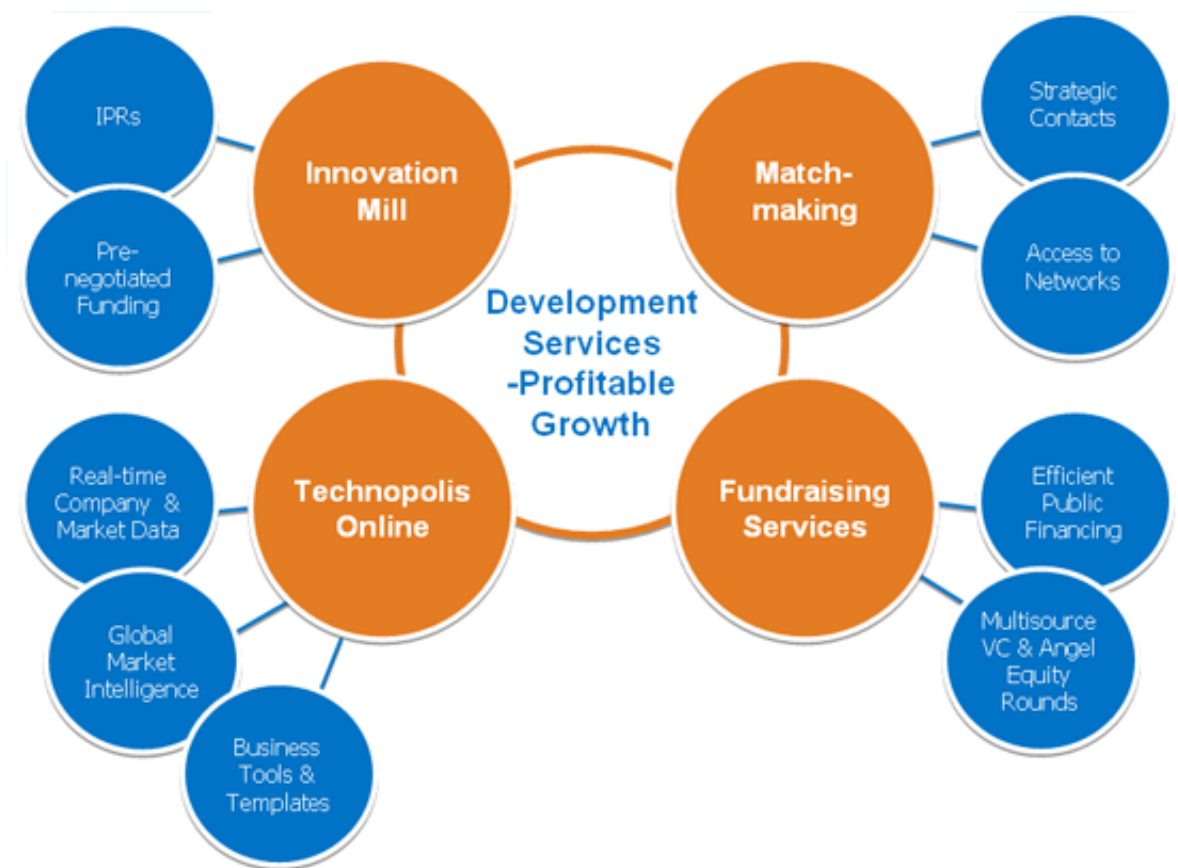
Figure 3 – Technopolis Development Services

A short description of each service area is provided below:

- Fundraising services offer independent help for companies to receive funding faster, more efficiently and with better terms. The aim is to find the most suitable financing solution from an extensive network of public and private sources of both international and national funds.

- Matchmaking Services or only *Matchmaking* refer to services, which assist customers to access the most relevant networks. Matchmaking plays an important role in Technopolis hosted events, especially in the field of entrepreneur-to-financier (*MoneyTalks®*) and B2B matchmaking events. Other services include *Preferred Partner Program*, which help customers to find suitable service providers; *Enterprise Europe Network*, aimed at companies in the internationalization stage; and *Cewic* water industry cluster.

- Innovation Services consist mainly of *Innovation Mill*, which is a joint program with Nokia, Tekes, Technopolis and local cities. The main idea of the program is to utilize Nokia's unused ideas and intellectual property rights and turn them into new ventures.
- Technopolis Online (www.technopolisonline.com) is a comprehensive investment database, which offers fresh data on investments, investors and high-tech companies.

This thesis mainly focuses on Technopolis Development Services and particularly to the matchmaking side of the business. The main reason for this is the author's nearly two-year-experience working as a venture analyst in Technopolis Development Services. The work has allowed following closely matchmaking in practice and becoming acquainted with the actors in the related business environment. It is expected that this personal insight of the industry bring additional applicability to the research. Nonetheless, the focus of the paper touches other Technopolis services as well. Consequently, the frameworks are chosen keeping in mind the interlinking of all services under the general Technopolis service concept.

4.1.2 Relevant Industry Trends

The tight competition in international markets, especially the economic advancement of Asia, has forced companies to cut their expenses, and at the same time further develop the existing product lines and innovate new products. The innovation activities have been dispersed and networked globally, which has had a dwindling effect on the research and development activities of Finnish technology sector. As a result, along with the general trend of all Western countries, the technology sector is moving from industrial production towards knowledge-intensive service creation. Technopolis' management believes this trend will increase the demand of versatile and customized operation environment services (premises bundled with various services) in the Baltic region alongside the need for international networking for the customers.

The continuation of globalization in real estate and property leasing industry will force current and potential customer organizations to plan their investments more from the global perspective. The ongoing trend in Western countries has been the decrease in demand of company premises – at the same time price competition has grown stronger. Answering the increasing call for customer companies' cost savings forces Technopolis to continually improve the efficiency of its services.

A relevant trend in the company premises industry, mainly meaning the rent of free office space, has been an increasing awareness in the total costs of a premise. Instead of just looking into the space-to-price ratio, the tenants are interested in the quality, efficiency and flexibility. In other words, the premises have to be easily managed and quickly adapted to the changing needs of the tenants. At the same time as the location has become an increasingly important part of many tenants' brand and image; the services that free the companies from their physical boundaries have grown their significance. Accordingly, telecommuting, virtual and communication tools are evermore important in space planning and demand. The Technopolis management believes that demand for cost-effective and functional operational environments and bundled services will further increase in the future. Being able to respond the aforementioned requisites is considered as a very important competitive advantage for Technopolis.

4.2 Research Objectives

Technopolis mainly dictated the research objectives. The objectives are based on Technopolis' current strategy and assessment of their business environment. The initial idea was to study ways how company matchmaking, i.e. helping companies to find other companies, can be improved using web tools. The idea derived from TechnopolisOnline's shift from being an investment database and a source for related industry news towards a 'matchmaking

machine'. First concrete steps in this direction are taken in Fall 2011, when companies participating Technopolis events are pre-matched before the event and automatically suggested interesting and relevant counterparts.

At the same time a more general trend towards effective matchmaking has surfaced within Technopolis. Mainly this has been expressed as the company CEO Keith Silverang's desire to increase the accessibility of Finnish workforce, both nationally and internationally. Thrive on better matchmaking while exploiting the future possibilities provided by technological progression is the main standpoint of this paper.

4.2.1 Research Questions

Based on the research objectives the following main research question can be introduced:

1. How can companies be half-automatically matched in a business park context?

In order to further limit the scope of the thesis the following supplementary research questions are developed:

1 a. What are the best selection criteria to be used in matchmaking?
1 b. What kind of organization is needed to support a matchmaking network?
1 c. How the proposed organization can be fit into Technopolis Development Services?

4.2.2 Research Methodology

The research method selected to study the topic of the thesis is a case study. According to Robert Yin (2003) a case study is a very practical tool when a researcher wants to answer a 'how' question, and the focus of the study is on

contemporary events. A case study has also the ability to utilize various kinds of documentation. Subsequently, this paper combines, inter alia, personal and expert opinions, industry analysis, and theoretical frameworks and models.

The interviews conducted for the thesis serve mainly on two levels. Firstly, they reflect the researchers own ideas and ensure the conclusions are in accordance with the views of other experts in the industry. Secondly, the interviewees provided their input on choosing the appropriate initial selection criteria for the matchmaking process.

In order to avoid moving only on the surface level of the research problem and being too narrowly focused on the Technopolis business context, all the thesis areas are tightly bound to existing higher-level frameworks. It can be stated that the research conducted in this paper has rather conceptual nature, which however extends the applicability of the results.

4.3 Thesis Structure

The structure of the thesis is fairly straightforward. The main intention is to build a solidly based and intelligible study of how different companies can be semi-automatically matched that has real-life implications in addition to forward-looking ideas.

4.3.1 Thesis Chapter Structure

The six main chapters begin with the current (fourth) chapter, which starts by introducing the case company Technopolis and their business environment. In the middle part of the chapter the research problem is formed and according to the research problem the research questions and methodology is developed. This last subchapter initially explains the structure, and later justifies the frameworks chosen for the thesis.

The fifth and sixth chapter form together the literature review. The fifth chapter begins by examining current and past research on organizational networks. Later in the chapter Virtual organization Breeding Environment framework is introduced in order to systemize the management of a business network. The chapter continues with approaches developed for virtual organization creation. The sixth chapter examines different forms of partnering and collaborative relationships. The mid-chapter presents an extended resource-based view on the company performance indicators and goes deeper in the matchmaking. The latter part of the chapter is about forming a viable service model to support the matchmaking.

The chapters from seven to nine constitute the case study. The chapter seven firstly introduce the results from the interviews, which support the chosen performance indicators used in the matchmaking prototype. After documenting and exemplifying the prototype, the gathered knowledge is theoretically implemented as part of Technopolis service concept and the fitting service model is formed. The eighth chapter discusses the results and conclusions. Finally, the ninth chapter summarizes the recommendations, managerial implications and limitations of the study.

4.3.2 Justification of the Chosen Frameworks and Models

The theoretical background of this thesis is basically three-fold. In other words, it moves on three interlinking levels that build on each other:

1. **Network theories – Virtual organization Breeding Environment:** This framework helps to understand the operational environment of Technopolis Development Services. Furthermore, it brings in a systemized management model and includes numerous theories supporting virtual organization creation and partner search and suggestion, which are linked to the following level. The

framework is important also from the part that studies the necessary supportive organizational and system structure.

2. **Matchmaking:** In order to be able to actually search and select companies, matchmaking in its different forms is studied. Strong emphasis is put on the finding of adequate selection criteria, which leads to examining company performance indicators. Westerlund's (2009) suggestion of using resource-based view framework extended with *capabilities* is chosen, because it allows keeping the matchmaking prototype model and interview questions used in the case effectively simple. Semantics is touched in order to avoid overlapping criteria. Furthermore, the need for a feedback loop is recognized. Feedback enables the use of performance history as selection criteria.

3. **Multi-Sided Platform Pattern:** In order to proof the economic viability of making business out of matchmaking, recent theories based on multi-sided platform business models are visited. Initially recognized by Eisenmann, Parker & Van Alstyne (2006), the more business-related thoughts are presented by Osterwalder & Pigneur (2010) and Mullins & Komisar (2009). The main idea is to tie together all the discussed frameworks, models and theories, and to form an initial sketch of a future business model that has its linkages to current Technopolis organizational structure.

Predominantly all the theories and frameworks chosen and applied in this study have three common qualities: They are recent, widely cited, and importantly, they have enough pragmatism to be implemented in practice. In order to study the relationships of the framework structure of this thesis, the following figure is formed:
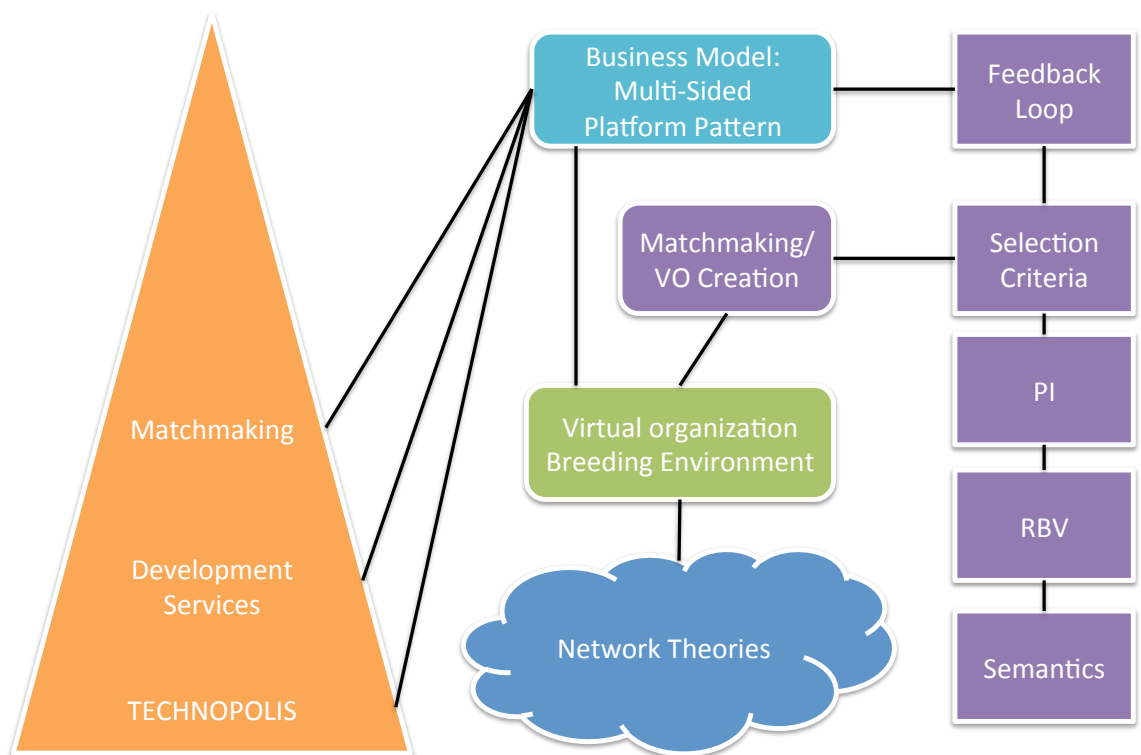
Figure 4 – Framework Structure and Relationships

5 BUSINESS NETWORKS: FROM FUNDAMENTALS TO SUPPORTING VIRTUAL ORGANIZATION CREATION

In this chapter first the different perspectives to business (*or* inter-organizational) networks are examined. The mid-chapter introduces Virtual organization Breeding Environment as a framework to understand and systemize the management of a business network. The latter part of the chapter takes a look into specialized approaches that have been used to create collaborative units of parties called virtual organizations.

