D3.3.2.2 New Value Network Profiles for Open Data

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Johdon yhteenveto

Avoin data murtaa perinteiset tiedon kulutuksen ja -julkaisun perinteet, niin valtiollisella kuin yksityiselläkin puolella. Valtion yksiköt ja muut viranomaiset avaavat valtavia määriä lakitekstejä, tilastotietoa, liikennedataa, terveysdataa, jne. Nämä uudet tietolähteet tarjoavat tapoja rikastaa mediasisältöä, esimerkiksi reaaliaikaisilla datavirroilla, visualisalisoinneilla tai paikka- ja tilanneriippuvalla tiedolla. Samalla kun uusia datalähteitä avataan, on myös uusia palveluja ja sovelluksia nähtävissä useilla alueilla. Olemme todistamassa ennennäkemätöntä median digitalisoitumista ja journalististen käytäntöjen muutosta.

Tässä dokumentissa raportoimme miten nämä trendit liittyvät yhteen. Laajan suomalaisen kenttätutkimuksen ja siihen pohjautuvan liiketoimintamallianalyysin avulla identifioimme miten alan edelläkävijät ovat muodostaneet liiketoimintansa, missä roolissa he toimivat avoimen datan arvoverkostossa ja mitkä ovat heidän pääasialliset tulonlähteet. Toisin sanoen, kuvailimme miten suomalaiset avoimen datan tienraivaajat näkevät uuden markkinapaikan.

Tuloksena löysimme joukon yrityksiä, jotka toimivat hyvin erilaisilla liiketoimintamalleilla. Ryhmittelimme nämä yritykset avoimen datan arvoverkkoon neljän profiilin alle. Nämä profiilit ovat (1) raakadatan käsittelijät (2) datan analysoijat (3) loppukäyttäjän käyttökokemuksen tarjoajat ja (4) kaupalliset datan avaajat. Nämä neljä profiilia pohjautuvat aikaisempaan akateemiseen taustatyöhön.

Tutkimuksen perusteella voimme sanoa, että yleisesti ottaen avoimen datan kaupallinen hyödyntäminen Suomessa on edelleen lapsenkengissä. Silti muutamia loistavia esimerkkejä kaupallisesta menestyksestä on nähtävissä, kuten oman datan analysointia joukkoistamalla saavutetut kustannussäästöt, tai julkisen datan laajamittainen käsittely ja analysointi kehittyneillä algoritmeilla. Lisäksi löysimme joukon pienyrityksiä, jotka ovat vasta rakentamassa liiketoimintaa avoimen datan ympärille. Tulevaisuus näyttää miten nämä toimijat kasvavat, ja edesauttavatko he avointa dataa lunastamaan sen ympärille rakentuneet odotukset.

Executive Summary

The trend of opening up government and private data transforms how data is supplied and consumed. We can observe new services and applications in many areas as the available amount of open data grows. Governmental units and other authorities are opening vast data resources concerning legal documents, governmental statistics, geographical data, traffic data, health data, etc. These open data sources can provide unprecedented ways for enriching media with live data streams, advanced visualizations and context and location dependent information.

At the same time, we are also witnessing unforeseen digitalization of the media landscape and changes in journalistic practice. Based on extensive fieldwork of the Finnish software landscape, we report how these trends come together. We identify through business model analysis who are the pioneer actors, how do they build their businesses, what are their roles in the value network and what are their main sources of revenue? In short: how do the Finnish open data business frontrunners view the emerging new marketplace?

As a result, we have identified a series of companies operating with very diverse business models. We grouped these companies under four profiles in an open data value network. These profiles are (1) extract and transform, (2) data analysers, (3) user experience providers, and (4) commercial data openers. These four profiles are founded on a theoretical framework established by previous academic papers.

We can conclude that the open data related industry in Finland is still very immature, but nevertheless there are some good commercial success stories to be found. Some companies have achieved costs savings by opening their own data, and by utilizing crowd sourcing to analyse it. Another big business is public data extraction and analysis with advanced algorithms and models. In addition, we found a range of start-ups and micro-companies opening their businesses in the field of open data. It remains to be seen, how these small players can grow in the coming years, and whether they will redeem the promises made by the open data.

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3   List of Acronyms and Abbreviations

A4F	Apps 4 Finland (pronounced "apps for Finland")
API	Application programming interface
HTTP	Hypertext Transfer Protocol
M2M	Machine-to-machine
RDF	Resource Description Framework
URI	Uniform Resource Identifier

4 Introduction

4.1 Purpose of this study

Open data is high on the managerial agenda in the media industry. The promises of increased transparency and new high-quality services are attracting developers, managers and business people (Poikola et. al, 2010; Kuk&Davies, 2011). Governments and cities all over the world are considering what data sets to open and what the opening would mean for the society.

The purpose of this study is to analyse the open data phenomena from a business model perspective. These business models draw an outline of how the open data ecosystem works, including what kind of players there are and what are the main revenue sources. As hobbyists and other enthusiasts largely provide current open data services and applications, it is crucial to understand what kind of sustainable businesses can be built on top of open data. If the revenue logics and business models are not viable, most services will have a short life span and the ecosystem will die. Thus it is vital for aggregators and data consumers to understand how the data providers can survive and even flourish.

The most important contribution of this paper is the empirical part, where a dozen of Finnish companies dealing with open data are interviewed and analysed. We grouped these companies under four value network profiles; extract & transform, data analysers, user experience providers, and commercial data openers. Going into further detail, within these profiles we found eight distinct business models, on which they are operating.

4.2 Structure of the study

The structure of the study is the following. In Chapter 5 we discuss the definition of open data in general and how we interpret it the business context of this paper. In this chapter we also look into previous research on business models and on media's relation to open data. This literature review builds the framework of the study. In Chapter 6 we describe our methodology and fieldwork. Chapter 7 describes the findings of the fieldwork, namely the different value network profiles. In Chapter 8, the accompanying business models and example case companies are described. And finally in Chapter 9 we draw conclusions of the results.

5 Overview of the open data and business models

5.1 Open data

Open data is defined by the Open Knowledge Foundation as being accessible as a whole, free-of-charge or at most with a reasonable reproduction costs,

redistributable, reusable, in a data format which doesn't cause technological obstacles, and without discrimination against persons or groups nor against any particular fields of endeavor (Open Definition). This definition is very popular, and it is utilized e.g. in a landmark Finnish book training to open data (Poikola, Kola, & Hintikka, 2010).

In addition to availability and licensing issues, there is also a technical dimension in the data openness. Tim Berners-Lee in his (2006) W3C paper outlines the concept of linked open data. Linked data is constructed to include relations to other linked data, thus forming a mesh of interrelated data. According to Berners-Lee, in order to create linked data; the data should use HTTP URIs as names for things; it should provide the information in a standardized technical format, such as Resource Description Framework (RDF); and it should contain links to other URIs. These universal references to other linked data make it easier to combine larger sets of data from several different sources together. In 2010 he updated his paper to include a 5-point starring scheme in order to encourage government data officers to open their data sets, and perhaps to even compete with their level of data openness.

5.2   Business model elements

There is a wealth of academic work done in the field of business models. Despite the different views between these authors, the prior research has achieved a consensus that business model is a conceptual and theoretical layer between strategy and business processes (Rajala, 2009).

One of the most known authors is Alexander Osterwalder, who is his (2010) book outlines a business model canvas with nine elements to help entrepreneurs better design their operations. This approach is, however, more aimed for business model innovation and is very general in nature.

In this study we decided to utilize a more software specific business model definition. Rajala, in his (2009) dissertation, has done an extensive work studying the advancement of the business model definition from a software business perspective. In his work (ibid.), Rajala defines business model as "a concise representation of how an interrelated set of elements – the offering, relationships, resources, revenue model and management mind-set – are addressed to create and capture value in defined markets".

