D4.1. Business and Policy - ESADE

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1. INTRODUCTION

Recently data has become a new type of capital for the global economy. As businesses are trying to improve the customer engagement and performance, the pressure resulting from the data explosion is enormous. Increase of the data volume and the technologies needed to collect, store, manage and analyze data, attract many firms to form a business around this potential opportunity of open data. At the beginning, the idea of open data was employed by governments to increase public transparency through tracking activity in parliament and the law making processes and enable citizens to hold officials accountable. Governmental open data has been a tremendous resource that is largely available and has been underutilised. Now, the trend of open data is moving into a drive for new business opportunities and promising big social returns; businesses in which almost all industries can find relevant open data to use it to improve their products and services. Open data Barometer research study (October 2013), which aims to uncover the true prevalence and impact of open data initiatives around the world indicates that by October 2011, twenty-eight nations around the world had established Open Data portals. Public administration officials are now beginning to realize the value that opening up data can produce for the whole society.

This report tries to translate open data into business case, addressing the needs of all the stakeholders in the ecosystem. The key link in the value chain of open data is the consumer (or the citizen). The application of open data can help citizens to make better decisions in life and enable them to be more active in society. The economy will benefit most from open data that has direct relevance to the choices individuals make as part of their day-to-day lives. This is the reason of the recent fast growth of the ecosystem of city applications. Many individuals and organizations collect a broad range of different types of open data in order to build an application or providing a service and create value (social and economic) that leads to cost savings and provides better service to citizens. Moreover, sustained engagement helps in an increased realization of economic value from data and better management of data quality. In this regard, the role of different types of dynamics such as application challenges and contests are undeniable. Basically, the mechanism behind the application competitions is to encourage development of new applications utilizing open data through a range of activities where the developers and third parties are able to find and use open data. Application contests promote and rewards innovative open data applications with the ideas from various areas from mobile education, knowledge sharing and museum visits, to politics and sustainable development.

Our objective is to aggregate knowledge that is vital for successful open data competitions. We addresses the business models of applications utilizing open data, used by citizens or city officials to interact with the city, and/or sponsored by the city (through a contest, hackathon, developer groups, or direct engagement). The objective of this report is to understand how applications ideas are generated, and how cities or organizations can provide better service to developers looking to use open data. For this purpose we were interested to grasp developers' motivations for creating applications, especially how the developers have already created them, the problems they faced through the development and how they will make them sustainable. How are the applications creating value and how this value creation can continue to grow?

Furthermore, in almost all the application competitions, mostly innovative applications are rewarded. But on the other hand, the result shows that the most innovative applications won't necessarily be the successful one in future business practice. We are seeking to address this phenomenon by analyzing underlying business models of applications through interviewing community of developers in five European cities (Barcelona, Rome, Helsinki, Berlin, and Amsterdam). As a key reference to determine how these applications do business in order to understand everything about applications ideas and how cities or organizations can add value to developers looking to use their open data.

2. REVIEW ON BUSINESS MODEL

General Overview

There is wide range of research in the field of Business Model (BM). BM underlines a system-level approach of explaining how firms "do business" and seeks to explain both value creation and value capture. It is centered on a firm, but its boundaries are wider than the firm. There are a variety of motives for doing research on business models. Some scholars attempt to define new forms of business models; some others introduce methodologies for evolving business models, while others challenge to alter the primary elements of BM.

Some researchers believe that the development of the business model concept, and the extensive use of the notion since the mid-1990s, may have been routed in the advent of the Internet (e.g., Amit & Zott, 2001), change in the traditional way of doing business, rapid growth in emerging markets and interest in "bottom of-the-pyramid" issues (Prahalad & Hart, 2002; Seelos & Mair, 2007; Thompson & MacMillan, 2010), and the expanding industries and organizations dependent on postindustrial technologies (Perkmann & Spicer, 2010). In other words, as Magretta (2002) put it "before the personal computer changed the nature of business planning, most successful business models [...] were created more by accident than by design and forethought."

Scholars have been addressed the notion of business model in different contexts such as strategy, management, entrepreneurship, innovation, e-business, information systems, and economics. In result, wide range of conceptualizations of business models has been developed within each context. According to Zott et al (2011), research in the business model subject can be discussed in three fields: "(1) e-business types; (2) strategic issues, such as value creation, competitive advantage, and firm performance; and (3) innovation and technology management." Similarly Wirtz (2011) had categorized the research on business model notion to comparable three different parts: technological approach, organization theory oriented approach, and strategic approach.