5.1 Forms and Functions of a Business Network

As the technology advances at ever-increasing pace, one of the direct outcomes has been the diversifying of all industries into smaller sub-branches of highly specialized companies – especially within the small and medium enterprises (SMEs) in high-technology field (Camarinha-Matos et al., 2008). In order to survive, virtually every company has been forced to form different kinds of alliances and relationships with each other to pool their know-how. The general distribution of these networks is usually twofold. Klint and Sjöberg (2003) divide the networks into strategic networks and organic networks. Organic networks describe the more traditional buyer-seller relationships where companies sense closeness for conducting business with each other. Strategic networks are used to explain the purposely build networks connecting companies, which aim at a common objective. Similarly Provan and Kenis (2008) divide enterprise networks into 'serendipitous' networks, which have more opportunistic nature and goal-oriented networks, which are set up for a specific purpose. Emphasizing the relevance of goal-oriented networks, the authors argue that '[goal-oriented networks] have become extremely important as formal mechanisms for achieving multi-organizational outcomes' (p.231).
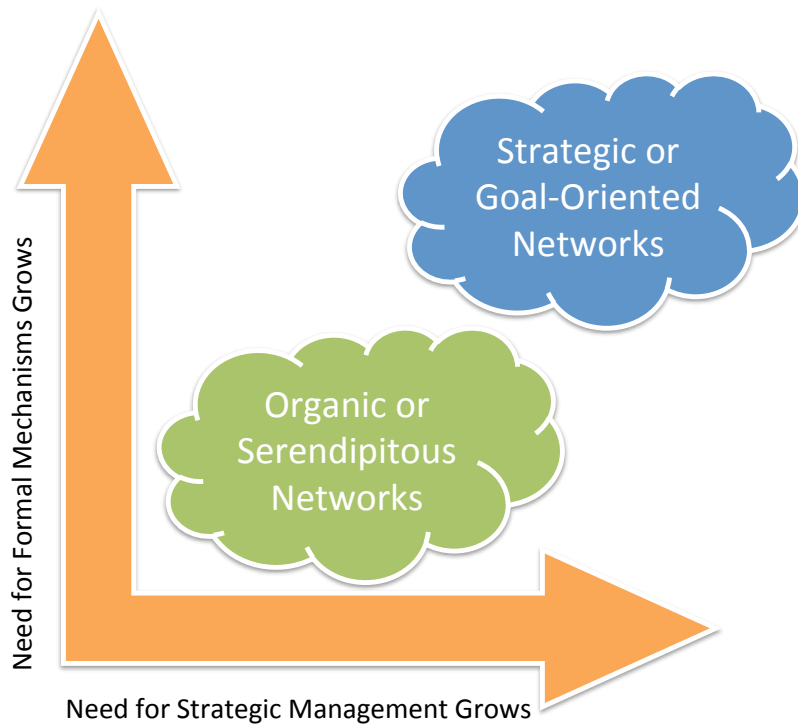
Figure 5 – Two Dimensions of Inter-Organizational Networks

There are different starting points for portraying networks. The points of view affect how the advantage of being a part of one is perceived. Podolny (2001) recognizes two approaches in conceptualizing an inter-organizational network. According the more established view, networks are seen as conduits or pipes carrying information and resources. Another framework that has only recently received attention portray network as 'a lens or prism through which the qualities of actors are inferred by potential exchange partners' (p.27). The first mentioned approach emphasizes on the benefits that are gained through the prominent position in a network, while the latter approach highlights the entrepreneurial opportunities that arise from the 'structural holes' i.e. the gaps between the different interconnecting links (Koka and Prescott, 2008). Ahuja (2000) introduces a resource-based view on network formation. He suggests that link formation is more likely when the technical, commercial, and social capital of an organization is high, and such firms gain the most advantages in an inter-organizational network. In a similar manner Powell, Koput & Smith-Doerr (1996) have found that research and development focused alliances and

networks often contain a 'locus' of innovation, which become the central hub and source for collaboration. However, there is a major movement in network theory that stresses the personal connections and 'the strength of weak ties'; reminding how open networks with loose connections bring more innovation and opportunities (Granovetter, 1992). Thus, the excessive centralization of knowledge may also be harmful for the network.

In economic literature the performance of different types of networks has been one of the greatest interests. Accordingly, great effort has been put into structural approaches in order to understand the efficiency of an inter-organizational network. Possibly the most comprehensive framework for analyzing network structures is given by social network analysis (SNA). The basis of SNA lies in studying the 'relationships among social entities, and on the patterns and implications of these relationships' (Wasserman & Faust, 1994:3). In SNA networks are analyzed either as full networks, where all the relations between the entities are included, or as ego networks, where the analysis is concentrated on single node and includes the ties of only one entity. Networks can be also classified as one-mode networks (include one type of entity, such as firms) or two- or higher-mode networks, which include several kinds of entities (Van der Valk & Gijsbers, 2010). As concluded in the previous paragraph, centralization and strong ties are needed for better information flow and creating trust. Still, weaker out-of-your network ties are necessary as they secure the access to new information. Uzzi (1997) calls this crucial balancing of a network as 'the paradox of embeddedness'.

Creating ecosystems that embrace innovation has been central to Finland's governmental policies concerning entrepreneurship (e.g. Sitra, 2005). The innovation-based mindset has engrossed so much attention that some believe it has already backlashed (Ruckstein et. al, 2011). Nevertheless, businesses are increasingly interested in 'open innovation' and looking for novel ideas outside the intrafirm innovation processes (Van der Valk & Gijsbers, 2010). Accordingly, actively participating in inter-organizational activities and understanding the

mechanics of connections surrounding a business entity is crucial for companies. Björk and Magnusson (2010) go as far as hypothesizing that innovation quality correlates straight with the number of connections of a single network member. However, the authors note that after a certain amount of connections the innovation quality begins to decrease. All things considered, it is expected that systematically managing and planning a firm's network environment is beneficial for generating and exploiting new ideas (Koka & Prescott 2008, Westerlund 2009, Kauppila 2011).

5.2 Managing Business Networks

Westerlund (2009) identifies two major schools of thought in network management discussing whether and how much networks can be managed. According to the view of Turnbull et al (1996) and Håkansson & Ford (2002) cited in Westerlund (2009), the first school of thought strongly believes that firms can only alter their own behavior, since networks are intensive and complex entities, which merely adapt to the actions of their participants. The second school of thought (Jarillo 1988, Lorenzoni & Badenfuller 1995, Parolini 1999, Möller & Svahn 2006 cited in Westerlund 2009) argument that in goal-oriented and strategic networks the central hub firm may have power over the others and is able to manage the network to some degree. However, many current business models are based on active network management (Eisenmann 2006), consequently, Westerlund (2009:20) concludes:

> The present study maintains that network management contains both purposeful and active management of the strategic network relationships, as well as the 'unintentional' management in networks, where the actor's action and behavior indirectly influence part or the whole network of actors.

5.2.1 Technopolis Ecosystem as a Virtual Organization Breeding Environment

One very established approach to business network management comes from the studies on Virtual Organization (VO) and its governance and management known for European Community funded project ECOLEAD. Virtual Organization is used almost interchangeably with Virtual Enterprise (VE). In order to avoid confusion, the use of the term Virtual Organization is preferred. A great part of the studies are based on creating Virtual organization Breeding Environments (VBE), which enable the ideal conditions for the forming of VOs. A VO is a collaborative set of independent organizations working towards a common goal. It has a temporary nature as a VO is dissolved after it has reached its objectives (Jansson et al, 2008).
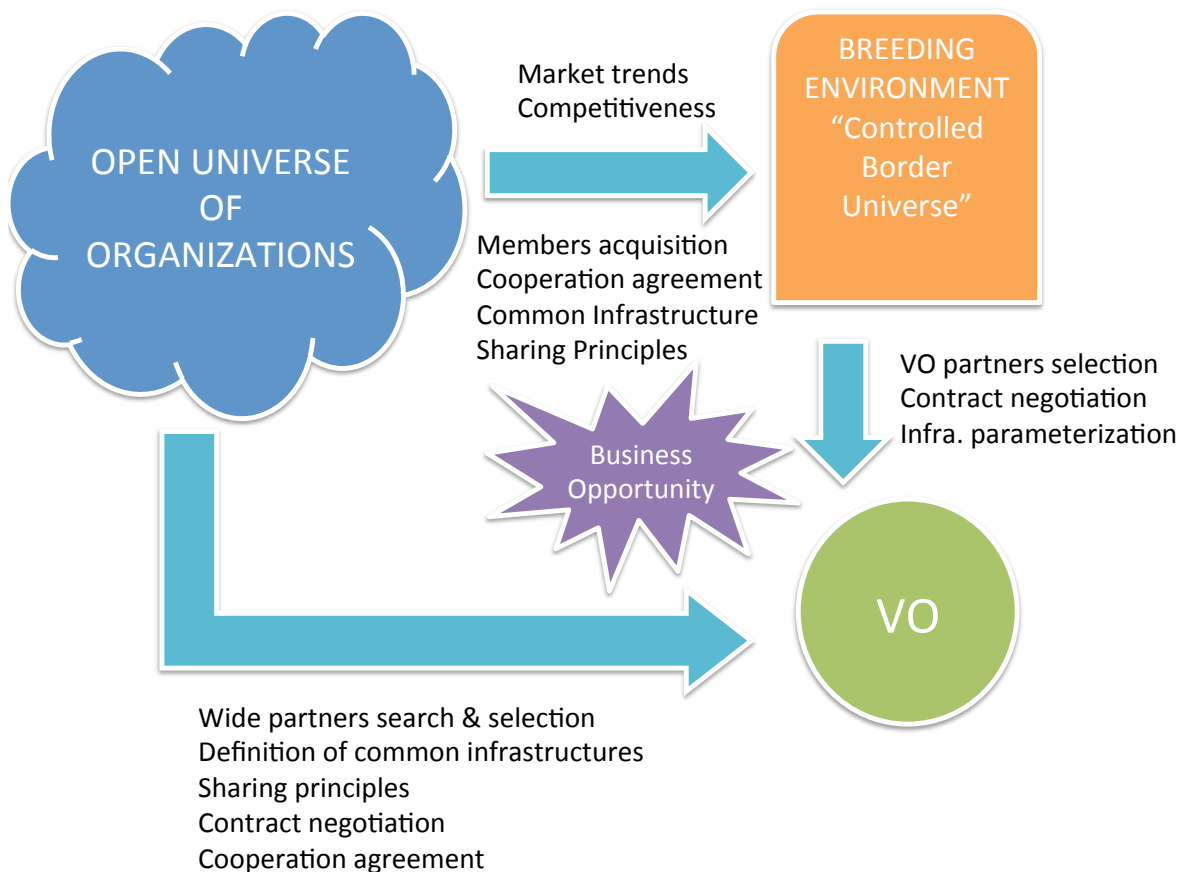
Figure 6 – VBE Framework and VO Creation

(adapted from Afsarmanesh, Camarinha-Matos & Ermilova, 2008)

The Virtual organization Breeding Environment is chosen as the central or reference framework for this Master's thesis to understand Technopolis as an international, multi-site business and technology park company and to take into account its surrounding ecosystem. The first generations of VBEs are traditional clusters and branch-specific associations, which often operate on a regional basis. Afsarmanesh, Camarinha-Matos & Ermilova (2008:36) introduce a 2nd generation VBE, which have a significantly broader meaning and define it as follows:

> VBE is an association of organizations and the related supporting institutions, adhering to a base long term cooperation agreement, and adoption of common operating principles and infrastructures, with the main goal of increasing their preparedness towards collaboration in potential Virtual Organizations.

In order to more easily fit Technopolis into VBE framework, only the 2nd generation of the VBE model is used in this work. VBEs exist primarily for efficient creation of VOs. Through VOs a VBE pursue opportunities in the market and society, and pure innovation. This is done increasing the opportunities of the member organizations for collaboration in a network structure. Technopolis' main aspiration is to promote the growth of its customer companies, which matches the primary function of a VBE (Technopolis, 2011a).

There are other analogies that justify counting Technopolis' ecosystem of premises and services as a 2nd generation VBE. One way to define the similarities is to look into the structure of Technopolis customers, partners and organizational activities. Afsarmanesh, Camarinha-Matos & Ermilova (2008) identify three kinds of organizations that can be found within a VBE. The examples of Technopolis counterparts are provided in brackets.

1. *Business entities* – provide products and services and aim at quantitative profit in VOs, mainly enterprises (Over 1300 tenants, more customer companies involved in different programs. Includes among others innovative

young growth companies e.g. Zokem Ltd, large Finnish publicly listed companies e.g. Tieto Plc and sub-branches of international conglomerates e.g. Texas Instruments Inc.)

2. *Non-profit institutions* – involved in VO activities for qualitative profit, mainly academic and research institutes (Collaboration with main Finnish university research institutes, such as Aalto University, University of Oulu and VTT Technical Research Centre of Finland)

3. *VO Support institutions* – Supporting organizations include different service providers, ministries, sector associations, chamber of commerce etc. (To name a few, Otaniemi Marketing, Finnvera and TEKEL)

(Technopolis, 2011b)

All in all, it can be fairly considered that Technopolis holds within its premises an advanced business ecosystem, where a 2nd generation VBE model can be implemented. Even though all the elements of an entire business ecosystem would already be there, a systematic approach is needed for the full exploitation of the business opportunity and value creation for Technopolis.

5.2.2 Main Concepts of VBE Framework

In this sub-chapter the main concepts of the VBE framework will be explained to the reader, starting with the primary objectives. The main aims of a VBE can be summarized as follows: 1. Establish trust among the collaborating organizations. Credibility records and the definition of proper credit-assignment principles are helpful in this process. 2. Reduce the cost and time for finding suitable partners. 3. Assist with the creation, reaching agreements, and contract negotiation in the VO establishment process. If needed, assist also in reconfiguration. 4. Provide commonality for interaction with base ICT infrastructure, cooperative business rules, template contracts, and base ontology according to the business sector. Altogether the aim is to prepare the members to be ready for future VO collaboration (Camarinha-Matos & Afsarmanesh, 2007). As all above points are without doubt important, the item

number 2 should be stressed for Technopolis' inclination for becoming the leading matchmaker, which is also in focus of the thesis.
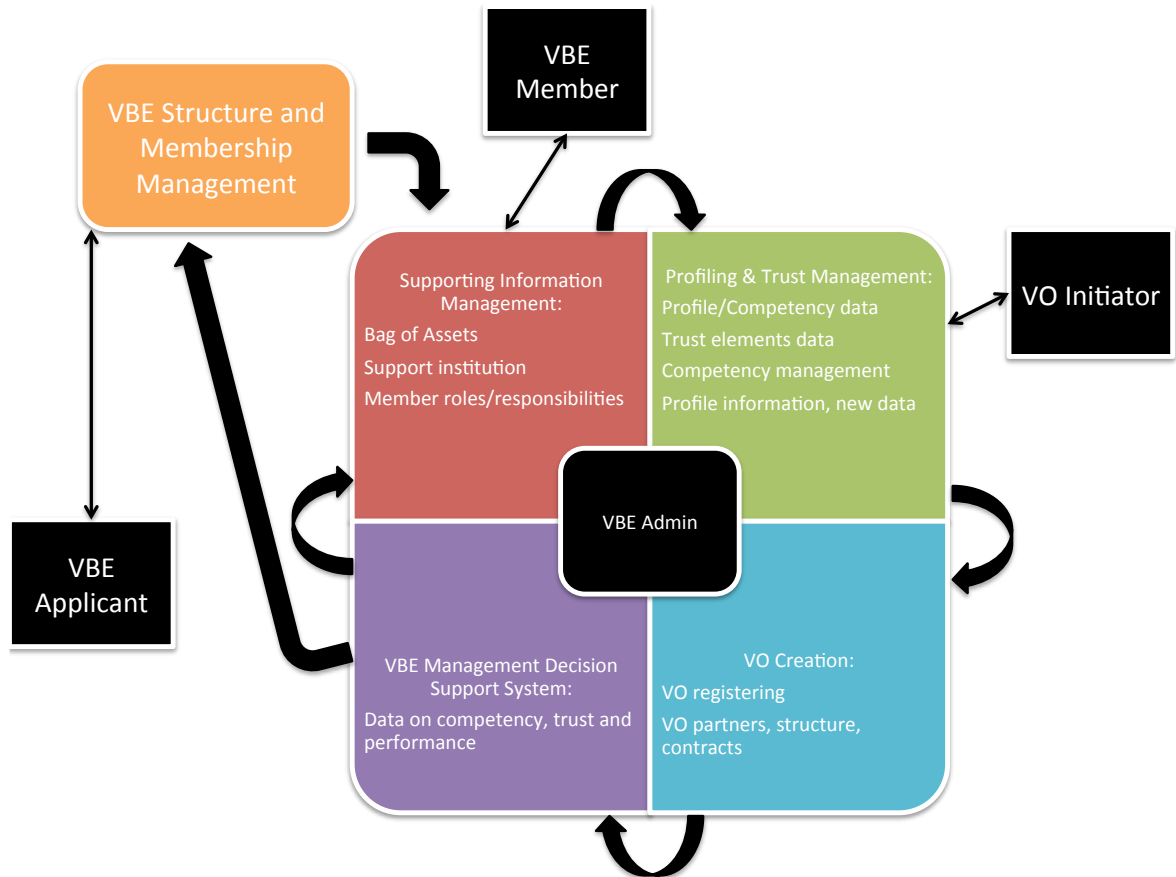
Figure 7 – VBE Management System
(Adapted from Camarinha-Matos & Afsarmanesh, 2007)

5.2.2.1 VBE Advantages and Requirements

A properly established VBE provides certain advantages, which enable efficient management and operation for VOs. Originally fully listed by Afsarmanesh, Camarinha-Matos & Ermilova (2008:39), the most relevant advantages for Technopolis as a potential VBE initiator are explained below:

- *Agility in opportunity-based VO creation*: supporting reduction of needed efforts and complexity, flexibility for VO re-configurability, and cost effectiveness.