Rajala proposes that these interrelated elements can be analysed separately, in order to make sense of the company's operations. Rajala defines these elements as following (Figure 1):

- Offering is a value proposition that a software firm offers its customers and other stakeholders, and with which it positions itself in the market.

- Resources are the assets and capabilities that are needed to develop and implement a given business model. They can be tangible (personnel, equipment, etc.) or intangible (brand name, relationships, etc.). In essence,

they are the internal source of advantage, or the core competency of a company.

- Relationships are the means to access external resources and capabilities.

- Revenue model includes the revenue sources, pricing policy, cost structure, and revenue velocity. It is the firm's means to capture value out of its offerings.

- Management mind-set distinguishes business model as something that stems from the values, emotions, and attitudes of management; instead of cognitive, rational thinking and planning.
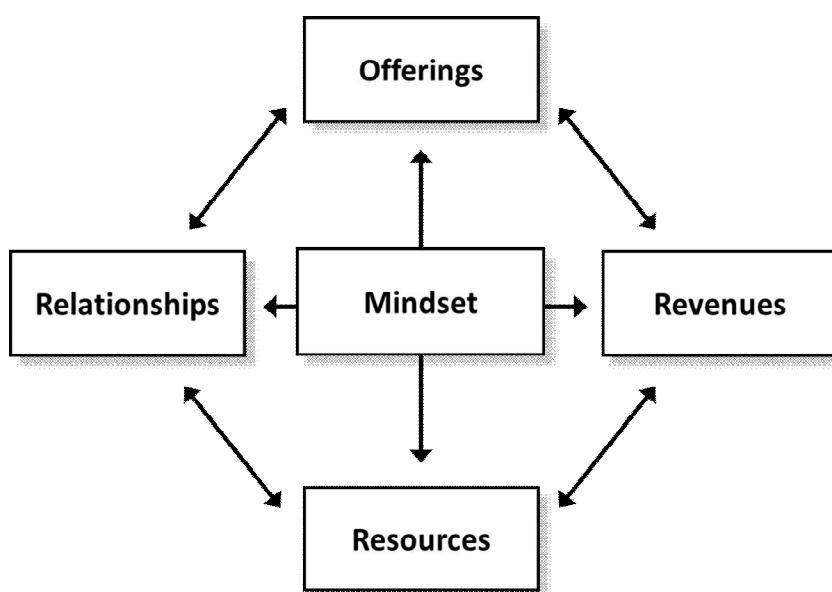
Figure 1 Business model elements as defined by Rajala (2009)

In this study we will use Rajala's business model elements as a basis for studying the open data companies.

5.3   Open data business models in research

There is some academic work done also from the business models and value chains relating to open data. Latif et al. in their (2009) conference paper depict a linked data value chain which has four entities: raw data provider, linked data provider, linked data application provider and end-user (Figure 2). Raw data provider publishes raw data, linked data producer utilizes the raw data to produce the linked data, and finally the application provider utilizes the linked data to produce a valuable application for the end-user, respectively. (Latif, Saeed, Hoefler, & Stocker, 2009)
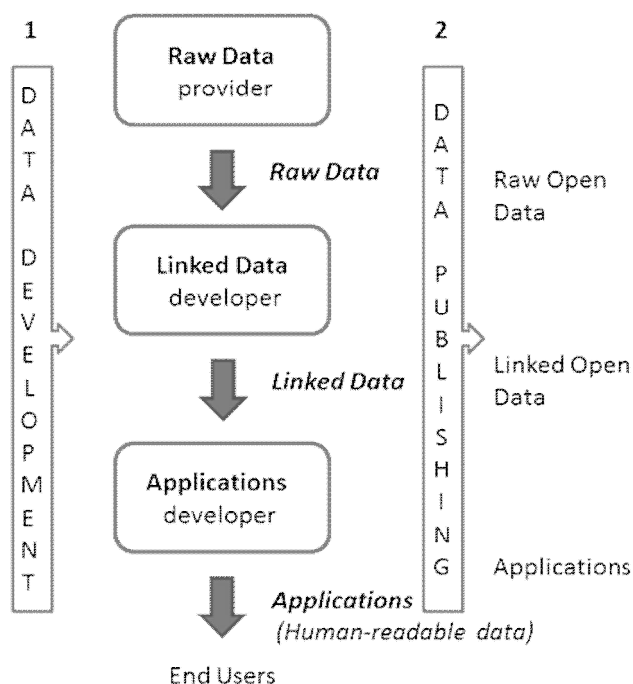
Figure 2 Linked data value chain, adopted from Latif et al. (2009)

There are several possible roles in open data chain as shown in the model of data development (Figure 2). All of these phases are aimed at improving overall data use in the later phases of the chain. The tasks solved in each stage vary, and consequently the value capturing techniques that are needed to sustain the actors business vary as well.

Tammisto et al. (2011) have conducted research on the roles of the linked data developers and application developers in Finnish context. Their findings indicate that consulting on the different phases was one extra source of revenue (Figure 3)
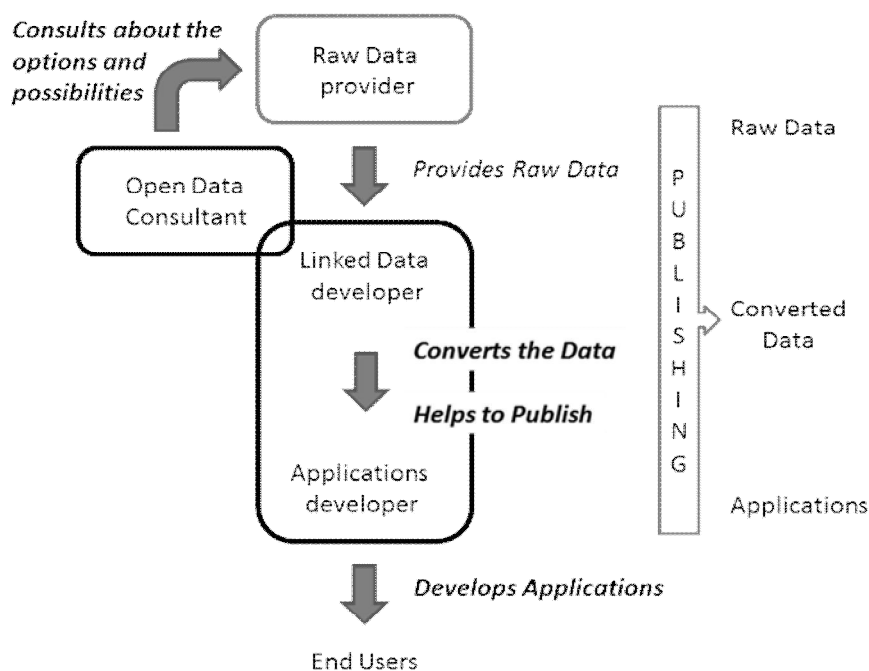
Figure 3 Linked data value chain, adopted from Y. Tammisto and J. Lindman (2011)

According to Tammisto et al. (2011), the main revenue sources of their organizations in open data related activities were: Consulting raw data providers about the possibilities of developing and publishing their data, transforming the data into linked open data, and developing applications on top of the data. Along performing these three activities of data development, data service providers also help data providers to publish the data, which can happen at any stage of data development (Figure 3). Data development process can include an additional stage – "data filtering" that refers to removing the pieces of data that contain private and other sensitive information from the datasets before publishing.