Accelerating growth of Information and Communication Technologies (ICT) which was mainly possible with the expansion of the Internet and the rapid decline in computing and communication costs (Moore´s Law), lead to the transforming traditional business models and developing new ones exploiting better opportunities. Furthermore, the Internet as a tool opened new windows and new ways of doing business and development of new ways to create and deliver value (Amit & Zott, 2001). There is no doubt that certain new business models have just become viable through the potential deployment of ICT. While traditional businesses failed to compete in highly competitive market, with the help of advances in ICT some businesses created Blue Ocean through changing the most rigid dimensions of their businesses. Indeed, developments of modern ICT have opened new horizons for the design of business models by empowering firms to transform fundamentally the way they do business and engage in economic exchanges, both vertically and horizontally (Mendelson, 2000).

The coming subsections will address: (1) state of the art e-business models; (2) e-business model taxonomies; (3) open data and previous study on open data business model.

State Of The Art of E-business Models

The study of business model, beyond the underlying drivers and methods that scholars may have used to define business model, is fragmented over different contexts such as information systems, strategy, innovation, and entrepreneurship. My intension in this section is to chronologically summarize some fundamental definitions that are mostly used as reference in other articles in the area of information systems and e-business. Also some recent definitions have been included which mainly illustrate the current interest of scholar to the subject.

In order to categorize various types of business models in Internet electronic commerce, Timmers (1998) provided one of the first business model definitions. According to his definition, business model is

"architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues (: 4)." He chose a systematic approach to identify possible architectures for business models based on value chain elements and possible ways of integrating information along the chain. Timmers definition clearly neglects the cost structure of the firm that directly affects profitability.

Tapscott et al. (1998) introduced the concept of a new generation of business models. Due to network technologies, organizations are encouraged to move from an introvert "M-form"[1] to the "E-Form" that is based on the forming of business ecosystems. The main strategic action dimensions that an E-form organization must incorporate are: customers, markets, products, processes, organizations (structures and relationships), shareholders and financing, social values, and government policy. In another article Tapscott et al. (2000) refers to a business innovation model in the form of "business webs (b-webs)", which are "inventing new value propositions, transforming the rules of competition, and mobilizing people and resources to unprecedented levels of performance. A b-web is a distinct system of suppliers, distributors, commerce service providers, and customers that use the Internet for their primary business communications and transactions (Tapscott et al. 2000)." Although Tapscott et al. (2000) did not provide an explicit definition for business models; their approach emphasized the feature of "network".

In their famous book about Internet business models and strategies, Afuah and Tucci (2000) defined business model as the method by which a firm builds and uses its resources to offer the customers better value than the competitors and generate revenue doing so. The business model is what enables a firm to have a sustainable competitive advantage, to perform better than its rivals in the long term. Moreover, business model details how a firm capture monetary value now and how it plans to do so in the long-term.
In the book "Electronic Commerce: B2C strategies and models", Elliot (2002) comprehensively explored a broad range of examples of Internet e-commerce through various countries. He defines business models as the relationships between different participant in a commercial venture, the benefits and costs to each and the flows of revenue. According to Elliot all business models address a simple equation, regardless of the model or the level of complexity of it:

$$Profits = revenue - costs$$

Chesbrough and Rosenbloom (2002) defined business model as "the heuristic logic that connects technical potential with the realization of economic value." The business model is conceived as a focusing device that mediates between technology development and economic value creation. Thus, business model provides a coherent framework that takes technological characteristics and potentials as inputs and converts them into economic outputs through customers and markets. In his book "Open Business Models", Chesbrough (2006) stressed once again that a business model has two central important functions: value creation and value capture.

In a recently published book, Bouwman et al. (2008) defined business model as a "blueprint for a service to be delivered, describing the service definition and the intended value for the target group, the sources of revenue, and providing an architecture for the service delivery, including a description of the resources required, and the organizational and financial arrangements between the involved business actors, including a description of their roles and the division of costs and revenues over the business actors."
Teece (2010) mentioned that a business model "articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers." Accordingly business model

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[1] M-Form (*Multidivisional form*) refers to an organizational structure by which the firm is separated into several semi autonomous units which are guided and controlled by (financial) targets from the centre

summarizes the architecture of revenues, costs, and profits associated with delivering value. Teece emphasized that business model is a conceptual model of the business, rather than a financial model.