- *Acquiring a(n apparent) larger size and negotiation power,* which contributes to better access to markets / opportunities and better (joint) purchasing conditions
- *Provision of mechanisms, guidelines, and assisting services to both motivate and facilitate configuration and establishment of VOs*: creating system of incentives, mechanisms to create positive reputation, and services for partners search, contract negotiation, etc.
- *Proactive management of competencies and resources available in VBE*: assuring coverage of the needed competency / resources within the VBE.
- *Increasing the chances of VO involvement for VBE members, even from remote geographic regions*: through provision of members' profile in the VBE catalogue, including their competencies, resources, products, services etc.

In order to create an entire, thoroughly functioning VBE, there is a set of requirements that must be met to gain all the advantages mentioned above and more. The key requirements are the following:

- The VBE establishment needs to be supported by a strong ICT-based VBE management system, providing a set of tools to both support the administration of the VBE as well as the configuration and creation of new VOs.
- Active involvement from the VBE member organizations, including provision of up-to-date information about their capabilities, resources, capacities, costs, and conspicuities [sic] for the provided information.
- Proper establishment of a viable business model for the VBE establishment, covering the issues of VBE finances and how to survive in the market or society.
- Proper establishment of the management strategies, government rules and bylaws, addressing the working and sharing principles as well as contracting, rewarding and sanctioning.

<div align="right">(Afsarmanesh, Camarinha-Matos & Ermilova (2008:40)</div>

The creation of and commitment to the VBE framework is a vigorous long-term process, where all the components must be carefully studied and implemented. In order to increase the possibility of success, there are instantiation

methodologies developed for this special purpose. (e.g. Romero & Molina, 2010).
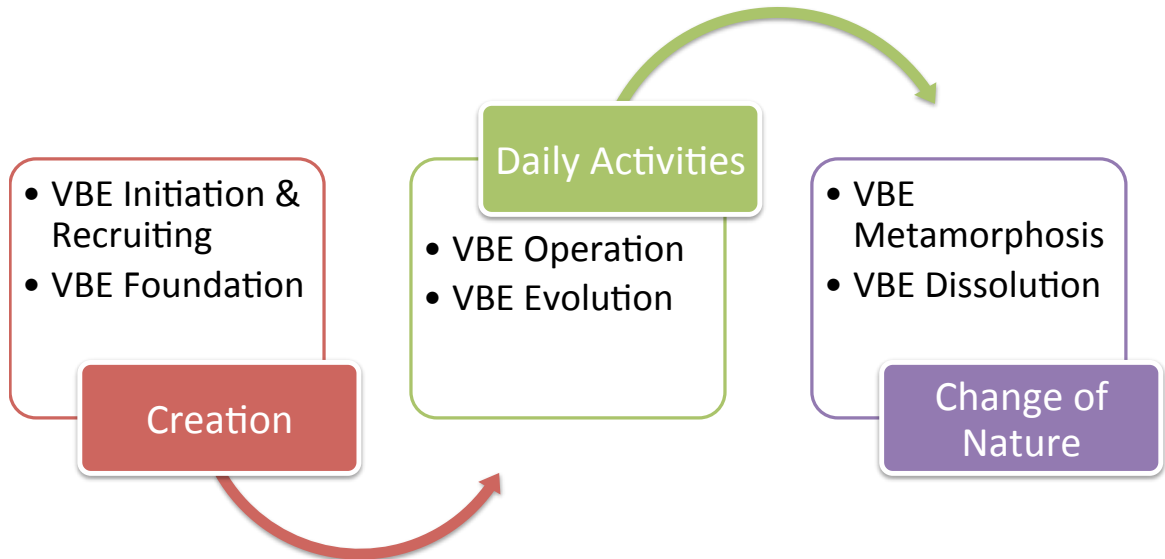
Figure 8 – VBE Lifecycle

(adapted from Afsarmanesh, Camarinha-Matos & Ermilova, 2008)

5.2.2.2 VBE Structure and Roles

The three categories of VBE actors and examples of their Technopolis ecosystem counterparts were discussed earlier in this chapter. The actors assume different roles in a breeding environment, which create interdependencies in continua of *networking* (communication and information exchange) to *collaboration* (sharing risks, resources, responsibilities and rewards for common goals) and *coordination* (aligning and altering activities) to *cooperation* (sharing resources for compatible goals) (Camarinha-Matos & Afsarmanesh 2006, Romero & Molina 2010:7). In order to illustrate the roles and their relationships in VBE, the following scheme is adapted from Afsarmanesh, Camarinha-Matos & Ermilova (2008:45-46) and Romero & Molina (2010:4):

VBE Administrator
- Registers members, brokers, planners, coordinators
- Assign roles to members, monitor, evaluate etc.
- All needs of advisors

VBE Advisor
- Advises in specific expertise fields, recommends administrator
- All needs of providers and organizers

VBE SUPPORT PROVIDERS:
- All needs of VBE members

Ontology provider
- Provides common VBE services to VBE actors

Service provider
- Provides all other VBE services, tools and mechanisms to VBE actors

Support institutions
- Keep VBE updated with new trends / technologies, expertise field solutions and optimizes them to VBE
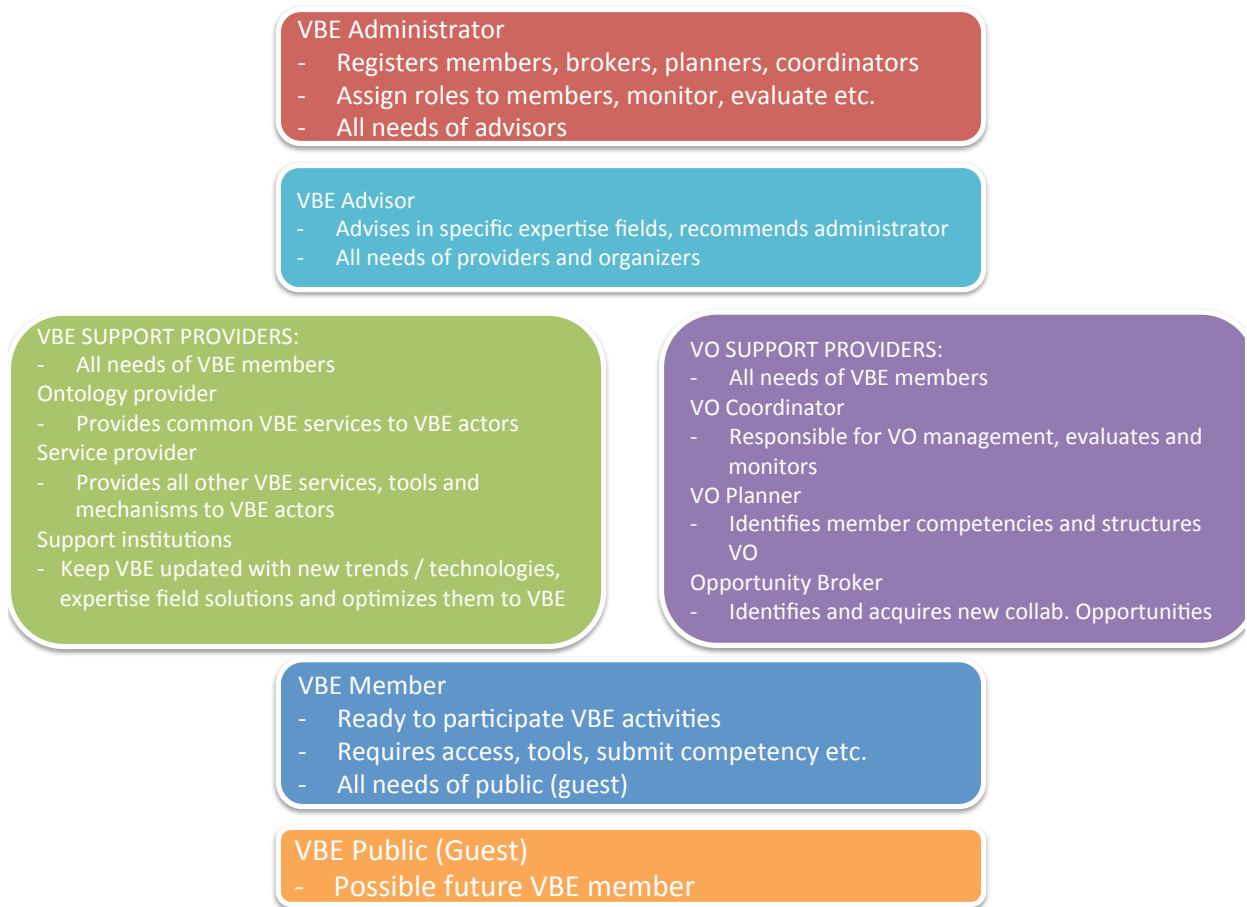
VO SUPPORT PROVIDERS:
- All needs of VBE members

VO Coordinator
- Responsible for VO management, evaluates and monitors

VO Planner
- Identifies member competencies and structures VO

Opportunity Broker
- Identifies and acquires new collab. Opportunities

VBE Member
- Ready to participate VBE activities
- Requires access, tools, submit competency etc.
- All needs of public (guest)

VBE Public (Guest)
- Possible future VBE member

Figure 9 – Roles and Relationships in VBE

In addition to being *a VBE member*, especially the roles in purple square (VO Support Providers) and being a *VBE administrator* suit Technopolis' desire of making more out of the current business ecosystem. Regarding the ambition of becoming the leading matchmaker, *VO planner's* and *broker's* role should be taken into closer examination.

5.2.3 Opportunities and Challenges in VBE Framework for Technopolis

There are three immediate questions that arise when comparing Technopolis current ecosystem and existing internal systems and structures to VBE framework. First, should the call for VO forming, i.e. the business opportunity, need or request, to come directly to Technopolis? There lies a possibility for aligning the matchmaking process by also assuming the role of a *broker*.

Second, should TechnopolisOnline and Viivi enterprise resource planning system be more integrated and extend their data to contain the competency and resource information of the affiliated companies? This is a requirement to fully operate as a *support provider*, and the information already partly exists in the aforementioned databases. Third, should VBE framework be piloted first in one program or taken straight as the general working framework for Technopolis Business and Development Services? Adopting VBE as a general framework would benefit the coordination and day-to-day processes of Technopolis' services and cooperation between multiple sites (business and technology parks).

5.3 Recent Approaches to VO Creation

The efficiency of creating a VO is critical factor in VBE context (Camarinha-Matos et al., 2009). There are two approaches to create a VO. 1. *Designed VO*: The collaboration opportunity goes through VBE member acting as a *broker*, who launches a top-down process and chooses the appropriate participants. 2. *Emergent VO*: *Broker* announces the collaboration opportunity to VBE members and wait for the emergence of candidates. In collaboration with the customer, the broker chooses the best partner alternatives (Camarinha-Matos & Afsarmanesh, 2007:120-121). One of the main advantages of VBE in VO creation is that partners can be selected from a well-known group of actors instead of vast 'open universe' of unlisted companies (Camarinha-Matos, Afsarmanesh & Ollus, 2008).
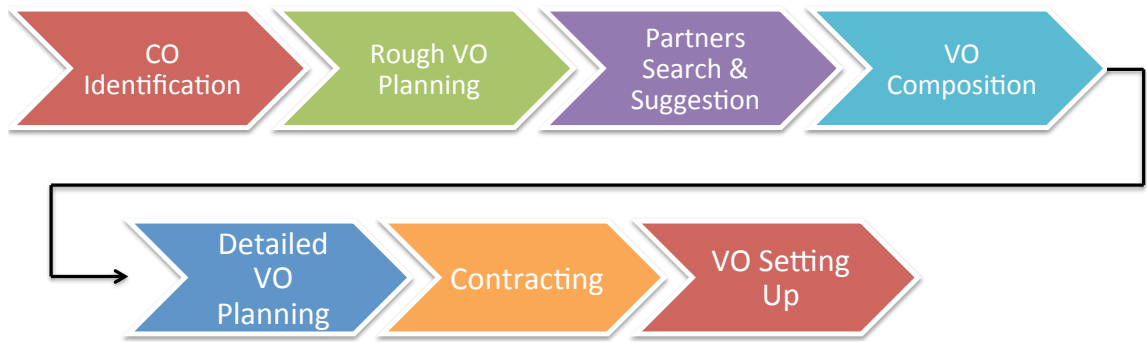
Figure 10 – Setting up a VO
(adapted from Camarinha-Matos et al., 2009)

There has been recently a considerable amount of academic interest in VO creation processes. Some of the approaches have been aimed at creating fully automated processes. However, many of these approaches have based on 'a set of simplistic assumptions' (Camarinha-Matos et al., 2009). Camarinha-Matos and Afsarmanesh (2007) note that creating a completely automated process is not (yet) applicable, and computer-assisted method with a skilled human planner making the final decisions should be preferred. They identify three main approaches to VO creation, and in addition, recognize VO creation as an optimization problem.
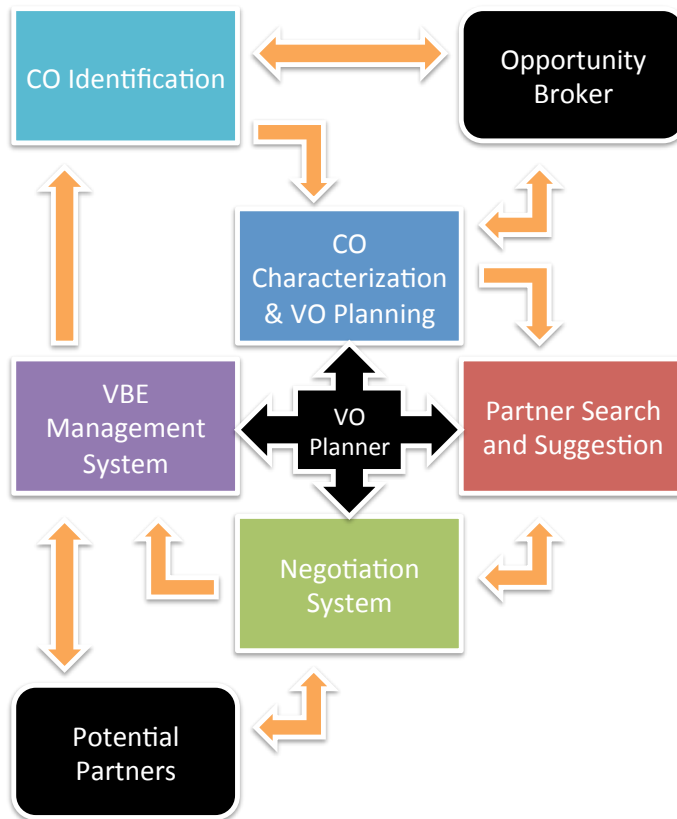
Figure 11 – General Interactions of VO Creation
(adapted from Camarinha-Matos & Afsarmanesh, 2007)

5.3.1 Manual or Assisted Approaches

At the birth of VO paradigm most of the approaches used required a huge amount of manual work. However, the latest advances in ICT enabled tools have made computer-assisted methods for VO planning and launching the most prevalent ones. Camarinha-Matos et al. (2008) point out that there are still cases today, where fully manual VO creation process is used. Typical difficulties that many attempts have faced are related to the handling and control of information about potential VO participants' profile and performance (Camarinha-Matos & Afsarmanesh, 2007).