Poikola et al. in their (2010) book list 10 roles in the open data value chain. Seven of these roles are considered from the data publishing perspective, and freely translated from Finnish they are: Data recorder, data refiner, data aggregator, data harmonizer, data updater, data publisher, and registry maintainer. In addition, they see three end-users for the data: Application developer utilizing the data as part of his service; data interpreter utilizing data in his research, commercial, or democratic activities; and finally a human, a company, or an organization as an end-user utilizing these applications or interpretations. (Poikola et al., 2010)

Compared to Tammisto (2011), Poikola et al. have used finer grain in their value network representation. In addition to the roles mentioned by Tammisto et al, Poikola mentions also data updater, registry maintainer, data aggregator, data harmonizer, and data interpreter as an end-user. Some of these roles could be seen to be included in the Tammisto's (2011) value network as well, depending on the exact definition. Tammisto, on the other hand, pays emphasis on consultancy companies' role in the value network as an adviser, especially in the phases relating to data publishing.

Some minor definitional differences aside, however, the value networks proposed by Tammisto (2011) and Poikola (2010) include very similar roles. In this study we will utilize the work done by Tammisto and Poikola as a basis, when we outline the different profiles in the value network we found during the interviews.

5.4 Open data definition in this paper

The open data definition of Chapter 5.1 is problematic from the perspective of this paper, since we want to study the business perspective of the opening the data. Many of the interviews revealed that the utilized data wasn't necessary free of charge. Some companies had scraped the data from websites, which didn't explicitly allow re-use of the data. Others had combined free and commercial data together. In one case, the company had distributed their data against a fee, or with an otherwise limited license. Nevertheless, in this study we considered all of these companies to be operating with open data.

In reality, some of these companies operated with commercial or partly-commercial data, sometimes even without an explicit legal permission of the data owner. However, often the usage of the data had ultimately led to a situation where the data owner changed its position on the data re-usage, and was more willing to open its data sets. This do-it-yourself or even hacker-type of activism is very common in the open data community, and since it also has business consequences, it should be included in this study.

Thus, in order to include these cases, we will utilize a broader definition of the open data. In this paper, we understand open data as:

> *Data, which is accessible through Internet in a machine readable format. It doesn't necessary have to be completely free of charge or free or licenses, but it should allow experimenting with the data, and even running a small-scale-business without restrictions. Technically the data can be in a linked- or in any other machine readable format.*

Machine readable, in this context, means any format, which is readable by a computer. This includes, for example, comma-separated values (.csv), Excel spread sheet (.xls), or even PC-axis (.px) formats. In addition, all websites and text documents are considered machine readable as well. However, a scanned paper document (.pdf) or any image are not machine readable, because a computer can only show these files, but cannot easily make sense of its contents.

This definition is a bit different than adapted by Poikola et al. (2010), but it is very useful in the context of this paper since we wish to map out the business consequences of open data.

5.5 Open data and media business

In media context, open data is usually related in to data journalism. Data journalism utilizes public information sources in enhancing articles and even creating new article ideas. Sirkkunen et al. in their *Trends in data journalism*

(2011) report state, that reporters at US daily newspapers routinely turn to local, state and federal government websites to hunt for data that they can use in their stories. The journalists see data journalism as a way to find hidden stories and to increase transparency in the journalistic process. Sirkkunen says that news organizations are searching for sustainable business models to support data journalism. Many have visions of becoming a number-one data store.

P. Lehtonen in her (2011) report *Open data in Finland – Public sector perspectives on open data* sees that the role of media in the open data ecosystem is to work as a mediator. Media was seen to gather and filter diverse information, and then winnow out the parts serving the needs of public. The benefit of open data was seen on the one hand to provide better and more reliable stories; and on the other hand to improve transparency in journalism, administration and decision making. In addition, Lehtonen also proposes that media could open its own data for wider re-use.

The idea of media as a data publisher was taken onwards in the report by Sirkkunen et al. (2011). They describe a data hub model (Figure 4), originally presented by Nicholas Kayser-Bril (2011), where the media house collects data from different sources and makes them accessible to outside end-users, developers and organizations interested in data. The data should be open for re-use through application user interfaces (API). According to an article by Lorenz, Kayser-Bril, and McGhee (2011), by becoming this hub of data, media companies would turn themselves into a center of trusted data, able to do complex analysis. Lorenz et al. propose that instead of "attention market", media should think themselves to be at "trust market".
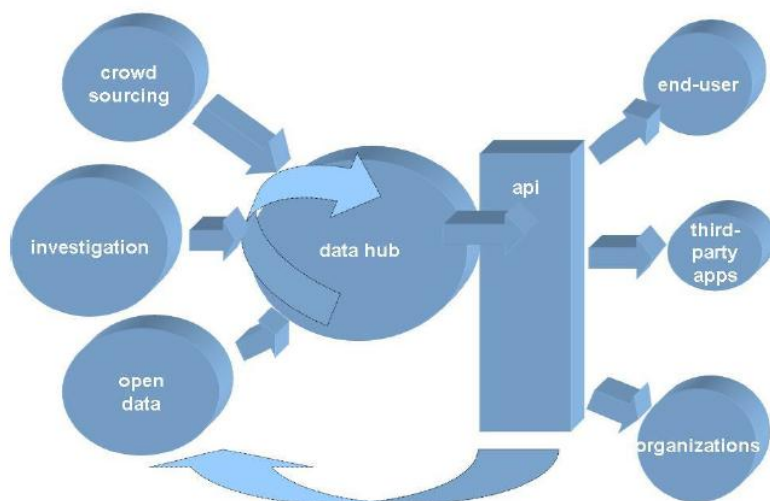

Figure 4 Data hub model adopted from Sirkkunen (2011), originally presented by Kayser-Bril (2011)

6 Interviews

In order to find what business models the open data companies are utilizing in Finland, a set of interviews was conducted. The idea was to interview companies, which core business would somehow be based on open data. To find these companies, Apps 4 Finland competition was taken as a starting point.

Apps 4 Finland (A4F) is an application contest run by Forum Virium, which aims to encourage developers to create new applications for open data. The contest has been orchestrated three times, and the amount of submissions has increased yearly. The first competition in 2009 received 23 submissions, whereas in 2011 already 140 different applications were received. The 2011 competition had four categories for the submissions: Visualization, Data opening, Application, and Concept.

6.1 Selecting the companies

There were too many submissions to analyse everyone, so we focused on finding developers, who would have continued the development of their idea and founded a company around it. When searching through the submissions, the concept-category was omitted because it contained idea-level submissions, and not actual working applications or visualizations.

In the A4F contest years 2009, 2010 and 2011 there were altogether 193 submissions posted. Out of the 193 submissions, we found 29 works which development had been continued. From these, 17 had any business activity. Six of these works were developed by Flo Apps Oy and two by Hahmota Oy, thus giving 11 separate companies. These 11 companies are the main focus of this study, and they were contacted. Three companies didn't answer to our inquiry and one refused, thus seven companies were interviewed out of the 193 original submissions. These seven companies filled the requirements of continued development and business intentions. See Figure 5 for an overview of the process.

Figure 5 Apps 4 Finland submission research process

To make sure we are interviewing the right people, a snowball sampling-technique was also used. In the snowball sampling we ask each interviewee who else should be interview. In addition, Ville Meloni, an open data expert and one of the organizers of the A4F contest from ForumVirium, was interviewed and asked for guidance in selecting the right interview subjects. The full list of interviewed companies, contact persons and interview date is given below in Table 1. The

"FROM" field in Table 1 indicates from where we got the interview lead; from Apps 4 Finland contest, Ville Meloni or snowball sampling.