E-business Models Taxonomies

Identification and ordering of existing types of business models and inventing new types of business models is an interesting area in business model research, specifically in the context of e-business model. This will help scholars, entrepreneurs, and practitioners deeply understand business model dynamics and enhance innovation based on successful examples. In this part, I am going to address some e-business model classification present in literature and business environment.

In an early attempt Timmers (1998) provided a framework for classification of Internet business models based on commercial Internet business and experimental work in European R&D programs. Through a qualitative mapping of business models along two dimensions and considering the degree of innovation and the extent of integration of functions, he represented following business models taxonomies:

- *E-shop:* "This is web marketing of a company or a shop." Some benefits of this model are increase in demand, low-cost for going global, decrease in price, 24-hour availability, and increase in choices and information, and convenience of selecting, buying and delivery.
- *E-mall:* This basically consists of a collection of e-shops, usually enhanced by a common umbrella. Some benefits are, advertising space, brand reinforcement, traffic increase, and for customers convenience of easy access to lots of brands and ease of use through a common user interface.
- *Virtual communities:* The final value here comes from the members who share their information in the environment provided by the virtual community company. Revenue comes from membership fees and advertisement. This model can be used to shape customer loyalty and receive customer feedback. Virtual communities can also be integrated to all above models.
- *Information brokerage, trust and other services:* There is a huge amount of data available on open networks or coming from integrated business operations. The revenue sources are subscription, pay-per-use basis, advertisement schemes, software sales and consultancy.

By highlighting the role of Web, Rapp (2000) did a comprehensive categorization of the business model. The four related types of business models are:

- *Brokerage model:* Brokers bring buyers and sellers together and facilitate the transactions. These transactions can be in business-to-business (B2B), business-to-consumer (B2C), or consumer-to-consumer (C2C) markets. The revenue comes from a fee or commission for each transaction.
- *Community model:* This model is mainly based on user loyalty and users have high investment in time and emotion. The revenue comes from sale of ancillary products and services, voluntary contributions, advertisement, and subscriptions for premium services. This model includes: open source, open content, public broadcasting, and social networking services.
- *Subscription model:* This is a model in which users are charged a periodic fee for using the service. Some models combine the free content with premium content. Another main source of revenue is from advertisement.
- *Utility model:* This is typically based on metering usage or a "pay as you go" approach. So actually users are charged based on real usage rate.

Afuah and Tucci (2002) summarized (Internet) business models by how the models are described regarding the four building block or dimensions: profit site, revenue model, commerce strategy, and pricing model. They classified business model based on revenue models as follow:

- *Advertising-based:* In this model the owner of the website provides the end users subsidized or free content, services, or even products that attract end-user visitors. In this model revenue comes from charging advertisers fees.
- *Subscription-based:* In this model the fees are charged based on unlimited use. Company charges a flat rate on a periodic basis that qualifies the user for a certain amount of service.
- *Fee-for-service-based:* In this model the fees are charged based on metered service. For this model to be sustainable, the businesses have to convince customers to intensively use service or to have a large volume of customers.

Osterwalder and Pigneur (2010) classified business models with similar characteristics, similar arrangements of the building blocks, or similar behaviors. Based on the literature, they described five patterns for business models, which are placed into the Business Model Canvas to make the concepts comparable, understandable, and applicable. These five patterns are as follow:

- *Unbundling:* with respect to different economic, competitive, and cultural imperatives, there are three different types of businesses: Customer Relationship businesses, product innovation businesses, and infrastructure businesses.
- The Long Tail: The essence of this model is about selling less of more. This model offers a large number of niche products in relatively low volumes.
- Multi-Sided Platforms: bringing together two or more distinct but interdependent groups of customers. The created value in this platform for a group of customers is in presence of other groups of customers.
- Free: there is always at least one substantial customer segment that continuously benefit from a free-of-charge offer. The revenue comes from another part of the business model.
- Open Business Models: The value created in this model is through systematic collaboration with outside partners. This can happen in two ways, from the "outside-in" or from the "inside-out".