Fornasiero & Zangiacomi (2004) propose in their case study of Italian footwear district a web-based process, which enables the shoe producers to evaluate

their suppliers and customers in short-term relationships. Nishioka, Kasai & Kamio (2003) introduce a supply chain management system, which supports 'collaboration of planning and scheduling processes of different enterprises' and allows evaluation on products and delivery date. The system is built on a SUPREME architecture, which includes web-based design of VOs.

5.3.2 Multi-Agent Based Approaches

Multi-agent based approaches systematically apply negotiation mechanisms used in market-oriented environments. A multi-agent system (MAS) resembles greatly a collaborative network, thus 'a natural motivation to use MAS as a modelling and implementation support for the VO creation process has been present in many research works' (Camarinha-Matos et al., 2008). In its most rudimentary form, independent actors place bids based on their offerings (price, quality, availability, etc.) in action mechanisms, and an agent chooses the most favorable options based on confirmed selection criteria. Often multiple rounds are needed to come to an effective conclusion.

Probably the most extensive model is described in Kaihara & Fuji (2008), which imply a game-theoretic standpoint to support negotiation in VO creation. First the researchers classify the possible participants' business models into vertically integrated, horizontally specialized and hybrid business models – the resulting VO becomes a combination of all of these. Later, a contract net protocol based negotiation system is implemented to all different business models. According to the results, the vertically integrated business model seem to maximize the profit and horizontally specialized business model seems to be the most flexible, while hybrid business models lie between these two. However, the researchers admit their model is still very unsophisticated. Accordingly, Camarinha-Matos & Afsarmanesh (2007) argue that MAS approaches ignore many 'soft-computing issues', like 'trust, commitment and successful cooperation history'. Other limitations are related into managerial

and security problems and the general complexity regarding choosing the partners from the 'open universe' (p.4).

5.3.3 Service-Federation Approach or Implicit VO Creation

The service federation approach begins by seeing potential members of VO as 'service providers', which 'materialize' their set of services (Camarinha-Matos et al., 2008:161). Further in the VO creation process, the appropriate services are selected implicitly to form the VO according to the collaboration opportunity. The starting point for this approach is different from the others, as it emphasizes the services offered rather than the organizations as such. Typically a sort of search query is needed to find the right service providers.

The abovementioned framework has been a long time starting point for various studies conducted in the construction industry, which base greatly on the OSMOS, C-Sand and eCognos projects (Rezgui et al., 2011). The research highlights the need for solid industry-wide ontology, and proposes architectures for inter-organizational collaboration that are based on web-services. The restraints of the practical implementation of the aforementioned studies, and more generally the web-service paradigm, relate to trust and to the broad definition of a service (Camarinha-Matos et al., 2008).

5.3.4 VO Creation as an Optimization Problem

A slightly different viewpoint from the abovementioned three approaches is formed when VO creation is examined as an optimization problem. Camarinha-Matos & Afsarmanesh (2007:5) categorize optimization approaches in partner selection as *cost minimization models, multi-criteria models, and matching of skills and needs*. An example of integer programming model, where manufacturing cost is minimized is provided by Wu & Su (2005). The researchers have developed a two-phase algorithm, which lamentably does not

solve the whole optimization problem. However, it can iteration by iteration near the objective. A mixed integer linear programming model created by Jarimo & Pulkkinen (2005) minimizes fixed and variable costs according to company core competencies and is able to use collaboration history as reference data to maximize the cooperative efficiency. In addition to this, the model minimizes risk factors by incorporating capacity risk-measures. The model is also somewhat elementary, nevertheless, it can be improved especially to support decision-making under uncertainties and to include the profit-sharing rules.

6 NETWORKING: PARTNERING, COLLABORATION, COOPERATION, AND MATCHMAKING

The different types of inter-organizational relationships are discussed first in this chapter in order to form hierarchy within the terminology. The middle-part of the chapter introduces a resource-based view as a basis for the theoretical background of the selection criteria. The latter part of the chapter visits the terminology and concepts related to matchmaking, forming finally a structure for the development of a viable business model.

6.1 Different Types of Inter-Organizational Relationships: Partnering, Collaboration and Cooperation

The current highly competitive and specialized business environment embraces more agile and flexible organizational structures, and calls organizations to open new kind of relationships with other organizations. The idea of collaboration between entities *per se* is nothing new: Peter Watson (2005) assumes that the long-distance trade dates back to circa 150.000 years ago. Consequently, in business literature, there exists a plethora of theory to understand and improve organizations' ability of working together. Very recently the advancements in information and communications technology have enabled such revolutionary ways of working together that many of the older theories have become utterly outdated. As a result, the academic researchers are feverishly trying to keep pace with the ever-quickening technological progression. The enterprise in the digital age is indeed 'virtual and interlinked and networked on various levels' (Filos, 2005:33). For all the abovementioned reasons, it is necessary to take a look into contemporary definitions of inter-organizational affairs.

Many classifications describing different collaborative relations are slightly overlapping in the academic literature (Varis, 2004). The intention of this sub-chapter is to start from the deepest level of inter-organizational relationships

and work towards the more shallow ones. The terms *partnership* and *(strategic) alliance* reflect the most intensive kind of collaborative relationship under networked organizations. The two terms are often used interchangeably. Fontenot & Wilson (1997) describe partnerships and strategic alliances as a tight affiliation, 'where each organization makes substantial investments in developing a long-term collaborative effort and common orientation toward individual and mutual goals' (p. 6). At the same time as the relationship between the two or more organizations becomes more intensive, the commitment to work together is often planned for a longer duration. Consequently, such aspects as trust, open communication, close interaction, sharing of risks and common interests become increasingly important (Varis, 2004). Westerlund (2009) reminds the more organizations become involved in deeper relationships, the greater grows the need for strategic management of network activities.

Camarinha-Matos & Afsarmanesh (2006) note that the use of the terms collaboration and cooperation are often mixed together. However, the separation of these terms is important to describe the depth of an inter-organizational relationship. *Collaboration* features teams working together in the same project, which generally aims at one common outcome, often a product. In other words, two or more organizations jointly share resources, risks, and importantly rewards, working towards a common goal. *Cooperation*, being the shallowest form of organizations *working together*, include also sharing of resources, however, the goal(s) are compatible, making the organizations semi-independents.

In order to distinguish *partnerships* and *strategic alliances*, *collaboration*, and *cooperation* from each other, the following figure is introduced.

ALLIANCE OR PARTNERSHIP

- Common Strategic Goals
- Substantial Investments
- Share of Strategic Risks

COLLABORATION

- Common Goal
- Intermediate Investments
- Share of Rewards

COOPERATION

- Compatible Goal
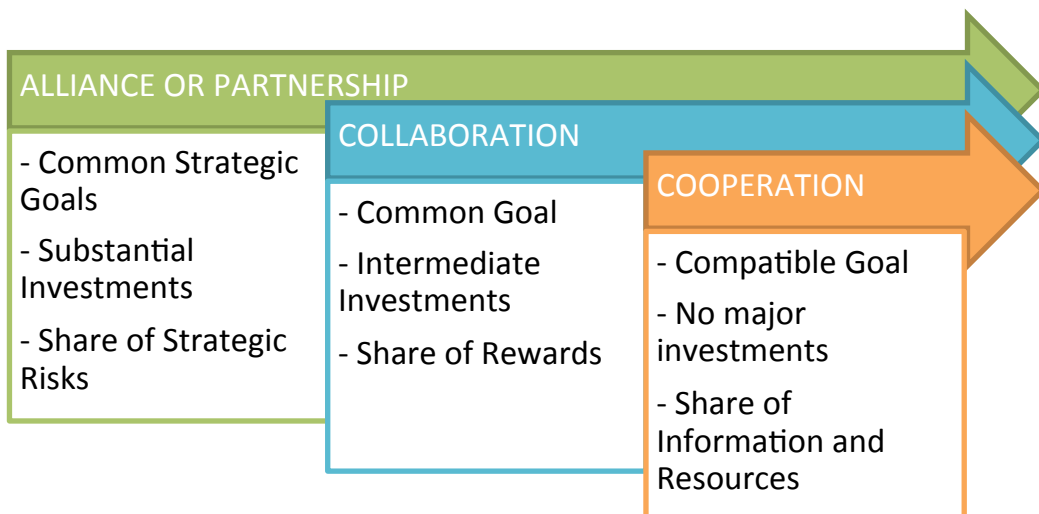- No major investments
- Share of Information and Resources

Figure 12 – Hierarchy of Inter-Organizational Relationships

The length of the arrow depicts deeper and longer-term relationship, and mutual interdependence. Nonetheless, it is important to note that for Technopolis forming all above-mentioned relationships is rewarding, since they all carry an opportunity for customer company growth.

6.2 Resource-Based View and Organizational Fit

Assessing organizational performance is a very complex issue, where no single theory or framework is enough to describe the differences between the organizations. Albeit not enough to completely understand the competitive advantage of an enterprise (Barney, 2001), the resource-based view (RBV) offers a perspective to recognize the assets of a company. As the ultimate intention is to create a framework to grasp what criteria firms are looking for to be able to collaborate, RBV is at the same time enough simple to comprehend and sufficiently extensive to include both tangible and intangible assets and capabilities.

The resource-based view on a firm has its roots in the work of Penrose (1959), and has been further developed by numerous researchers. The core of the theory is to identify the potential key resources of a company. After recognizing the potential key resources, they are valuated in accordance to the competitive advantage they bring to the company. In his widely referenced research paper, Barney (1991) summarizes four different categories that gather the resources creating competitive advantage:

1. *Valuable*: A resource that enables the company to create value by outperforming its competitors or reducing own weaknesses.
2. *Rare*: A resource has to be rare to have value.
3. *In-imitable*: A resource that is controlled only by the company, competitors are unable to copy the resource completely.
4. *Non-substitutable*: A resource creating competitive advantage cannot be countered by other measures.

Barney (1991) looks mostly into strategic management of a company. However, when an organization is looking for another organization to collaborate, the perspective is significantly different. Westerlund (2009) emphasizes the *capabilities,* when a company is seeking for a partnership, and perceives it as an extension to RBV. Attention is also brought on how these competences are developed and obtained; this can happen either externally or internally. In other words, when companies select their partners, they look into products and services the candidate is able to produce, and importantly, does this happen completely in-house or are other organizations involved.

Apart from different assets a company may or may not posses, Kauppila (2011) reminds of the importance of the organizational 'fit' in inter-organizational partnering (p.21). In order to achieve a fit that enables the organizations to achieve their highest collaborative performance, careful inspection of organizational structure, strategy and external environment has to take place. Nevertheless, VBE framework, when thoroughly implemented, should be able to take into account these and other issues (such as trust) that are very difficult

to compute (Camarinha-Matos & Afsarmanesh, 2008). According to the VBE framework presented in the previous chapter, it is suggested that factors related to issues regarding the organizational fit (e.g. ICT) and the external support activities (VBE and VO Support Providers) are reduced from the matchmaking model of this paper.

6.3 Selection Criteria

The intention of the first part of this subchapter is to provide general theoretical background into selection of collaborative counterparts. Despite of the notion that Varis (2004) makes on every single business sector needing a sector specific criteria, it is assumed that some universal conformity can be found. Furthermore, the findings will be a base for the questionnaire presented to the interviewed companies, and in addition, make the suggested matchmaking model more comprehensive and applicable. Knowledge of selection criteria is also useful, no matter which approach presented in the previous chapter is chosen for partner selection. When searching for the appropriate criteria, it is assumed that the VO Broker, which searches the right attributes from the database in a semi-automatic process, has received an input of collaboration opportunity (i.e. examples use a top-down process). The latter part of the subchapter is dedicated to introducing a feedback loop, which uses performance history as selection criteria.

6.3.1 Selection Criteria in Past Studies

Geringer (1991) made an early and widely referenced contribution to the partner selection criteria in his studies regarding international joint ventures. He composed a list of fifteen variables, which reflect his view on the most important factors that companies seek when choosing an international counterpart. Although many of these variables are not applicable to VBE framework, as the companies are searched from a restricted database of VBE members instead of

an open universe of companies, many of the variables still deserve a notion: *financing*, *management*, *employees, site*, *low costs*, *patents*, *trademarks*, and *full line* [of products and services] (p.12-13). Other variables are included or countered in the VBE framework. Similarly to Geringer (1991), Eisenhardt & Schoonhoven (1996) point out such attributes as *technical know-how*, *management skills*, *capital*, and *reputation*, but also emphasize on the role of the social construction of the partnering counterpart.

Wu & Su (2005) base their research on the manufacturing point of view. The researchers choose cost and time as their primary constraints, however the time factor is restrained from their model due to simplification. In their model, a manufacturing product is decomposed into different manufacturing tasks that take account resource utilization, production planning and quality control among others. The manufacturing activities are grouped by core resources, accordingly, one activity contains one core resource. If an activity does not include a core resource, it is included in another activity. It is noted in the research that different manufacturing processes require completely different resources. Stoica & Ghilic-Micu (n.d.) evaluate technically each attribute to be purchased. As a technical evaluation they suggest such methods as: 'automatic monitoring (traffic, network speed); absolute term evaluation service systems (using a point scale); evaluation systems that consider the importance of the attribute and the expectancies of the client, the performance induced by using the service, type of user (adaptation of the buyer satisfaction model)' (p.9). Largely can be accepted that research based on manufacturing point of view still lacks unified selection criteria.