#	A4F SUBMISSION	COMPANY	CONTACT PERSON	INTERVIEW DATE	FROM
1	soRvi- avoimen datan työkalupakki R-kielelle	-	Leo Lahti, Co-founder	9.3.2012	Snowball sampling
2	Suomen kansantaloudellinen Elämänpuu	Hahmota Oy	Peter Tattersall, CEO	29.3.2012	A4F 2011
3	Reitit for iPhone	Yes	Pasi Kolkkala, Software developer	30.3.2012	A4F 2011
4	Hilmappi.fi - Implementation read more	Gemilo Oy	Arto Liukkonen, Social network developer	30.3.2012	A4F 2009
5	Duunitori.fi	Skyhood Oy	Thomas Grönholm, CEO	3.4.2012	A4F 2010
6	Pikkuparlamentti.fi	Forum Innovations Oy	Jaakko Hilke	4.4.2012	A4F 2010
7	Mitä mukaan lennolle - hakupalvelu	Suomen Turvaprojektit Oy	Panu Häikiö, CEO	23.4.2012	A4F 2011
8	-	Cloud'N'Sci Ltd	Pauli Misikangas, CEO	24.4.2012	Ville Meloni
9	-	Essentia Solutions Oy	Markus Halttunen, CEO	24.4.2012	Snowball sampling
10	Kansanmuisti.fi	KAMU Ry	Juha Yrjölä, Chairman of the association	25.5.2012	Snowball sampling
11	-	Logica	Jukka Ahtikari, Development Director	4.5.2012	Ville Meloni
12	Several	Flo-Apps Oy	Tapio Nurminen, CEO	22.5.2012	A4F 2011
13	-	Suomen Asiakastieto Oy	Heikki Koivula, Director	22.5.2012	Ville Meloni
14	-	Helsingin Seudun Liikenne	Jari Honkonen, Project manager	28.5.2012	Snowball sampling

Table 1 List of interviewed companies

6.2 Interview process and questions

The purpose of the interviews was to define on what business model each of the company was operating with. As we discussed in Section 5.2, the business model can be broken down to five interlinked elements. These elements are the offering, the resources, the relationships, the revenue model, and the management mind-set. Thus, the interview questions were written to reflect these five aspects of the business model. A full list of interview questions can be found in the Appendix A.

The interview technique was an open-ended interview. The idea of an open-ended interview is to make general enough questions to not lead the interviewee into a predefined conclusion. They also leave room for unexpected answers. In general, the interview questions were used more as a backbone for the discussion, and not as a question-quoted answer type of conversation. The questions required also some adaptation to situation, because the companies varied quite a lot in size. The smallest companies were one-man endeavours and the largest a 4.5 billion euro corporation.

Most of the interviews were recorded with a portable recorder for further reference. During the interviews, written notes were also taken to cover the most important answers. In addition, an interview diary was kept during the entire interview process to shelter more general thoughts from each interview. The interviews were conducted between 9th of March and 28th of May, 2012. Most were done face-to-face, but two had to be done over a Skype-call and one over e-mail due to logistical problems. Each interview took between one to one and half hour of time.

7   Value network profiles

In this chapter we will present the profiles of the interviewed companies in a media-oriented value network. These profiles are based on the earlier work done by Poikola (2010), Tammisto (2011), and Lehtonen (2011). The process of defining the profiles started by first conducting the interviews, then analysing the business model each company is utilizing, and finally when we had a broad view of the whole business field, we categorized the companies under four distinctive profiles in the value network.

Each of these profiles has its own way of adding value on top of the raw data. Namely, the four profiles are (1) extract & transform, (2) data analysers, (3) mobile & web user experience providers, and (4) commercial open data publishers. These are sketched in the value network in Figure 6 from the media perspective. To highlight the new value network profiles, they are coloured green in the figure.

In addition to these four value adding profiles, an important role in the open data ecosystem is that of the public information publisher, marked as "open data" in the Figure 6, respectively. This includes the governmental, communal, and other public sector information sources.

We will next describe each of these value network players in a greater detail, and in Chapter 8 we will drill in further by examining particular business case examples within each of these profiles.
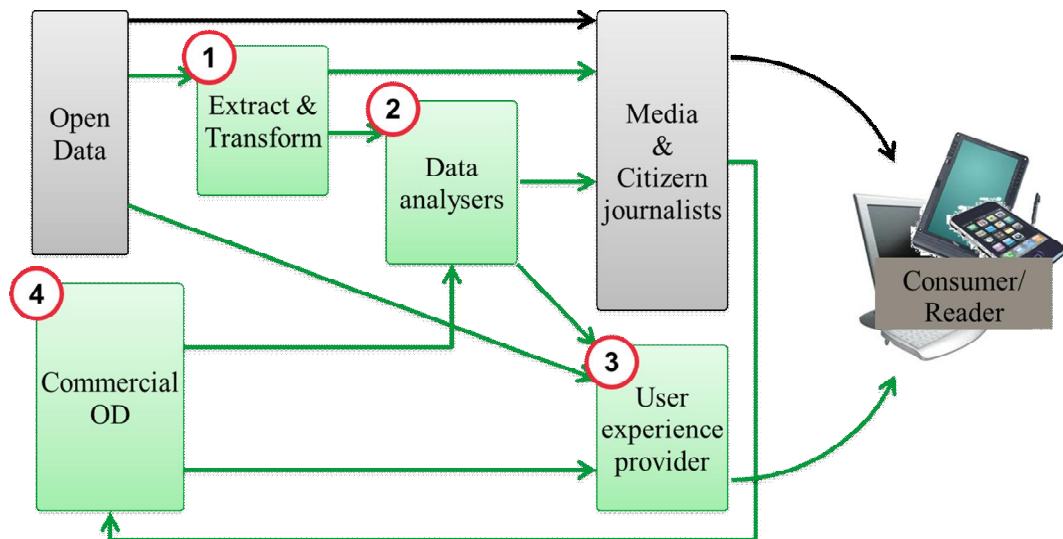
Figure 6 Open data value network profiles in media context

7.1 Extract and transform

In order for the raw data to be analysed onwards, it must be available in a format allowing easy processing and handling. Sometimes the raw data must be first administered in order to ensure its integrity. The data might include double records, missing information or otherwise incorrect information. In addition, the raw data is published in a number of different forms, ranging from Excel files to proprietary formats, which are not necessary compatible with each other.

In order to cross-analyse the data from different sources, the data must be in the same format and in the same scale. This doesn't happen automatically, as the different government bureaus, for example, do not necessary coordinate their data publishing activities. Thus, in order to combine several data sources, someone has to extract the data from its original sources and transform it in to a meaningful format, allowing further analysis. This is the value adding functionality of the "extract and transform" –value network entity. To be clear, this entity doesn't do any analysis for the data, just extraction, administration and transformation tasks.

7.2 Data analysers

Data analysers are an obvious part of the value network. We found multiple kinds of data analysers in the interviews. Some were analysing the data to create new visualisations, others were cross-analysing different data sources with advanced algorithms in order to provide valuable knowledge. Some analysers did their job pro-bono, only to serve the common good. It is also possible to encourage and facilitate this volunteer data analysing community to do analysis on a preferred topic, as the HS Open case will show in Chapter 8.5.2.

Depending on the case, the analysers might utilize public data, private data, or both. Sometimes the data is brought to the analysers by the customer, wishing the

analyser would make visualisations out of it. If the data is not available in a transformed and meaningful format, the analysers need to extract the data from its original source and transform it by themselves. Therefore, sometimes the analysers need perform the tasks of the extract & transform entity in the value network.

7.3   User experience providers

User experience providers are the only entity directly in contact with end-users. The core idea is to utilize open data sources to create a valuable application for the end-users. The interaction can be done either through a mobile or a web user interface. As we will see in Chapter 8.2, there can are many different revenue models for this player.