6.3.2 Feedback as Selection Criteria

One of the greatest advantages of using a VBE framework is the structure, which allows collecting and using past performance as selection criteria for upcoming VO creation. Instead of searching collaborative candidates from the open universe of companies, the system learns more from its members after

every successful VO creation. In order to monitor, control and overall improve the member and VO performance, *performance indicators* (PI) are introduced. Westphal, Mulder & Seifert (2008) define PI as 'variables that assess the state of an object in scope, e.g. cost figures, the output of a production process or the responsiveness of a partner'. The authors note that there is not a single performance measurement framework that would be consistent enough to take the collaborative aspects of VOs into account. Furthermore, the selection of performance measurement network is related to the industry in question. Consequently, Westphal, Mulder & Seifert (2008) suggest using the following frameworks:

1. *Performance Perspectives and Indicators*: DuPont-Scheme, Economic Value Added, Intangible Assets Management, Logistics Scoreboard, Performance Prism, and Performance Pyramid
2. *Performance Measurement Concepts*: Activity Based Costing, Benchmarking, Integrated PM System, and Six Sigma
3. *Holistic Performance Measurement Methodologies*: Balanced Scorecard, EFQM, and X-COR

As a generalization, the role of performance management (PM) in VBE context can be described as follows:
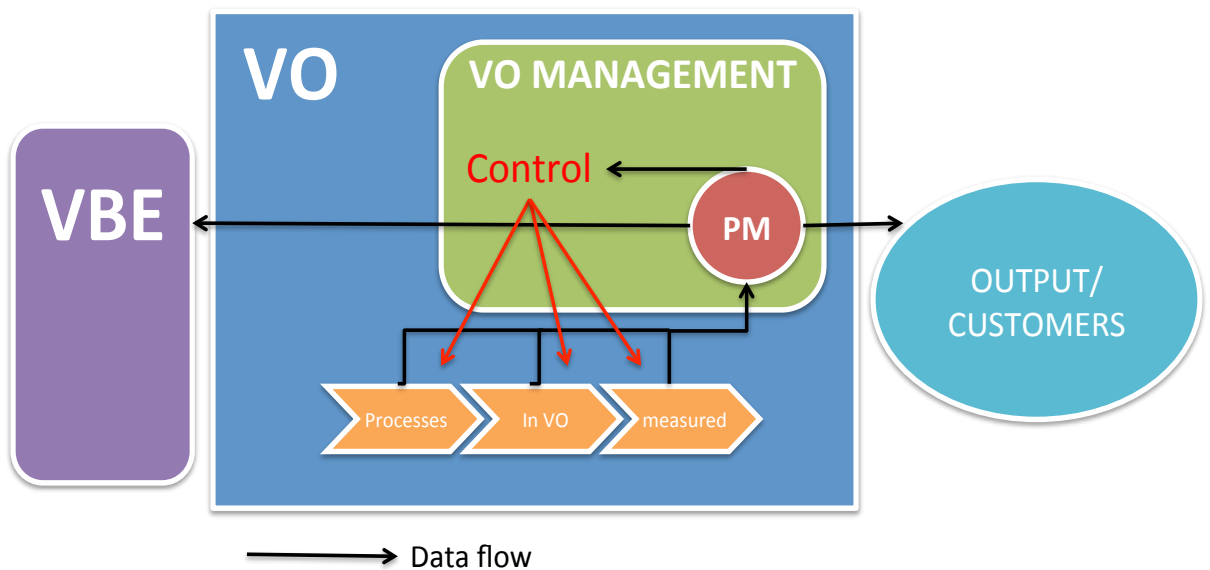
Figure 13 – Performance Management in VBE Context
(adapted from Westphal, Mulder & Seifert, 2008)

The graph shows how VBE customers, such as VO members, suppliers, customers and other stakeholders are provided with the performance data. Key part in the graph is VO management, which monitors and controls VO's objectives and related processes. Performance indicators also provide transparency on the status of the VO and form a basis for the communication within the VBE and VO.

Perhaps the most comprehensive model for using performance indicators as partner search and selection criteria has been developed by Baldo, Robelo & Vallejos (2009). Despite the detail that the authors are unable to answer directly what PI to use, they have created a robust model and a software prototype that uses semantic search function to support their framework. According to the collaboration opportunity (CO), the researchers identify four steps to select the most relevant PI:

1. To get as much information as possible about the description of those PIs that compose the entire set of indicators used to measure performance among the organisations below to a specific VBE.

2. To understand what these PIs mean, through the processing of unstructured textual information and the recognition of relevant words that explain what they exactly represent and measure.
3. To get the COs requirements description and to translate them in relevant terms that can be further used to filter and to select PIs.
4. To select the proper PIs for a specific CO, applying information retrieval technique, and having the relevant terms translated from COs requirements into account.

<div align="right">(Baldo, Robelo & Vallejos, 2009:4)</div>

The main idea is to semantically annotate the most relevant PI in order to avoid overlapping criteria. The abovementioned process requires creation of a comprehensive ontology, which rationally describes all the concepts related to PI characterization. This reinforcement enables all the *relevant terms* used in the VO creation process to become *semantically relevant terms* (Camarinha-Matos et al., 2009:16).

The whole methodology of finding and using the PI for VO creation is divided into two macro phases: *configuration phase* and *execution phase* (Baldo, Robelo & Vallejos, 2009). Being a computer-assisted method it is worth noting that there is human involvement between every step. The configuration phase is further divided into three steps:

1. *PI and CO ontology creation*: The ontology enabling the use of the same terms of the same subjects is created using the chosen performance measurement system.
2. *PI and CO knowledge population*: The library of the used terminology is created.
3. *Automatic PI semantic annotation*: The terminology is semantically systemized in order to create semantic annotations of PI. The catalogue of semantic PI is now ready to be used in the next phase.
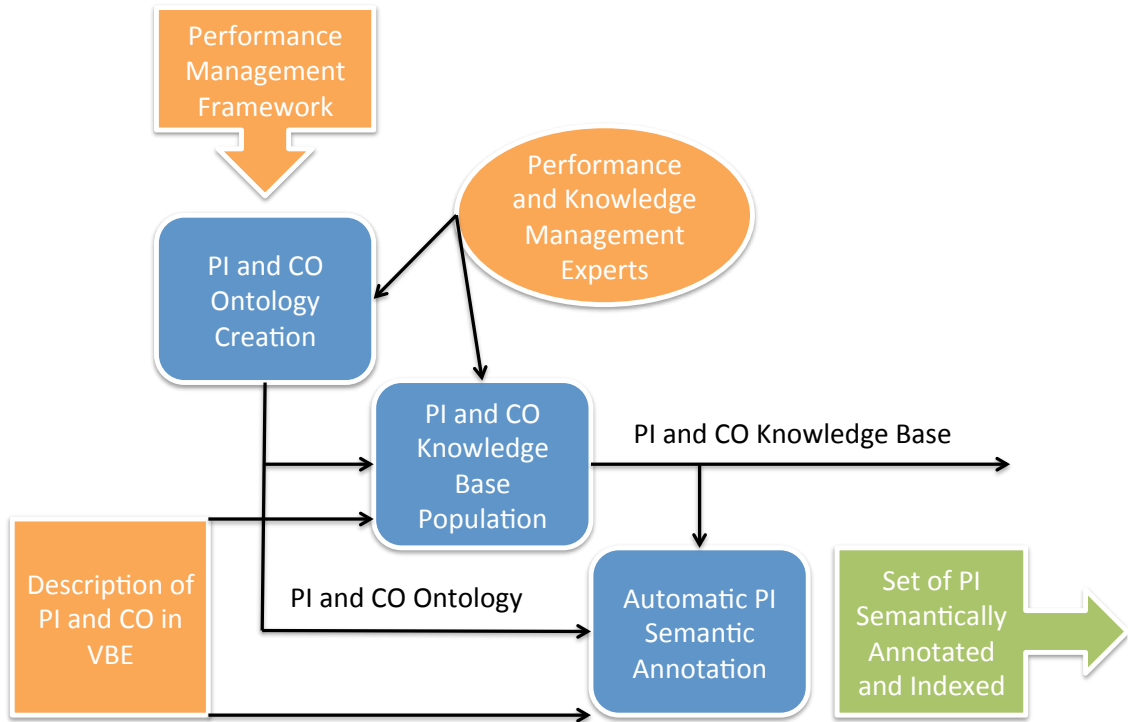
Figure 14 – Configuration Phase
(Adapted from Baldo, Robelo & Vallejos, 2009)

The execution phase can be processed multiple times when configuration phase is properly implemented. The execution phase is divided into four steps:

1. *CO requirements acquisition*: Collaboration opportunity's objectives, type and performance requirements are identified.
2. *Search criteria identification*: The semantic terms of the collaboration opportunity are identified for the search query.
3. *PI search*: The semantic terms of the previous step are used to retrieve the corresponding semantic terms of performance indicators. A list of the matching PI is created as a result.
4. *Result analysis and evaluation*: The result is analyzed and evaluated by the user. After the automatic process, the final performance indicators are identified in order to select the VO candidates.
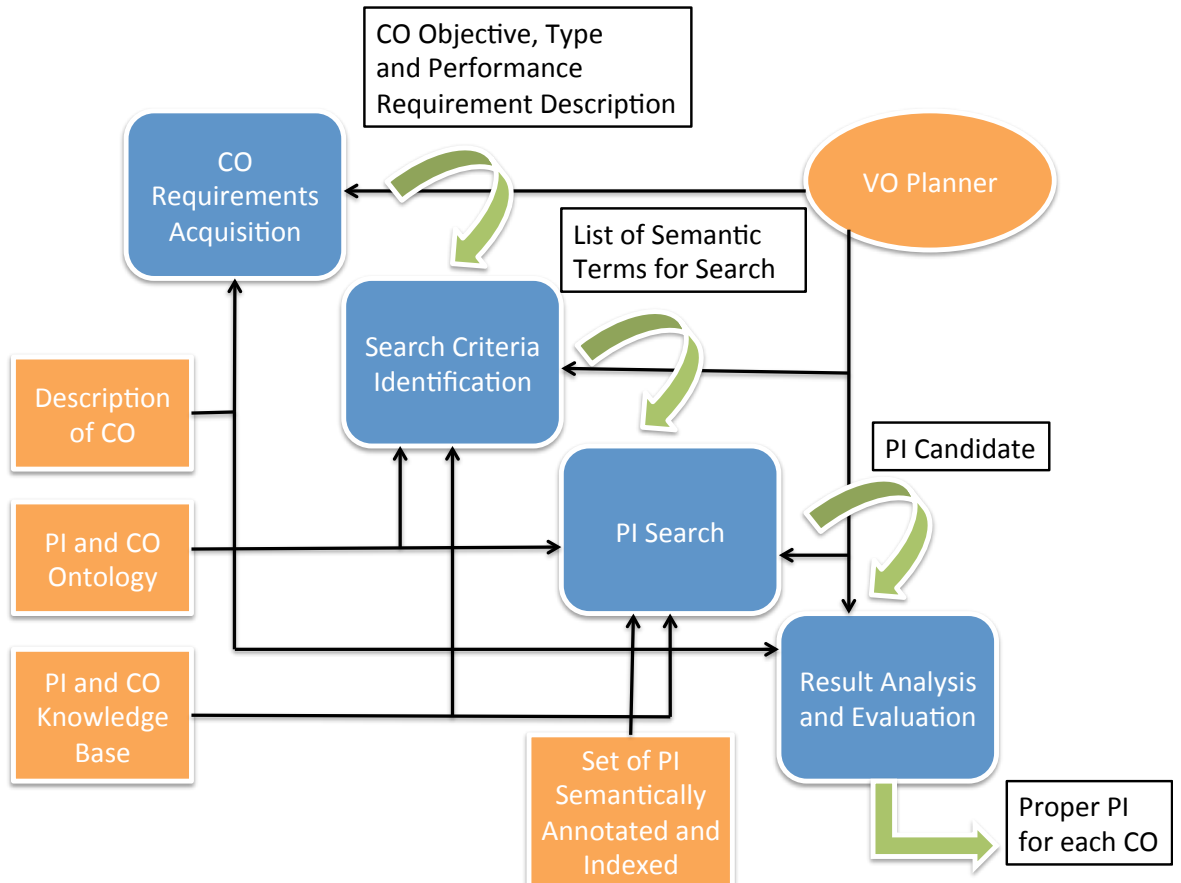
(Baldo, Robelo & Vallejos, 2009)

Figure 15 – Execution Phase
(adapted from Baldo, Robelo & Vallejos, 2009)

6.4 Matchmaking Service Platform

To finalize this chapter, *matchmaking* as a term, service and business model are discussed. Firstly, it is explained what matchmaking refers to and how it is fitted to Technopolis' business and technology park context. Secondly, different service models related to matchmaking frameworks are introduced. Finally, concepts related to leveraging matchmaking service into a working business model are briefly familiarized.

6.4.1 Matchmaking as a Term

Matchmaking as a term is used throughout Technopolis Development Services. Generally it refers to pairing off investors and companies in need of financing in hosted events, such as MoneyTalks®. More recently, TechnopolisOnline investment database has been moving towards semi-automatic virtual matching of companies in the registering phase of an event before the actual physical event.

In academic literature matchmaking as a term is not very widely used. As an example, ScienceDirect database finds 866 results matching the term matchmaking. In comparison, there are 294,337 results matching collaboration, 52,419 matching networking and 7,434 matching partnering (Accessed on 24 May 2011). Mostly matchmaking refers to dating services both in online and offline context (e.g. Houran et al., 2004), second most results are gathered under eCommerce (e.g. Ragone et al., 2009). Partly relating to eCommerce the other results relate to web services and especially to semantic web (e.g. Sbodio, Martin & Moulin, 2010). However, matchmaking is used in the context of matching companies, for example in the field of venture capital (e.g. Brown & Edmond, 1994). As matchmaking has a strong notion of marital (or dating) arrangements (and matching men's and women's qualities equates matching the qualities of business partners) a certain playful analogy to creating an online dating service for companies can be found in this research paper.

6.4.2 Matchmaking as a Service

Since matchmaking is typically offered as a service in Internet based companies, it is reasonable to study the service frameworks and models of the relevant literature and companies. Ragone et al. (2009) define matchmaking as 'the process of finding "good" counterparts for a given entry in the marketplace' (p.251) and take such companies as eBay, Yahoo and Sunday Times as examples of matchmaking in practice. Dumas et al. (2004) view matchmaking

from different angle as 'collecting and matching complementary intentions' (p.95), and offer ChemConnect.com, Island, Instinet, IntelliBarter and Monster.com as examples of matchmaking services. Fekete (2010) reviews extensively studies related to matchmaking, and defines matchmaking as 'the process of searching the space of possible matches between demand and supplies' (p.164). Generally, it can be concluded matchmaking is bringing together an entity that has something to offer (often a seller) and an entity that is in need of something (often a buyer). In the case of online dating service the counterparts are usually a man looking for a woman, in venture capital it is an unlisted company looking for an investor, and in the case of job search boards it is an employer looking for an employee. In any of the aforementioned cases the situation can also be vice versa.