As with data analysers, sometimes the user experience providers also need to extract the data from its original source. In addition, they often process and analyse the data as well, so it is possible for the user experience-entity to perform three types of activities in the value network. However, they are still easy to recognize, as they are the only entity having a direct contact with the end-user.

7.4   Commercial open data publishers

The commercial data publishers are especially interesting, because they bring a new horizon in the open data business – instead of using the data the public open data publishers have released, a company can also publish its own resources to the world, and achieve business benefits in doing so.

If private companies publish the data for commercial purposes, it is, however, in contradiction with the open data definition which states that the data should be free of restricting licenses and permitting unlimited commercial re-use (Open Definition; Poikola et al., 2010). Thus, commercially released data doesn't fully comply with open data definition. But as we discussed in Chapter 5.4, it is nevertheless an important element when considering the open data value network from the business perspective.

In Finland there are yet little examples of truly commercial data publications. In the world, The Guardian's Open Platform is a good example of commercially published "open data". Open platform lets developers utilize The Guardian's articles in a controlled fashion with the help of a three tier-system. The first tier lets the developers access the headlines, but not the article body. The second tier, which requires registration and an API key provided by The Guardian, grants the developers a full access to the article body as well. In both cases, the usage of the data costs nothing for the developers, and they can keep all the profits from their commercial activities. The only catch is that the developer is required to show The Guardian's advertisements in the article body. The third tier offers ad-free access to all The Guardian's content, but requires a contract with the newspaper. (The Guardian Open Platform website)

8 Business models

In this chapter we will examine the value network profiles in a greater detail by introducing eight business models. These business models were identified during the research process, and all the material was collected with the interviews made for this project. However, since there were only 14 interviews, many of the business models are based on only one real-life example. In addition, the open data-related industry in Finland is still very young. Thus, it is dangerous to make too strong generalizations based on this material. However, it still gives a summary of what kinds of business models are currently employed on the Finnish market.

8.1 Crowd-sourced client development

8.1.1 General description

A company can achieve remarkable savings by, in effect, outsourcing the client development to third party developers. One of the best known examples proving these benefits comes from the HSL Reittiopas journey planner API case, which we will describe below.

8.1.2 Case HSL Reittiopas

Reittiopas is a popular Finnish service, giving a point-to-point public transport instructions within the Helsinki-region for over 150 000 daily users. Reittiopas is a free service offered by HSL (Helsinki Regional Transport Authority), which runs the commuter traffic service in the greater Helsinki region. However, the service is officially available only through a web-browser interface, which is clumsy to use with mobile phones while on the move. No official mobile applications have been made. To issue this problem, HSL opened the Reittiopas API for 3rd party developer usage in 2009.

After opening the API for the public in 2009, the developers have been very interested about it. According to a project manager from HSL, as of May 2012, over 650 developers have already registered to get access to the API. HSL is listing over 30 completed third-party applications utilizing the API in their webpage (HSL Palvelut muissa kanavissa). The HSL project manager admits that developing and updating similar service offering for this amount of platforms would have been in practise impossible task for HSL to do in-house.

One of the most known applications is ReittiGPS by Essentia Solutions Oy, providing a native iPhone application for the journey planner service. The CEO of Essentia Solutions said the project was started in 2008 to satisfy the founder's personal need of checking the public transportation schedule easier on the road. At that time there wasn't yet a public API released from HSL, so the information had to be scraped from the HSL website. ReittiGPS was among the first applications to show journey planner information in a native mobile client

combined with GPS coordinates from the mobile phone's GPS receiver. (CEO, Essentia Solutions Oy)

The popularity and success of ReittiGPS was a strong indicator for HSL, that it might be worthwhile to release the API for the third-party developers. Quickly after HSL released the API, other similar applications started to emerge. Thus, although ReittiGPS sprang up without support from HSL, the official API release lowered the bar and encouraged several developers to create their own version of the mobile journey planner.

These new applications have increased competition and brought innovation to the marketplace. The newcomers forced the incumbent ReittiGPS to implement new features as well. A good example is when Reitit for iPhone integrated the Helsinki service guide interface in the application, ReittiGPS had to implement it as well. (CEO, Essentia Solutions; Software developer, Reitit for iPhone)

The increased competition has even started a price war in the Apple Appstore. In the interview with Essentia Solutions, the CEO said that they had to answer the increased price pressure by dropping ReittiGPS price from 4 €to 3 € The respondent from Reitit for iPhone said that they purposely challenged the incumbent ReittiGPS by carefully pricing the client at approximately 2.5 €

The respondent from HSL says that after releasing the API in 2009, they have continuously improved it to better answer the needs of the third-party developers. In 2011 HSL organized their own developer challenge, HSL Mobiilikisa, which invited people to innovate new uses for the API. HSL received 60 submissions in their contest, out of which 8 were rewarded (HSL Mobiilikisa).

8.2 Create valuable user experience

8.2.1 General description

The idea is to utilize and combine different sources of data, both public and commercial, in order to create an eye-catching user experience where the raw data has been enriched and made valuable for the end-user. The experience can be offered either through a website or a mobile application.

We found three revenue models for the user experience providers; advertisement, subscription or one-time fee, and crowd funded.

8.2.2 Advertisement

A good example of an advertisement-based business is Duunitori.fi by Skyhood Oy, which scrapes job openings from the government's mol.fi website, plots them on a map, and enriches them with data from several sources, including Tilastokeskus, Reittiopas, Yritystele, Great Place to Work, Facebook, etc. The result is an interesting mash-up of data fetched from different sources, offering jobseekers a hub to find all the relevant information from the employer with the

job opening. Duunitori.fi is a great example of the data hub model Sirkkunen et al. re-presented in their (2011) report, albeit it is lacking an API to let developers to re-use the information.

The revenue model is based on advertisements, the more visitors the page attracts the more advertisement revenues are possible. In addition, the company is doing custom advertisement campaigns with key partners, offering them increased visibility.

8.2.3   Subscription or one-time fee

Another popular revenue model is to collect the money either with subscriptions or by one-time fees from the end-users. For example, ReittiGPS is selling the client through Apple Appstore with approximately 3 euro price tag and Reitit for iPhone is selling its app for 2.5 euros in the same marketplace. This fee entitles to unlimited usage and updates.

However, although these applications are making revenue for their creators, both developers stated in the interviews that the revenue is not enough to quit their day jobs. Thus, although these have been popular applications in the Finnish Appstore, the income from the Finnish market is not enough to support full-time employment.

Hilmappi from Gemilo Oy is an example of subscription based pricing. They utilize the HILMA database of public procurement announcements offered by the Ministry of Employment and the Economy. Gemilo's Hilmappi offers a better user interface in to these announcements, plotting them on the map and offering tools to manage and tag the procurements. Accorging to a social network developer from Gemilo Oy, their user interface can save customers time remarkably. The respondent said that while their own workers used to spend 30 minutes daily just to browse the new HILMA announcements, they are now performing the same task in about 5 minutes. Gemilo Oy sells Hilmappi to customers with 50 €annual subscription fee.

8.2.4   Crowd-funded

In Finland, crowd-funding is still in its very early stages. This is largely due to a strict Finnish law about collecting funding from the crowds. The Money Collection Act 31.3.2006/255 dictates, that in order to arrange a money collection activity in which the money is collected by appealing to the public, a money collection permit needs to be acquired. The permit is granted only for non-profit purposes, thus completely outlining e.g. Kickstarter-type commercial crowd-funding activities in Finland. (Finlex 31.3.2006/255)

However, one early example of a crowd-funded project in Finland was found. Kansanmuisti.fi is a journalistic website helping citizens to follow parliament activity with the help of public information sources in a non-partisan way. In their website they state that their mission is to

"provide citizens with the opportunity to track parliamentary performance in an easily understandable and politically transparent fashion. Kamu collects information about the voting behavior of the MPs, members' statements made at plenary sessions (full-sitting sessions of parliament), as well as members' proposal of initiatives, and election funding." (KAMU Ry background)

In their rules the association states that they collect donations, heritages, and grants to fund their activities (KAMU Ry rules). However, in a discussion on 25.4.2012 with the Chairman of KAMU Ry, he stated that at the moment most of their income comes from speaker fees, not donations. Thus, they have still a long way ahead of them to reach a truly crowd-funded status, and only time will show if Kansanmuisti.fi will grow to be the first journalistic website funded by the crowds in Finland.

8.3 Create visualizations

8.3.1 General description

Data visualizations are an obvious part of the open data value network. Visualization is an efficient way to communicate the key points of the data for the masses. For a typical end-user, the raw data is basically worthless without an appealing interpretation of it.

Data visualizations are typically associated with data journalism. Data journalism is a form of reporting, which derives its article ideas from visualization of data. In Finland the commercial market for these data visualizations is basically non-existent. In the realm of journalistic photographs there is STT-Lehtikuva, which is a photo agency connecting professional photographers to the media buying these photographs. But for data visualizations, there has not emerged a similar marketplace to sell the data visualizations onwards to media.

Since there is no market to sell the visualizations, many of the analysers work on their spare time for general interest or for pro-bono causes. Typically they do not even consider asking a fee out of the work they have done, and release the material on their own website or on HS Open blog, for example.

The only commercial activity in this field is demonstrated by Helsingin Sanomat. They are considering to launch an ecosystem where they would compensate N euros per publication of the data visualization (Esa Mäkinen, 28.2.2012). They hope this would encourage more people to analyse and visualize the data.

Not all visualizations, however, are made strictly for the journalistic purposes. A good example is the Tax-tree visualization created by Hahmota Oy.

8.3.2 Case Hahmota Oy Tax-tree

Tax-tree visualizes financial data in a tree-like shape. The CEO of Hahmota Oy explains that Tax-tree basically offers a new metaphor for the basis of

conversation. The tree metaphor has allowed their clients to invent a new terminology in their discussion; they talk from leaves, branches, roots etc.

The CEO states that typically their clients offer the necessary data to be analysed, thus Hahmota Oy doesn't need to extract or transform any data. Hahmota Oy figures out the best way to visualize the data, and the client is charged a one-time fee for the entire project. However, sometimes they have made example visualizations for prospect customers as a starting point of the sales process, and this has required some data extraction as well.

The respondent from Hahmota Oy saw that their potential customers could be any governmental or commercial company, not only the media sector. The CEO also envisions that if they could create a new visualization method to be used with financial reports, it would open a completely new market for the product.

8.4 Algorithm-based analysing

8.4.1 General description

Data analysing can be also done in algorithm level, purely mathematically. This analysis doesn't provide eye-catching visualizations, but it refines the data and gives new knowledge. This research found two companies operating in this area of business, Asiakastieto and Cloud'N'Sci, which are both described below.

8.4.2 Case Asiakastieto

Asiakastieto is perhaps the leading player to monetize public data in Finland. The company is founded in 1906, and today generates 40 M€annual revenue, mostly by utilizing publicly available data sources. Currently they employ 150 employees.

Their core competence is extracting the data from various public sources, which might sometimes even require scanning paper documents into digital format. In addition they collect data directly from companies with questionnaires and balance sheets. Thus, their resources are not strictly open data, as open data should be accessible over the internet, but majority of the data sources are publicly available data nevertheless. In the value network they are involved in the data extraction and transformation, as well as, the data analysing, thus acting in two roles simultaneously.

A respondent from Asiakastieto states that they collect precise data on individual level, with the accuracy of identity number, business ID or real estate number. By cross-analysing this data with advanced algorithms, Asiakastieto can give a risk rating for each individual and company in Finland. Since this knowledge is used in important credit decisions, there is no room for mistakes in the data.

The respondent said that if someone applies for a credit in Finland, the chances are that at some point of the process the request goes through Asiakastieto's

information systems. Asiakastieto is a perfect example how the public sector information can be refined, combined and monetized.

8.4.3 Case Cloud'N'Sci

Cloud'N'Sci Ltd is a young company offering an algorithm-as-a-service platform, in to which third-party algorithm developers can bring their mathematical tools. According to the CEO of Cloud'N'Sci, their platform supports several programming languages, and importing a new algorithm has been made very easy. The idea is to connect university researchers with ingenious algorithms to the business world problems, and monetise the added value.

The platform has a revenue share model between the algorithm developers, data sources, user interface providers, the algorithm-as-a-service platform, and the algorithm architect, who is responsible of the whole chain. The platform is agnostic to the type of data the algorithms are calculating; it could be open or closed data. The CEO states that for them open data is just one source of data among others.

8.5 Crowd-sourced analysing

8.5.1 General description

Crowd-sourced analysis is a good demonstration of the benefits of opening corporate data. The released data might find surprisingly innovative usages, if only encouraged and made possible by the data owners.

For public sector, the reasons behind publishing data are typically to advance citizens' participation in the decision process, increasing government transparency, and general public pressure to open up data sources. For corporations, however, similar reasoning does not apply. Quite often the core competency of companies is based on the data they possess, and thus they are understandably protective and cautious when it comes to opening their datasets.

In the case of private corporate data, the data opening should be carefully thought and planned. Most of the corporate data also should be kept private, but in some cases opening the data can be proven to show business benefits. The argumentation is similar as with the public sector; the owner of the data might not be its best exploiter. Thus, by opening the data, someone else could create a valuable application utilizing it.

Please see the following Helsingin Sanomat (HS) Open case as an example of open thinking within a company.

8.5.2   Case HS Open

HS Open is an event which brings journalists, graphical designers and programmers under a same roof and lets them brainstorm and create new purposes for open data. The event is organized by Helsingin Sanomat, and first HS Open was held on 14.3.2011. It has been a very successful activity, producing tens of prototypes utilizing open data in visualizations and innovative user interfaces. It has been organized regularly, and the fifth HS Open was held on 21.5.2012.

HS Open events have encouraged a crowd of people to make data analysing on their spare time, for free. These hobbyist analysers have used very advanced statistical methods, such as factor analysis, neuron networks, and self-organized maps in their work. Some of the analysers work as researchers in a universities or other organization, where they use statistical analysis as a part of their daily work. Most of these analyses are published only in the HS Next blog and on the creators own websites. However, some of the best visualizations have inspired articles which have been published in the Helsingin Sanomat newspaper.

One example, where these visualizations have been published comes from HS Vaalikone (an application aiding end-users to select a favourable representative in the elections) data opening on 6.4.2011. This was, in a way, a landmark data opening from HS, because previously the Vaalikone answers have been a strictly kept secret, and only readily digested results have been released for the public. Within a week after the data release, HS had received already 15 applications and visualizations utilizing the data (Esa Mäkinen, 12.4.2011). These visualizations motivated two newspaper articles, which were published on 12.4.2011 and on 20.4.2011.