Ströbel & Stolze (2002) study agreement and negotiation spaces in electronic commerce. The paper presents possibly the most generalized model of matchmaking, which is related to the authors' extended matchmaking component. As to graphically clarify matchmaking, the model is adapted below:
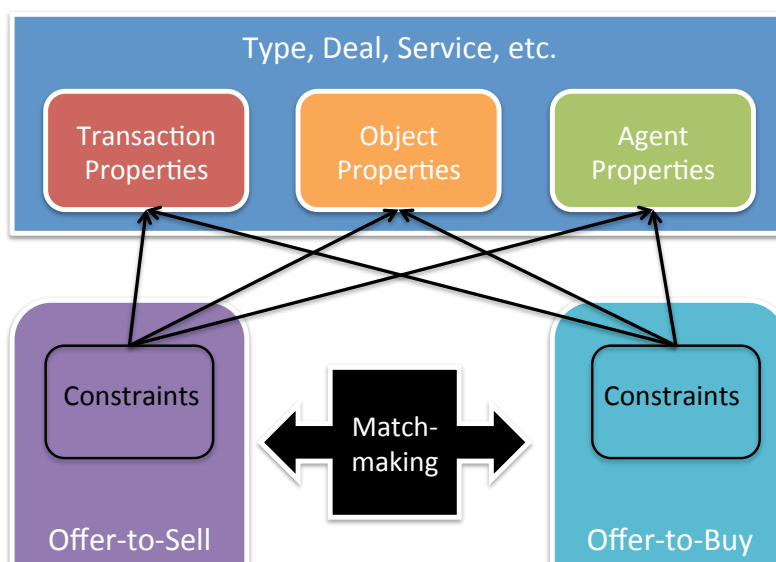

Figure 16 – Matchmaking

(adapted from Ströbel & Stolze, 2002)

Besides identifying buyer and seller, Ströbel & Stolze (2002) identify also a third agent, which triggers the matchmaking process, *an initiator*, which can be a market operator. It has also an analogue to a collaboration opportunity and to an opportunity broker. An offer has always some properties, which are detailed in the constraints of the buyer and the seller. They are related to the selection criteria discussed earlier in this chapter. Consequently, the selection criteria are a crucial part in the matchmaking process.

6.4.3 Matchmaking as a Business Model

Osterwalder & Pigneur (2010) define business model as 'the rationale of how an organization creates, delivers, and captures value. Hereafter, adjacent base theory to support the financial justification for matchmaking as a service is searched.

In their widely acclaimed research paper, Eisenmann, Parker & Van Alstyne (2006) introduce a framework for two-sided networks, which are economic platforms that connect two distinct groups that create valuable network effects. Examples of these are eBay and Amazon (connects buyers and sellers), and PlayStation and Xbox (connects players and developers). Network effects, either positive or negative, are defined as follows:

> A same-side effect, in which increasing the number of users on one side of the network makes it either more or less valuable to users on the same side; and a cross-side effect, in which increasing the number of users on one side of the network makes it either more or less valuable to the users on the other side.
>
> (Eisenmann, Parker & Van Alstyne, 2006: 96)

Two groups with a *platform provider* providing the architecture and rules for facilitating and governing the users' interactions, form advantageous triangular network dynamics. Referring to the three agents (offer-to-sell = *side 1*, offer-to-buy = *side 2*, and matchmaker = *platform*) included in the general matchmaking

model of the previous sub-chapter, a two-sided network model contains these three actuators. Consequently, two-sided network model can be used as the basis for the financial justification of the proposed business model in this paper.

Osterwalder & Pigneur (2010:87) introduce five fundamental building blocks required for a multi-sided platform pattern:

1. *Key Resources/Key Activities*: In multi-sided networks the key resource is the platform enabling the network effects. Key activities relate to the management and development of the physical, intellectual, financial and human domains.
2. *Value Proposition*: Is divided into creating value in two main domains: promoting the platform, and even more importantly, enhancing and enabling interactions between participating sides.
3. *Customer Segments*: In order to create value proposition and revenue stream beneficial for each side of the network, all the included sides need to be carefully structured as distinct customer segments.
4. *Revenue Stream*: Each side has to be individually charged in order to optimize the network effects. This may include subsidizing one side of the network over the other to reach critical mass needed for the adequate network effects.
5. *Costs*: Costs have to taken into consideration when budgeting the management and development of the aforementioned platform.

Mullins & Komisar (2009) warn of the dangers of emphasizing one element over the other: 'the implications of one element for the company's economic viability were meaningful for another element, and all were interlinked in such a manner that made the business viable from a cash flow perspective and easy to grow'. In other words, while the actual platform may be essentially fundamental and an enabling force in the creation of a multi-sided platform business model, attention should be given to all building blocks in their entirety.

7   CASE TECHNOPOLIS

This chapter begins by processing and expounding the interviews. A strong emphasis is on the expert opinions on the optimal selection criteria. In the middle part a database schema is presented and tested. The database is proposed to be the basis of the matchmaking platform, which is exemplified in the last part of the chapter.

7.1 Interviews

In order to receive information as a reference and for additional point-of-views from the surrounding ecosystem actors, five industry experts were interviewed for the case study. There were two main purposes for the interviews: 1. To find out what kind of firms are the ones that are the most difficult to find; i.e. where would the theorized half-automatic matchmaking model bring most value for Technopolis' customers 2. List the most relevant performance indicators that are used in the matchmaking model prototype developed for the case study.

The five interviewees represent different sides of the ecosystem, where Technopolis lies in the focal point. Below all the industry experts are introduced with accompanying background information.

> **Mika Okkola** (interviewed on 6 July 2011 on site) is Director, Developer and Platform Evangelism of Microsoft, probably the company with the most extensive partner network in the world. He has an extensive knowledge of partnering in the software industry.
>
> **Aape Pohjavirta** (interviewed on 21 June 2011 via email) is CEO and Founder of Ympyra and Sendandsee mobile companies. He is a board member of Finnish Mobile Association and known as an active speaker in startup ecosystem.

Anni Rouvinen (interviewed on 16 June 2011 on site) is Business Development Manager at Fira, a young and innovative construction company with net sales of about 50 million Euros.

Dr. Petri I. Salonen (interviewed on 28 July 2011 via Skype) is CEO and Founder of TELLUS International, which provides management services for software and high-technology companies. He is also the Chairman of the Board of Sininen Meteoriitti, company focusing in Microsoft SharePoint technology and development of intelligent collaboration solutions for enterprises. He is also Ph.D., Information Systems Science, and author of two books.

Marjo Uotila (interviewed on 15 June 2011 via Skype) is Director of Technology Transfer Services at TEKEL (Finnish Science Park Association) / Enterprise Europe Network, which helps small companies to exploit the business opportunities within European Union.

Marjo Uotila's extensive work searching suitable business partners in both science park context and as part of European Enterprise Network sheds light on the network management side of the business and covers the general ecosystem point of view. Anni Rouvinen from Fira represents the medium sized company that has not the ability to manage a large, organized business network on its own. However, as an agent in the construction industry, they have a recognized a need for effectively finding suitable partners, subcontractors and alike. Aape Pohjavirta's industry opinions base on the entrepreneurial experience gathered mainly from mobile companies called Ympyra and Sendandsee. Furthermore, the active participating in Finnish startup ecosystem also broadens his view on the thesis' subject. Mainly, Pohjavirta represents the small business part of the interviews. Mika Okkola has been working in Microsoft from 2004 and holds an extensive knowledge of software business and related business platform models. He expands the view on the thesis topic from large corporation perspective and draws from the experiences related to managing Microsoft's extensive partner network. Petri I. Salonen, being an entrepreneur and Doctor of Science (Economics), has experience both from the academic world and business life. He combines research, strategy development

and solution delivery to various organizations in his professional work and can be truly called as one of the leading experts in the field of the thesis topic.

7.1.1 The Interview Questions

The interviews had 4 predetermined questions, which were introduced through the research gathered in the literature review part of the thesis. While collecting straight answers to the aforementioned questions, the interviewees, when applicable, had also the liberty to express their thoughts around the subject and to bring their personal experiences into the discussion. The four questions that structured the interview were:

1. What kind of Finnish companies that you seek to partner, collaborate or cooperate with are the most difficult to find? (size, branch, location…)
2. What kind of indicators you look into in a company when you're seeking to partner, collaborate or cooperate?
3. Imagine that you're seeking a collaborative counterpart to participate in a big project. Please put the following performance indicators of the potential counterpart into a descending order of importance (from highest to lowest level of importance, each row is the same indicator):
   - Perceived management skills
   - Perceived employee technical know-how
   - References, completed products and projects
   - Patents and trademarks
   - Low costs
   - Financial resources, financing, capital
   - Perceived reputation
   - Swiftness, effectiveness
   - Flexibility, adaptivity
   - Possibility to a longer-term partnership
4. How do you feel about the idea that your customer acquisition management would be partly or fully outsourced?

7.1.2 Processing the Interviews

This subchapter goes through the interview questions one by one. Also additional relevant thoughts provided by the interviewees are discussed along the question answers. The exact questions presented can be checked from the previous subchapter.

To begin with, it can be largely said that the smaller the company is, the more difficult it is to find. Rouvinen adds that nevertheless also big companies are challenging from the network perspective, as they usually are deeply involved in their existing customer grid. She also points out that it is hard to predict, which contacts bring in more customers, and she supports a customer acquisition oriented view. Pohjavirta notes that regardless of the company size, the ones that are actually world-class within their field are the most demanding to get acquainted with as such companies are often very focused on their own operations. Uotila summarizes that small and middle-sized companies often lack the resources to enhance their visibility and achievability. Okkola has mainly knowledge from the software sector, and he sees generally a partner ecosystem bringing the most added value, when a company is looking for supplementary know-how or expanding its distribution channels or own product and service offering. Salonen perceives interesting opportunities in the recently begun partnership of Nokia and Microsoft. By profiling Nokia's partners Technopolis would be able to enhance the collaboration between the partners of the two technology giants. This is something nobody has tried before in Finland.

The second question provided the most differentiated answers, which is understandable as each respondent has a very different standpoint in the ecosystem. The idea was to freely think the most important factors when choosing a collaborative counterpart. If there were no existing personal contacts to a potential collaborative counterpart, Marjo Uotila would first simply look for the references of the company. Aape Pohjavirta provides a longer list of

aspects he tends to look when planning to work together on a company level: Being a company founder himself, he starts by looking the background and current contributions of the founders. The financing structure and references from mutual contacts are also important. Pohjavirta also uses social media and tends to check the Twitter presence and tweet history. Finally, he mentions that he revises if the company has scientific collaboration with the leading institutions in their own niche.

Rouvinen takes a more long-term approach to the selection of a counterpart. The question left it open to draw from company's own experiences, no matter how deep their relationships have been. She states that Fira promotes partnership, where both counterparts can evolve and develop ideas in a close relationship. Other important factors Rouvinen points out are past research and development, size of the company, and resources. She defines that in resources the company mostly looks into the fast cycle in the development and design processes; their collaborative counterparts must be able to adapt fast as plans often tend to change suddenly in construction business. Okkola remarks that on his field and when partnering in general the qualities of companies are assessed from a different perspective as a venture capitalist, for example, would look the situation. He highlights such attributes as know-how, customers, team and financial state of the company. Salonen would take a different route to answer the question. He argues that external attributes, such as size, are often overly emphasized. Instead, it should be carefully studied that the counterparts are on the same level. Consequently, Salonen suggests using partnering maturity models to evaluate companies (e.g. Dover & Werngren, 2010).

In the third question the interviewees had to place preset selection criteria in order of importance. In the set there were 10 aspects describing different sides of a company performance and fit. The result was processed so that the criterion, which was ranked the most important by an interviewee, received ten points, the second received nine and so forth. When on par, the criterion that

received the highest individual score from an interviewee was preferred (underlined). Here below, the outcome is presented:

1. References, completed products and projects (10 + 6 + 8 + 10 + 8 = **42** points)
2. Perceived management skills (5 + 4 + 10 + 7 + 9 = **35** points)
3. Perceived reputation (9 + 3 + 7 + 9 + 4 = **32** points)
4. Flexibility, adaptability (8 + 9 + 4 + 4 + 6 = **31** points)
5. Possibility to a longer-term partnership (6 + 10 + 3 + 1 + 10 = **30** points)
6. Perceived employee technical know-how (4 + 2 + 9 + 8 + 7 = **30** points)
7. Swiftness, effectiveness (7 + 8 + 5 + 5 + 5 = **30** points)
8. Financial resources, financing, capital (3 + 7 + 5 + 6 + 3 = **24** points)
9. Low costs (1 + 5 + 1 + 3 + 1 = **11** points)
10. Patents and trademarks (2 + 1 + 2 + 2 + 2 = **9** points)

Additional criteria were also suggested. Rouvinen would like to highlight the importance of such factors as continuous improvement, entrepreneurial spirit and development possibilities of the counterpart. Uotila strongly argues that mutual trust and chemistry are in the end the most important elements, however, they can be only seen when the physical contact has already been made.

Regarding the fourth question, which reflects the attitudes towards the model developed in the literature review, all respondents seemed to be excited about the initial concept of matchmaking-based business network. Uotila remarks that generally a network where all the participants only try to sell something to each other often brings unsuccessful results. She notes that there is myriad number of different databases, but the model presented in the thesis would definitely bring significant value to its members – if properly implemented. Uotila believes that the feedback loop will work on its own weight, if companies truly feel that they receive more from the network than they give. She also emphasizes the importance of correct balance between sharing of resources or know-how and technological transfer. In addition, the network should have clearly defined mission and goals.

Rouvinen details that Fira's motivation in participating a business network is strongly based on generating more sales. She also has hopes that a network would bring possibilities to find something that would not otherwise cross the minds of the company management. They are currently interested in forming energy and cleantech based cluster, where especially wind power, biofuel plants and integrated cleantech building technology would be in focus. Rouvinen would like to see aspects that highlight the transparency of a potential network. Pohjavirta sees the proposed idea interesting. He believes their company would look into suggested proposition.

Okkola considers the model suggested in the thesis as one supplementary channel that could be used within the software industry. He views it nearly impossible to create a general model that could be used in all industries and suggests concentrating on one particular industry. Salonen uses similar models in his professional work as proposed in the thesis. He mentions Osterwalder and using platform business models as a basis a good starting point. However, he strongly recommends concentrating largely on the 'soft' issues in partnering, otherwise the actual matchmaking may result to resemble too much an engineering project.