Another example is on 24.6.2011 published article about electoral funding relations (see Figure 7 for demonstration). The analyser is a bioinformation technology student, who noticed that an algorithm made for the network analysis of genes could be utilized in electoral funding as well. The visualization inspired an article examining the power structure connections behind electoral funding. (Esa Mäkinen, 10.2.2012)

It is exactly these types of examples, which prove that the data owner is not always the best interpreter of the data. These examples would not have been imaginable without the support and facilitation of HS Open, and in the Vaalikone case, the courageous data openings by Helsingin Sanomat. Thus, in addition to selecting right data to open, companies should also put effort to encourage crowds to analyse the data.
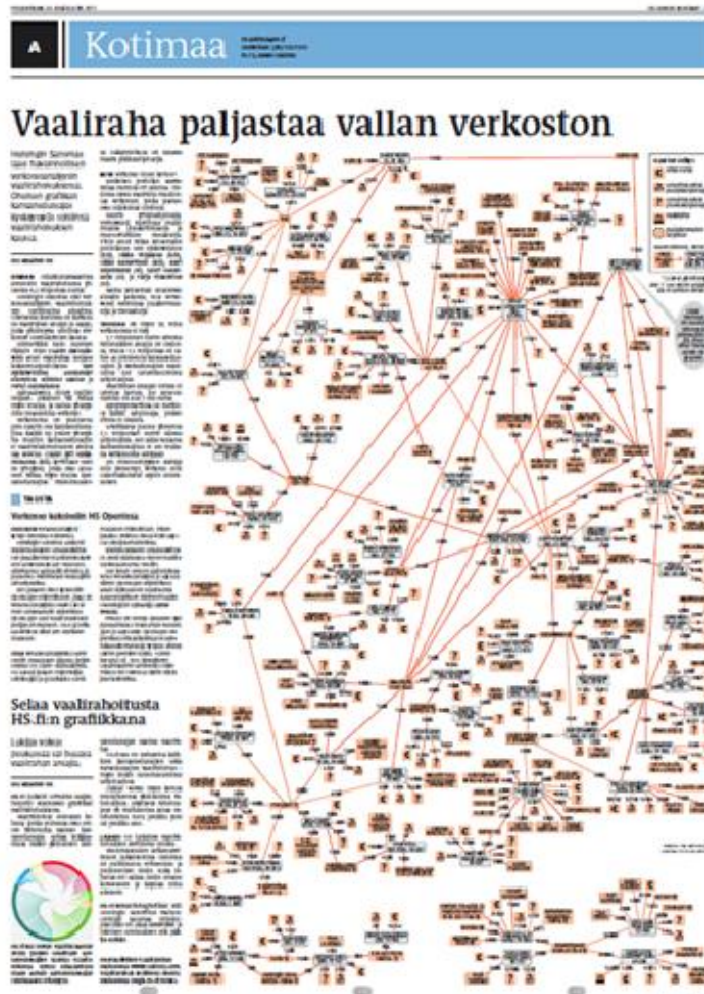
Figure 7 An example newspaper article based on crowd-sourced analyzing.
Source: HS Next-blog posting by Esa Mäkinen 10.2.2012

8.6 Extract, transform and sell

8.6.1 General description

Before any of the analysis in the previous business models can be made, however, the data needs to be first extracted from the original source and transformed in to a suitable format for further analysis. Many of the analysers do this on their own, but there are also dedicated companies focusing only on extracting, converting and storing the original data for further analysis.

Different data owners, such as government bureaus, often publish the data in various formats. There are no efforts made to make the data consistent between the government bureaus. In addition, a single bureau might change its own data format over time, thus making comparative analysis even more difficult. Data publishers also give no guarantees of how long the historical data is available.

Therefore, there is demand for a third-party player, who extracts the data from its original source and stores it in its own databases. Regardless of in which format the data was originally published, it is consistently available through the third-party data provider's tools.

In addition to transformation, this body could also store the data from different sources for further reference. Over time, stored data would make a time-series analysis possible. In addition, since the original data publisher might keep records only from the near past, on a third-party database the information would be available from the entire time span.

8.6.2   Case Louhos

Currently there is surprisingly little commercial activity in this field. Perhaps the best example in Finland is the soRvi-toolkit created by Louhos. The soRvi-toolkit offers a comprehensive software library for R-language, helping analysts and journalists alike to extract and analyse open data from several sources.

The toolkit offers automatic data fetching-routines, which support several Finnish governmental open data sources. Some commercially operated data sources, e.g. Helsingin Sanomat Vaalikone data, are also supported. In addition to data fetching, the toolkit provides also analysis routines to process the data onwards in R. For example, plotting county-level information on a Finnish map is made very simple with the toolkit. The toolkit as such doesn't automatically store the data, however. It extracts the data from the original source each time the toolkit is run.

In an interview with the founders of Louhos-project, they said that currently they are operating on pro-bono model, thus generating no revenue. They are planning to extend soRvi-toolkit to support other countries with the help of volunteer activists from abroad. They said that for now Louhos will operate on volunteer work, but in the future a combination of commercial and volunteer activity would probably be the most feasible path onwards.

8.7   Consultation and project work

8.7.1   General description

Open source software, a close relative of open data, has long established its business model on a combination of volunteer work, free-to-download software, support services, and consultation (Fitzgerald, 2006).

In the open data realm there can be found several companies utilizing similar approach. They have created open data applications or visualizations to work as a marketing material for the company, thus increasing the image and the publicity of the company. Their goal is to become a known player within the open data niche, and consequently an obvious first choice for a potential customer.

The customers could be government bureaus deciding how and in which format they should release their open data, companies figuring out the possibilities of open data etc.

8.7.2 Case Flo Apps

Flo Apps is a Finnish software company providing technical implementations of open data visualisations. Their customers typically wish to present their data in a more visual and appealing form. In 2010, 30 % of their revenue came from open data-related activities (CEO, Flo Apps).

Flo Apps has sent six submissions to the Apps 4 Finland competition, with very good results. The CEO of Flo Apps said that they have participated to A4F competitions in order to build reputation for their company. However, the competition rarely brings new customers directly, but instead positions the company stronger in the open data segment and makes the subsequent sales work easier.

The CEO stated that the customers usually require tailored solutions, including information design, user interface design, and software implementation. Flo Apps implements only the technical execution in-house, and outsources the graphical and information design from partners. This approach has kept the company cost-effective, and able to execute a wide variety of different projects.

In the interview, the respondent also said that the Finnish market is so small that creating and supporting open data-related products would not be profitable. The product-based business would require at least European wide distribution, which would require standardized open data interfaces within European Union. Thus, at the moment, Flo Apps is focusing on tailored software projects and consulting.

8.8 Machine-to-machine communication

Machine-to-machine (M2M) communication is part of the open data sphere. It is usually not directly visible for the end-users, but nevertheless plays an important part in the background through information systems design.

However, to be consistent with the rest of the report, M2M isn't exactly a real business model with revenue model, distribution channels etc., but more like an area of application for open data in general. Within the M2M area, there can be found several individual business models. Probably the most obvious is the one of Logica, which works as a systems integrator helping its customers to succeed in this sphere.

A respondent from Logica stated that the M2M communication is important especially when designing user centric services. For example, in government bureaus data is often stored in inaccessible and incompatible information systems. The consequence is, that the end-user needs to re-enter trivial data, such as his name and address, again and again in different electronic forms. This can be very

frustrating. In addition, if the users' address changes, in some cases, the user needs to re-enter the data again to different governmental systems.

The respondent sees M2M communication as one answer to this problem. By opening the data internally within a bureau and also between the governmental bureaus, such problems could be avoided. Information sharing could bring other benefits as well. For example, by collecting data from several bureaus, and utilizing advanced algorithms, more precise predictions could be made from the residents. If only permitted by privacy policies, forecasts could be made even on an individual level. According to the respondent, a Social Services Department worker could proactively approach a long-term unemployed citizen, if the two bureaus could coordinate their datasets. This could prevent social exclusion and bring inclusive service experience for the end-user. (Development director, Logica)

Youngin Yoo, a professor at Temple University Philadelphia, in his speech at Aalto School of Economics, took an example of Philadelphia's fire department not having access to the infrastructure information relating to water and gas pipelines, electrical cables etc., although this information is electrically available in another city's bureau. This is a good example, where M2M communication could again bring a better solution to everyday life.