7.2 Matchmaking Model Prototype

The idea of the second part of the case study is to form a generally applicable model of the database, which can be used as the basis of the proposed matchmaking function for Technopolis. Furthermore, the model was tested with dummy companies in order to examine its functionality. The software application used to generate and test the model was Microsoft Visio 2010. Henri Ström from Aalto University School of Engineering provided help with design and testing. The database schema is shown below:
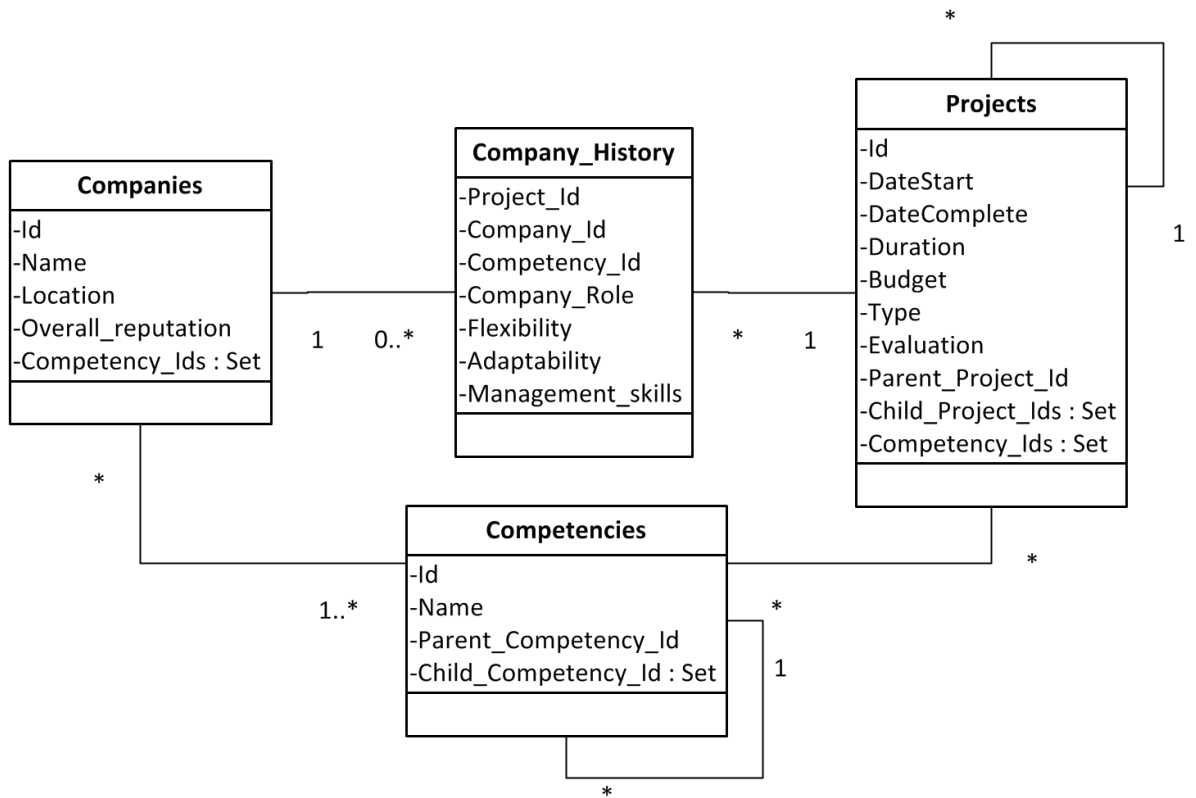
Figure 17 - General Matchmaking Database Schema

7.2.1 Introducing the Matchmaking Database Model

The data in the schema is divided into four classes. The classes are described and exemplified below. The relationships of the classes can be seen in Figure 17. For example, each company can join several projects but not vice versa.

Companies: In the company class there are all members of the network that are involved in the projects (or willing to collaborate). These members are assumed to be mainly companies, but they can be extended to involve also service providers, industry associations, research institutes or other supporting organizations. Under each company some general information is provided, such as location and contact information. In addition, each company has a summary of its evaluation and the definition of its roles. The roles define the relationships the members have in the organization. The roles also allow the placement of all

project participants, such as customers, contractors and universities, under the same class. Finally, a company has a set of competencies.

Competencies: The competencies class involve basically a description of what a company searching for collaboration opportunities is able to produce. In the case of a software firm, competencies could be Java and Flash programming languages. The class is structured so that each competency can have an unlimited number of sub-competencies. In the matchmaking process it is assumed that competencies are the first 'limiting factor' in the search query, when matching skills with projects. A clearly described and followed ontology is a critical part of the competencies class. The issues related to ontology can be partly avoided with semantic techniques. Both ontology and semantic annotation are discussed more in detail in the literature review.

Projects: In the projects class all the projects are individually and systematically detailed, which helps backtracking the history of the network. It is essential to note that all the competencies acquired through the network are located under each project. One company can be involved in several projects and each project can have unlimited number of subprojects. However, in practice the amount of subprojects has to be limited in order to ease the evaluation process. Accordingly, each project also has a feedback and is individually evaluated.

Company_History: This class can be visualized as a spreadsheet, where one row represents a company's linking to a project. Each company is evaluated based on its role in the project and the competencies used in the project. In the schema the top six selection criteria from the interviews were used as examples of evaluation measures. Nevertheless, whichever evaluation and monitoring standards can be applied. The idea is that the companies receive a kind of report card for each project they have participated, which is further accumulated to overall grades of company qualities.

7.2.2 Testing the Matchmaking Database Model

The main thought when designing the database schema was to enable different kind of searches using all data labels, the effective multiple direction of searches and the easy extension of the database. In matchmaking context, there is typically a collaboration opportunity, i.e. a planned project, which requires a set of competencies. In the first place, a long list of the companies with the matching competencies can be produced to see all the possible collaborative counterparts. This long list can be additionally limited by using company size, location and evaluation history as search criteria. As concluded in the literature review part of the thesis and further in the interviews, historical performance is the best indicator to evaluate the effectiveness of the company. Nevertheless, the database can be searched in other direction too: for example, all the projects of a certain kind from the past five years can be searched in order to see the participated firms.

The model was tested populating it with a set of SQL-based dummy companies with random company information and competencies. However, in order to save time and effort, each company had only one competency and project. In an example of a search terms, all the companies with competency 1 (Java) were searched with an overall company reputation (average of evaluation) more than 2:

```
SELECT companies.name, companies.reputation FROM companies inner join
competencies on companies.competency_id = competencies.id where
competencies.id = 1 and companies.reputation > 2;
```

In the testing phase no errors or inconsistencies were found and the database schema was found generally applicable for matching projects with companies.

Two general conclusions emerged while testing the database, which further support the conclusions in the literature review: 1. The matchmaking model and the database have to rely heavily on historical data and evaluation of the

companies and projects. 2. The database shows its true efficiency only after a significant amount of data is gathered. The larger the database grows, the more useful it becomes.

7.3 Technopolis Multi-Sided Platform Model Proposition

The intention of this final subchapter of the Technopolis case study is to exemplify a model or pattern of the matchmaking platform that fits the company's Development Services department. The platform model draws strongly from the general VBE framework. However, its complexity is reduced to adapt the needs of a pilot program, which is the predicted as the next step for Technopolis in case the proposed matchmaking platform is realized. In addition, the groundbreaking work of Eisenmann, Parker & Van Alstyne (2006) and later enhanced by Osterwalder & Pigneur (2010) is incorporated in the model. A proposition of the matchmaking platform pattern is provided below:
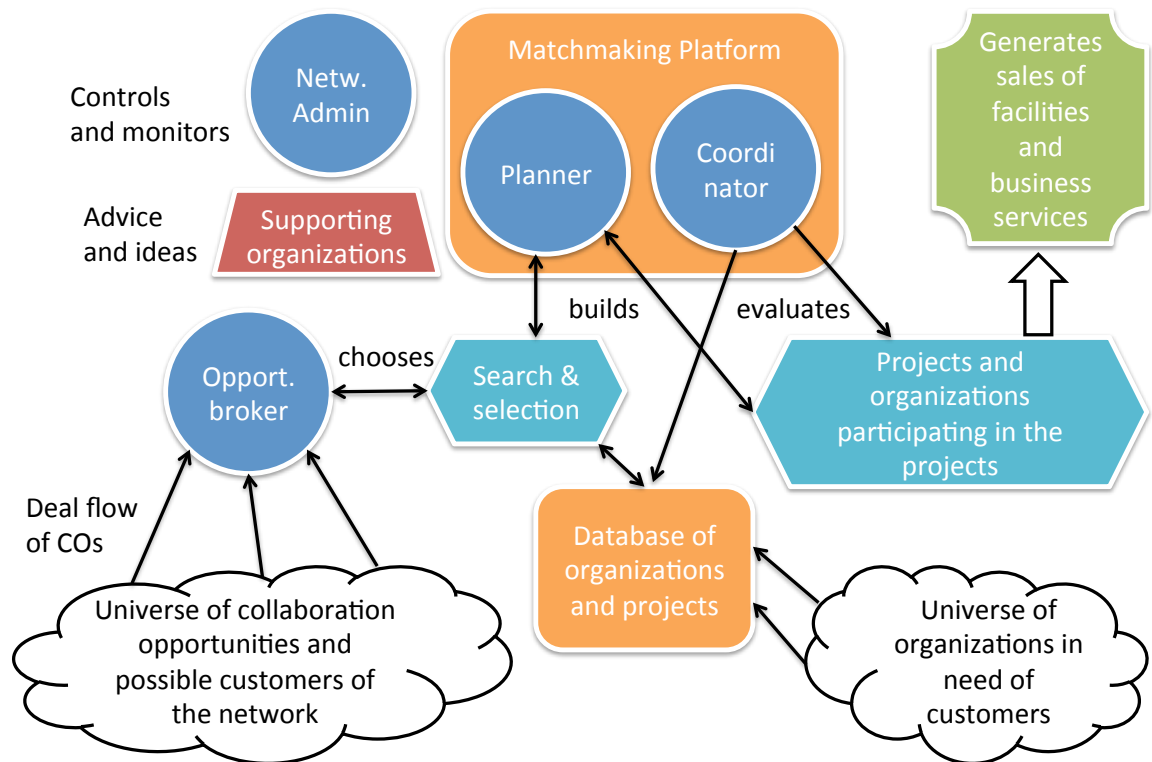

Figure 18 – Matchmaking Platform Pattern Proposition

Working the model from down to up, in the bottom are two clouds. These two clouds represent the two sides that the matchmaking platform has two serve. On the left hand side there are all the possible 'customers' of the network, in other words, the organizations that are searching for companies as subcontractors to complete their projects. The customers present the collaboration opportunities to an opportunity broker, which acts as a sort of an agent or a gatekeeper and recognizes the promising projects, which the member organizations are able to accomplish. The cloud on the right hand side represents all the organizations that are in need of work and are willing to participate the matchmaking platform.

When a collaboration opportunity is accepted, the opportunity broker in collaboration with the planner starts the search process. The planner ensures with rough plans of the impending virtual organization that the right competencies and resources are identified. All the information needed in the search and selection process is stored in the matchmaking database, which is presented in the previous subchapter. When the optimal organizations are chosen, the VO is formed and it starts completing the project with planner taking care of the general functions of the VO, for example, communication with the client. Coordinator evaluates the completed parts of the project and the overall collaboration storing all the information in the database. Network administrator monitors the whole process and provides the matchmaking network, among other things, the ontology in collaboration with supportive organizations. The supportive organizations can be anything from industry associations to non-profit organizations. They provide new thoughts and advice to the members of the network.

The roles Technopolis is recommended to acquire are marked as blue circles. In the initial stage, each role probably occupies one employee. The opportunity broker could also be an independent party, however, it might make the partner selection process more difficult, as Technopolis probably wants to limit the

access to the database. The systems within the pattern are marked as rounded orange rectangles. The thesis gives a general schema of the database, however, the detailed functions of the physical matchmaking platform have to be defined more closely in the future. In the green placard the promise that the matchmaking network generates sales through the extended need for company premises (for example, work space for R&D) and business services (for example, video conferencing) is represented.

As Eisenmann, Parker & Van Alstyne (2006) and Osterwalder & Pigneur (2010) have suggested: the question, which sides of the network to cash, has to be thoroughly considered. It is proposed that in the early expansion stage mainly the organizations offering the collaboration opportunities are providing the income. It is assumed that such public financiers as Tekes or Sitra could also provide the needed initial funding for the project, as the matchmaking has a generally positive impact especially on Finnish small and medium sized companies sector. As the network grows and the data increases through the completed projects, the companies searching for collaboration opportunities might be willing to pay for their membership as they get more out of the network.

8   CONCLUSIONS

There are several conclusions that can be made out of the research, and some intervening conclusions are presented throughout the text. In this chapter the main findings of the study are presented.

The first and perhaps the most important lesson is that matchmaking cannot be made alone – *or* only for the sake of matchmaking. There are several elements, which have to be in place in order to make matchmaking meaningful. The fundamental starting point is that on one side of the table there are entities with 'offer-to-sell' and on the other side entities with 'offer-to-buy'. This is clear in the venture capital context: there are venture capitalists and companies looking for funding, they both need each other. These prerequisites are discussed in detail especially in subchapter 6.4 – Matchmaking Service Platform. In brief, a direct quote from Marjo Uotila (2011): "A network, where all the organizations are trying to sell each other something, brings very little value for its members." This is why a matchmaking organization has to bring in a direct call for collaboration – the collaboration opportunity – into the network.

The second important finding is that systematic matchmaking needs a solid supportive organization around it. The following roles are especially important for Technopolis, without them matchmaking as presented in this study is impossible: 1. Opportunity broker – works as an agent bringing the projects, i.e. collaboration opportunities, into the network 2. Virtual organization planner – arranges all the tasks related to the forming and maintaining of a collaborative unit of organizations 3. Virtual organization coordinator – works as an independent unit, monitors and evaluates the collaboration 4. Virtual organization breeding environment administrator – head of the network, administrates and manages the system.

A large organization comes with a price. Accordingly, it can be concluded that designing and building a matchmaking network as proposed in the thesis is a

long task and requires a lot of resources. Strategic partners from both other businesses and governmental organizations are needed to share the weight and provide additional support. It is suggested to start the matchmaking network small, perhaps a pilot program within a narrow business sector. It may take several years of investment before the network becomes profitable. Still, as found out in the testing phase of the matchmaking database: the larger the network and the database grow, the more useful it becomes.

The search criteria are crucial in the actual matchmaking component. It is proposed that when searching for members to complete a project, first the companies are long-listed according their competencies, and in the second phase, the companies are assorted and ranked based on the historical evaluation data of completed projects. Another important notion is the prerequisite of established and complied ontology within the organization. The companies must use same terminology within the network context. This notion also supports the proposal of conducting the pilot program within a clearly limited branch of business; it is easier to control the ontology on a narrow business sector. Semantic annotation can be used to overcome issues related to terminology, however, it only seems to cover issues related to search, not the communication problems. Organizations participating the network must be also encouraged to provide as much information on them as possible, and a general aim within the network must be transparency.

As a final conclusion, Technopolis should consider connecting its facilities and other business services with the proposed matchmaking network. The collaboration often requires physical space, which the company can offer to the formed virtual organizations. On the business service side, especially video conferencing should be considered, as the collaborative counterparts might often be geographically in different locations, possibly even in other countries. The collaboration can also mean increased sales for Technopolis customers, which further support the growth of business park clientele. This is well in line with the company strategy. The abovementioned demands might require even

more flexible working environment solutions in the business and technology parks.

9 RECOMMENDATIONS AND LIMITATIONS

This final chapter recognizes the limitations of the study and indicates recommendations in order to find out the viability of the proposed matchmaking network.

As the focus of the thesis is limited on generating a universally applicable framework (how systemized matchmaking for creating collaboration in the business and technology park context would be possible) the study is mainly conceptual and moves largely on an abstract level of the phenomena. There is not a categorically solid proof that the proposed matchmaking platform pattern would be economically feasible. A lot depends on how the whole framework would be implemented and executed in practice, which organizations are willing to participate and finally, the resources available to devote to the project. Consequently, there are a number of uncertainties, which are turned into suggestions for future research.

It is proposed that Technopolis closely listens its customers and possibly conducts a survey to find out a business sector, where the matchmaking would bring the biggest value for its customers and is simple enough to implement. When the business sector is identified, a pilot program should be conducted in order to test the suggested framework in practice. Another possibility would be integrating the framework as a part of an ongoing program or a business function.

In addition, supplementary calculations of the costs of the matchmaking network should be estimated. The main reason for leaving the initial calculations out of the study is the lack of available references. It is also very difficult to predict the expansion pace of the network and organizations' will to participate.

10   REFERENCES

Afsarmanesh, H., Camarinha-Matos, L. & Ermilova, E. (2008) 'VBE Reference Framework' In: Camarinha-Matos, L., Afsarmanesh, H. & Ollus, M. (eds.) *Methods and Tools for Collaborative Networked Organizations.* New York: Springer. pp. 35-68.

Ahuja, G. (2000) 'The Duality of Collaboration: Inducements and Opportunities in the Formation of Interfirm Linkages'. *Strategic Management Journal,* 21 (3): 317-343. Retrieved from: EBSCOhost Database [Accessed on 31 March 2011]

Baldo, F., Rabelo, R. & Vallejos, R. (2009) 'A framework for selecting performance indicators for virtual organisation partners' search and selection'. *International Journal of Production Research*, 47 (17): 4737-4755. Retrieved from: ScienceDirect Database [Accessed on May 20 2011]

Barney, J. (1991) 'Firm Resources and Sustained Competitive Advantage'. *Journal of Management*, 17 (1): 99-120. Retrieved from: JSTOR Database [Accessed on 14 May 2011]

Barney, J. (2001) 'Is the Resource-Based "View" a Useful Perspective for Strategic Management Research? Yes'. *The Academy of Management Review*, 26, (1): 41-56. Retrieved from: JSTOR Database [Accessed on 14 May 2011]

Björk, J. & Magnusson, M. (2010) 'Where Do Good Innovation Ideas Come From? Exploring the Influence of Network Connectivity on Innovation Idea Quality'. *Journal of Product Innovation Management*, 26 (6): 662-670. Retrieved from EBSCOhost Database [Accessed on 2 April 2011]

Brown, E. & Edmond, A. (1994) 'Matchmaking for Venture Capital'. *Black Enterprise,* 24 (11): 48. Retrieved from: EBSCOhost Database [Accessed on 24 May 2011]

Camarinha-Matos, L., Afsarmanesh, H. (2006) ' Collaborative Networks Value creation in a knowledge society'. *Knowledge Enterprise: Intelligent Strategies in Product Design, Manufacturing, and Management*, 207: 26-40.

Camarinha-Matos, L., Afsarmanesh, H. (2007) 'A framework for virtual organization creation in a breeding environment'. *Annual Reviews in Control,* 31 (1): 119-135. Retrieved from ScienceDirect Database [Accessed on 7 May 2011]

Camarinha-Matos, L., Oliveira, A., Desar, D., Sesana, M., Molina, A., Baldo, F & Jarimo, T. (2008) 'VO Creation Assistance Services' In: Camarinha-Matos, L., Afsarmanesh, H. & Ollus, M. (eds.) *Methods and Tools for Collaborative Networked Organizations.* New York: Springer. pp. 155-190

Camarinha-Matos, L., Afsarmanesh, H. & Ollus, M. (eds.) (2008) *Methods and Tools for Collaborative Networked Organizations.* New York: Springer

Camarinha-Matos, L., Oliveira, A., Sesana, M., Galeano, N., Demsar, D., Baldo, F. & Jarimo, T. (2009) 'A framework for computer-assisted creation of dynamic virtual organisations'. *International Journal of Production Research*, 47 (17): 4661-4690. Retrieved from EBSCOhost Database [Accessed on 10 May 2011]

Dover, C. & Werngren, P. (2010) *Partner-to-Partner Networking: Partnering Maturity Model*. IDC [Electronic form]

Dumas, M., Benatallah, B., Russel, N. & Spork, M. (2004) 'A configurable matchmaking framework for electronic marketplaces'. Electronic Commerce Research and Applications 3: 95-106. Retrieved from ScienceDirect Database [Accessed on 24 May 2011]

Eisenhardt, K. & Schoonhoven, C. (1996) 'Resource-Based View of Strategic Alliance Formation: Strategic and Social Effects in Entrepreneurial Firms'. *Organization Science*, 7 (2): 136-150. Retrieved from JSTOR Database [Accessed on 14 May 2011]

Eisenmann, T., Parker, G. & Van Marshall, W. (2006) 'Strategies for Two-Sided Markets'. *Harvard Business Review,* 84 (10): 92-101. Retrieved from EBSCOhost Database [Accessed on 2 April 2011]

Fekete, A. (2010) 'Matchmaking Framework for B2B E-Marketplaces' *Informatica Economică,* 14 (4): 164-170. Retrieved from EBSCOhost Database |Accessed on 24 May 2011]

Filos, E. (2005) 'Virtuality and the Future of Organizations' In: Putnik, G. & Cunha, M. (eds.) *Virtual Enterprise Integration: Technological and Organizational Perspectives*. London: Idea Group Publishing

Fontenot, R. & Wilson, E. (1997) 'Relational Exchange A Review of Selected Models for a Prediction Matrix of Relationship Activities'. *Journal of Business Research*, 39: 5-12. Retrieved from ScienceDirect Database [Accessed on 13 May 2011]

Fornasiero, R. & Zangiacomi, A. (2004) 'Web Services for the Footwear Sector in a Networked Context'. *Virtual Enterprises and Collaborative Networks IFIP 18th World Computer Congress TC5 / WG5.5*, 149: 559-566. Retrieved from SpringerLink Database [Accessed on 11 May 2011]

Geringer, J. (1991) 'Strategic Determinants of Partner Selection Criteria in International Joint Ventures'. *Journal of International Business Studies*, 22 (1): 41-62. Retrieved from JSTOR Database [Accessed on 14 May 2011]

Granovetter, M. (1992) 'Economic Institutions as Social Constructions: A Framework for Analysis'. *Acta Sociologica,* 35 (1): 3-11. Retrieved from: EBSCOhost Database [Accessed on 1 April 2011]

Houran, J., Lange, R., Rentfrow, P. & Bruckner K. (2004) 'Do Online Matchmaking Tests Work? An Assessment of Preliminary Evidence for a Publicized 'Predictive Model of Marital Success''. *North American Journal of Psychology,* 6, (3): 507-526. Retrieved from: EBSCOhost Database [Accessed on 24 May 2011]

Jansson, K., Karvonen, I., Ollus, M. & Negretto, U. (2008) 'Governance and Management of Virtual Organizations' In: Camarinha-Matos, L., Afsarmanesh, H. & Ollus, M. (eds.) *Methods and Tools for Collaborative Networked Organizations.* New York: Springer. pp. 221-274.

Jarimo, T. & Pulkkinen, U. (2005) 'Programming Model for Agile Virtual Organization Creation' In: Camarinha-Matos, L. & Afsarmanesh, H. (eds.) *Collaborative networks and their breeding environments*. Boston: Springer. pp. 127-134

Kaihara, T. & Fuji, S. (2008) 'Game theoretic enterprise management in industrial collaborative networks with multi-agent systems'. *International Journal of Production Research,* 46 (5): 1297–1313. Retrieved from: EBSCOhost Database [Accessed on 11 May 2011]

Kauppila, O-P. (2011) *Creating Ambidexterity through Interorganizational Partnering.* Espoo: Aalto University

Klint, M. & Sjöberg, U. (2003) 'Towards a comprehensive SCP-model for analysing strategic networks/alliances'. *International Journal of Physical Distribution & Logistics Management,* 33 (5): 408-426. Retrieved from: ProQuest Database [Accessed on 31 March 2011]

Koka, B. & Prescott, J. (2008) 'Designing Alliance Networks: The Influence of Network Position, Environmental Change, and Strategy on Firm Performance'. *Strategic Management Journal,* 29: 639-661. Retrieved from EBSCOhost Database [Accessed on 1 April 2011]

Mullins, J. & Komisar, R. (2009) *Getting to Plan B – Breaking through to a Better Business Model.* Boston: Harvard Business Press

Nishioka, Y., Kasai, F. & Kamio, Y. (2003) 'A planning and scheduling integration platform for operational virtual enterprises'. *GLOBEMEN Book* [Online]. Available from: http://cic.vtt.fi/projects/globemen/book/index.html [Accessed on 11 May 2011]

Osterwalder, A. & Pigneur, Y. (2010) *Business Model Generation – A Handbook for Visionaries, Game Changers, and Challengers.* New York: Wiley

Penrose, E. (1959) *The Theory of the Growth of the Firm.* New York: Wiley

Podolny, J. (2001) 'Networks as the Pipes and Prisms of the Market'. *The American Journal of Socielogy,* 107 (1): 33-60. Retrieved from: JSTOR Database [Accessed on 1 April 2011]

Powell, W., Koput K. & Smith-Doerr, L. (1996) 'Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology'. *Administrative Science Quarterly,* 41 (1): 116-145. Retrieved from: EBSCOhost Database [Accessed on 1 April 2011]

Provan, K. & Kenis, P. (2008) 'Modes of Network Governance: Structure, Management, and Effectiveness'. *Journal of Public Administration Research & Theory,* 18 (2): 229-252. Retrieved from: EBSCOhost Database [Accessed on 31 March 2011]

Ragone, A., Straccia, U., Di Noia, T., Di Sciascio, E. & Donini, F. (2009) 'Fuzzy matchmaking in e-marketplaces of peer entities using Datalog'. *Fuzzy Sets and Systems,* 160: 251-268. Retrieved from: ScienceDirect Database [Accessed on 24 May 2011]

Rezgui, Y., Boddy, S., Wetherill, M. & Cooper G. (2011) 'Past, present and future of information and knowledge sharing in the construction industry: Towards semantic service-based e-construction?'. *Computer-aided Design*, 43: 502-515. Retrieved from: ScienceDirect Database [Accessed on 11 May 2011]

Romero, D. & Molina, A. (2010) ' Virtual organisation breeding environments toolkit: reference model, management framework and instantiation methodology'. *Production Planning & Control*, 21 (2): 181-217. Retrieved from EBSCOhost Database [Accessed on 7 May 2011]

Ruckstein, M., Suikkanen, J. & Tamminen, S. (2011) *Unohda innovointi: Keskity arvonluontiin* (Forget about innovation: Concentrate on value-creation). Helsinki: Sitra

Sitra (2005) *Suomi innovaatiotoiminnan kärkimaaksi – Kilpailukykyinen innovaatioympäristö -kehittämisohjelman loppuraportti.* (Finland to the top of innovation activity) Helsinki: Sitra

Ströbel, M. & Stolze, M. (2002) 'A Matchmaking Component for the Discovery of Agreement and Negotiation Spaces'. *Group Decision and Negotiation,* 11 (2): 165-181. Retrieved from ABI/INFORM Database [Accessed on 24 May 2011]

Stoica, M. & Ghilic-Micu, B. (n.d.) *Virtual Organization – Cybernetic Economic System. Modeling Partner Selection Process*. Available from: http://www.ecocyb.ase.ro/art2/Marian%20Stoica.pdf [Accessed on 14 May 2011]

Technopolis (2011a) *Technopolis Brochure.* Helsinki, Finland: Technopolis Plc

Technopolis (2011b) *Technopolis – Customer companies.* Available from: http://www.technopolis.fi/technopolis/customer_companies [Accessed on 6 May 2011]

Technopolis (2011c) *Perusesite.* (Registration document) Available from: http://www.technopolis.fi/sijoittajille/perusesite [Accessed on 11 June 2011]

Uzzi, B. (1997) 'Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness'. *Administrative Science Quarterly*, 41 (1): 35-67. Retrieved from EBSCOhost Database [Accessed on 1 April 2011]

Van der Valk, T. & Gijsbers, G. (2010) 'The use of social network analysis in innovation studies: Mapping actors and technologies'. *Management, Policy & Practice,* 12 (1): 5-17. Retrieved from: EBSCOhost Database [Accessed on 1 April 2011]

Varis, J. (2004) *Partner selection in knowledge intensive firms*. Lappeenranta: Digipaino

Wasserman, S. & Faust, K. (1994) *Social Network Analysis: Methods and Applications.* New York: Cambridge University Press

Watson, P. (2005) *Ideas: A History of Thought and Invention from Fire to Freud*. New York: HarperCollins

Westphal, I., Mulder, W. & Seifert, M. (2008) 'Supervision of Collaborative Processes in VOs' In: Camarinha-Matos, L., Afsarmanesh, H. & Ollus, M. (eds.) *Methods and Tools for Collaborative Networked Organizations.* New York: Springer. pp. 239-256

Westerlund, M. (2009) *Managing Networked Business Models: Essays in the Software Industry.* Helsinki: Helsinki School of Economics

Wu, N. & Su, P. (2005) 'Selection of partners in virtual enterprise paradigm'. *Robotics and Computer-Integrated Manufacturing*, 21: 119–131. Retrieved from ScienceDirect Database [Accessed on 11 May 2011]

Yin, R. (2003) *Case Study Research: Design and Methods*. Thousand Oaks: Sage

Interviews:

Okkola, M. (2011) Director, Developer and Platform Evangelism, Microsoft. Espoo. 6.7.2011

Pohjavirta, A. (2011) CEO, Ympyra. E-mail. 21.6.2011

Rouvinen, A. (2011) Business Development Manager, Fira. Vantaa. 16.6.2011

Salonen, P. (2011) CEO, TELLUS International. Skype. 28.7.2011

Uotila, M. (2011) Director of Technology Transfer Services, TEKEL (Finnish Science Park Association) / Enterprise Europe Network. Skype. 15.6.2011

11   LIST OF FIGURES

12   ATTACHMENTS

Attachment 1 – Interview structure in English (translated)

1. What kind of FINNISH companies that you seek to partner, collaborate or cooperate with are the most difficult to find? (size, branch, location…)

2. What kind of indicators you look into in a company when you're seeking to partner, collaborate or cooperate?

3. Imagine that you're seeking a collaborative counterpart to participate in a big project. Please put the following performance indicators of the potential counterpart into a descending order of importance (from highest to lowest level of importance, each row is the same indicator):

-Perceived management skills
-Perceived employee technical know-how
-References, completed products and projects
-Patents and trademarks
-Low costs
-Financial resources, financing, capital
-Perceived reputation
-Swiftness, effectiveness
-Flexibility, adaptability
-Possibility to a longer-term partnership

Is there other performance indicators in your opinion that should be considered?

4. How do you feel about the idea that your customer acquisition management would be partly or fully outsourced?

Attachment 2 – Interview structure in Finnish (original)

1. Minkä tyyppisiä suomalaisia yrityksiä, joiden kanssa haluaisitte tehdä yhteistyötä, on vaikein löytää? (koko, ala, sijainti…)

2. Mitä ominaisuuksia katsotte yrityksissä, joiden kanssa harkitsette tekevänne yhteistyötä?

3. Laita järjestykseen seuraavat yrityksen suoritustasoa kuvaavat indikaattorit, joiden kanssa hypoteettisesti harkitsisitte yhteistyötä (tärkeimmästä vähiten tärkeään):

Liikevaihto/Resurssit

Johdon pätevyys (perceived management skills)

Henkilöstön/tekninen pätevyys (perceived employees, technical know-how)

Referenssit, tehdyt tuotteet ja projektit (References, completed products and projects)

Patentit/tuotemerkit (patents/trademarks)

Alhainen kustannustaso (low costs)

Taloudelliset resurssit, rahoitus, pääoma (financial resources, financing, capital)

Maine (perceived reputation)

Nopeus, tehokkuus (swiftness, effectiveness)

Joustavuus (Flexibility, adaptability)

Kumppanuuden pitkäaikaisuus (longer term partnership/collaboration)

Puuttuuko listasta mielestäsi jokin tärkeä indikaattori?

4. Miltä tuntuu ajatus asiakkaiden hankinnan ulkoistamisesta?