9 Conclusions

9.1 Contribution to research

The purpose of this paper was to study the Finnish open data landscape, to reveal what kind of business models the companies are operating with, and how the companies could be categorized under different value network profiles. In other words, to picture what the commercial open data activity is in Finland.

The result was eight business models, which we grouped under four value adding profiles in the value network. Within each profile, an example case company was presented. The grouping of the case companies in the value network is not trivial, as many occupy two or even three different roles in the network. These four profiles are very much in line with what Poikola et al. (2010), Tammisto et al. (2011), and Sirkkunen et al. (2011) have found earlier on. However, in this study we have envisaged them from strictly business value network perspective.

The four value network profiles are summarized below, and in parenthesis we have included the revenue models we found out within each profile:

- Extract and transform (usage-based fee, open source)

- Data analyser (one-time fee, pro-bono)

- User experience provider (advertisement, one-time fee, subscription, crowd funded)

- Commercial open data publisher (cost savings with crowd sourcing)

The revenue models are very different between the four profiles, because the profiles have very distinct customer bases. Whereas the user experience providers work with end-users, and might apply revenue models such as advertising or crowd funding; extract and transform works only with other companies, thus applying typical business-to-business revenue models.

In general, the extract and transform activity in Finland was surprisingly low. Asiakastieto was the only company we found to be storing the information for later usage. We see that in Finland there is room for more operators gathering open data from several sources, making it commensurable, storing it to enable time-series analysis and finally giving it away with APIs or other standardized methods.

Data analysis, on the other hand, was very active. Especially the community cultivated by HS open has generated tens and tens of visualizations from extensive amount of topics. However, the community lacks a marketplace where these activists could sell their work onwards to business clients. Currently it would be very cumbersome to deal with each newspaper separately, in order to sell them one visual analysis. It can be speculated that middle-men or exchanges – which could provide data visualizations, or the workforce that could create these data analysis, for e.g. to the needs of media – could be beneficial for the ecosystem. Existing models of case clearinghouses and photo exchanges could work here.

9.2 Impact for business

The business impact of this document can be divided into two larger conclusions; (1) the commercial activity is still at the innovation phase and (2) there is untapped potential for the companies to open their data to the world.

(1) Commercial activity is still in the innovation phase

Out of the 193 proposals submitted to Apps 4 Finland contests, only 11 had a company with commercialization plans behind them. This works as a good general indicator of the commercial activity in this field. At the moment, there is a lot of hype around open data in the world, and in this Finland is no exception. But when examining at the actual business activities, the reality has not caught the hype yet. The business potential is there, but the commercial activity is missing. If there is no commercial activity, one could fairly ask whether there are any business opportunities either. After this study, we still believe there are, but apparently it will take some time for the commercial open data industry to get off and start flying.

One comment which rose from several interviewees was that the value of the raw data is zero euros, without an application utilizing it in a meaningful way. According to the interviews, the public sentiment at the moment is to open as many data sources as possible, but commercially this is not a feasible if the data source doesn't have any relevant usage. The data openings are mostly done to

support open government and to increase citizen activism, not to enhance commercial activity.

Another observation was that in the Finnish market alone it was difficult to create a product generating enough revenue to support even one full-time employee. Most of the companies operated on per project basis or on consultancy fees, not on the revenues of their own product. For example ReittiGPS, although it is a popular client application, is employing its creator only part-time. Wider open data standardization was seen as one answer to this problem. If, for instance, EU would have a common standard for public traffic information, the same client could be sold to tens of cities within Europe.

(2) Commercial open data

One bright spot in the open data activity was the data opened by companies themselves. Open data cannot be commercial by its definition, and thus there is a contradiction in this statement. However, we believe there are ways for companies to open their data reserves commercially, while still roughly staying within the open data definition. The point is not to practise terminology acrobatics, but to really encourage and invite enterprises to become part of the open data sphere.

The two examples we found were HSL Reittiopas API and HS Open community. Neither of these was charging for its data, but HS had put some restrictions for the licenses, in practise not permitting a full commercial re-use. Thus, the commercial dimension of the released data itself is not very strong, but the commercial benefits are concrete nevertheless.

We saw three important points with companies opening their data:

- Raising a community of activists, which will rake the data and make small try-out projects out of it, is important. This grass roots level activism will eventually lead to commercial applications as well, and is important in order for the data release to gain speed and popularity.

- It is okay to restrict the data, because quite often company's core competency depends on it. HSL is a public authority, and thus didn't have any interests towards restrictions, but this doesn't fully apply to commercial companies. It would require further studies to conclude exactly what kind of licensing and pricing models would best suit the different kinds of commercial data.

- However, one simple point about pricing can be made: Since the grass roots community activity is essential in order for any commercial projects to rise, the pricing and licensing should not limit this activity, but instead invite developers to play around and even do small-scale business with the data. Google Maps API is a good example of this pricing: Below a certain usage level the cost for developers is zero, but above the level they need to pay a fee for Google from the map interface usage. (Google Maps FAQ)

9.3 Future avenues

This report focused on the Finnish market, and as we saw, the Finnish open data industry is still in the innovation phase. The situation is somewhat different in US and UK, where the open data thinking has longer roots. It would be worthwhile to compare the results of this paper to the situation in the world in order to see what unrecognized possibilities there might lay in the Finnish market. In addition, it would be also valuable to study the evolution of the businesses of certain companies in this study.

The research on open data business models and value networks in Finland will be continued in an Aalto University School of Economics Master's Thesis, which will be published in fall 2012.

Finally, the pricing and licensing relating to commercial data openings would be very interesting to examine in a greater detail. By commercial data pricing we mean Google Maps or The Guardian Open Platform type of pricing model, where the data itself is priced for the developers. In addition, the benefits crowd-sourcing in various forms strongly relates to the corporate data opening as well. We believe that many enterprises are still hesitant in opening their data reserves, because of the lack of research and evidence in this particular field.

Appendixes

APPENDIX I: QUESTIONS FOR OPEN DATA BUSINESS MODEL INTERVIEWS

I. Offering

1. For what do your customers use your service?
2. Are there any additional services offered to complement the product?
3. Who are the customers using your service? *Find out at least:*
   a. *If consumers, then what age, income class, tech awareness*
   b. *If businesses, then what industry, what size of companies, who is the buying business unit*
   c. *Where do they live, Finland, Nordic, Europic, Global?*
4. Do you customize your service for different geographical areas or customer segments?
5. How do you distribute the service to the customers?
6. How would you characterize the scalability of your service offering?

II. Resources

1. What are the key open data sources you are utilizing?
2. What other resources do you utilize to provide your service?
3. Have you encountered any obstacles in employing open data sources? E.g. with technicalities, licenses, etc.
4. Are there some type of data sources you would like to use, but which are unavailable or under too strict commercial license?

5. Can you think of any threats involved utilizing open data sources in business?

III. Relationships

1. Who are the key commercial actors in your business network, and what activities do they perform?
2. Who are your key partners in the open data community?
3. Who in your business network owns the end user information?
4. Do you have any competitors?
5. Have you stimulated any open data community involvement?
    a. *If, then how have you leveraged from these activities?*

IV. Revenue Model

1. What are the main sources of revenue? *Find out at least:*
    a. *Who pays to you (from whom do you get the revenues)?*
    b. *At which point of the transaction do you get paid?*
    c. *How frequent and recurring the payments are?*
2. How (on what basis) is the service priced?
3. Have you considered other potential revenue flows you could utilize in the future?

V. Other questions or comments emerged during the interview

1. Can you think of other open data companies, which should be interviewed in this Thesis?

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