Open Data and Previous Study on Open Data Business Model

On his first day in office, in January 2009, President of the United States, Barack Obama, signed the Memorandum on Transparency and Open Government. This Memorandum required that agencies within the federal government release their data; to make it open and available to the public. The data catalogue, which was created, the most comprehensive at the time, included real time crime feeds, school test scores, and demographic information by neighbourhood.

The genesis of this initiative was born from an overall push for transparency and accountability by the Obama administration. The major aims of the memorandum were to reduce the influence of special interests by preventing lobbyists from coming to work in government or sitting on its advisory boards; allow citizens to track how government uses the money with easy-to-understand websites like recovery.gov, USASpending.gov, and IT.usaspending.gov.; and to inform the public and empower them to influence the decisions that affect their lives (Open Government Initiative 2013).

The spirit of this initiative was rapidly adopted in the UK and translated to many European cities and governments, which started efforts in what was referred to as "Open Data". In Europe, Obama's Memorandum was mirrored in the Public Sector Information Directive of the European Parliament in 2013.

Two main strategies developed from the Memorandum on Transparency and Open Government. The first was Data.gov, which launched in January 2009. In this online repository, all the federal open data would be housed for easy public access with the objective of fueling new products and services.

More than 389,000 datasets have since been accessed form Data.gov in areas such as education, energy and health (Open Government Status Report, 2013). The site is fueled by data provided by more than 200 organizations, including federal agencies, non-profits, and public-private partnerships (Open Government Status Report, 2013; Jeppesen et al. 2010). Further, in order to encourage use of Data.gov, the Federal

Government has sponsored more than 50 Open Data challenges, with prizes ranging from $30 to $15,000,000 (Challenge.gov 2013).

After the impressive success of Data.gov, similar initiatives have been launched; first in the U.K. with Data.gov.uk and later through Continental Europe in cities such as Helsinki, Amsterdam, Barcelona and Berlin.

The second outcome of the Memorandum on Transparency and Open Government were more city-focused strategies at encouraging the use of open data. The first of these was led by the City of Washington D.C. to encourage citizens to access civic open data repositories, Vivek Kundra the chief Information Officer (CIO) of the United States launched "Apps for Democracy" an innovation contest based on Open Data. This, the first city-sponsored apps contest, held in 2009, had quite impressive results. In just 30 days 47 web, iPhone and Facebook apps were developed with an estimated value of $2.3M at a cost of $50K (Apps for Democracy). Since Apps for Democracy, other cities across the United States, Europe, and the World have followed suite.

Based on Deloitte research on open data growth of more than 230 businesses and non-profit organizations in the UK and overseas, five common business models have been identified as follow:

- Suppliers: Organizations that publish their data via an open interface to allow others to use and reuse it such as public sector and also private sector companies. The direct revenue from publication of data is nil and businesses benefit from customer engagement and loyalty increment and a further revenue boost from reputational enhancement.
- Aggregators: organizations that collect and aggregate open data and find correlations, identify efficiencies or visualize complex relationships. This category is considered as value added services to businesses or consumers and in some cases back to government.
- Developers: organizations and software entrepreneurs that design build and sell web-based, tablet or smartphone applications for individual consumption. These applications basically use more dynamic types of open data that are updated frequently.
- Enhancers: Large and established organizations that use open data to enhance existing products and services and typically such products and services are not entirely dependent on open data.
- Intermediaries: organizations that facilitate the supply or use of open data, such as challenges website, but are not themselves users or re-use of open data. The business models are directly revenue generating and also encourage greater supply of open data by providing cost-effective solutions for businesses.

3. RESEARCH STUDY AND DATA COLLECTION

Research Methodology

We constructed an empirical investigation into community of developers developing city applications using open data in Barcelona, Rome, Helsinki, Amsterdam, and Berlin. Due to the fact that the emerging application ecosystem is complex, comprising many established and start-up businesses, a case study is the most appropriate method of capturing rich and meaningful data from a wide range of applications scenarios. Our case study approach is to get responses from key responsible person for developing applications. Along

with interviewing for analysing the business model application, the case study method was the most appropriate means of generating rich and insightful data and information on application experiences. A semi-structured questionnaire was designed to elicit data on the four key themes: ideas behind the application, application availability and adaptability, collaboration with city officials and developers' community, and motivation and investment (outlined in Table 1: Questionnaire structure).

About the Application	
	What is the idea behind your application?
	How did you come up with the idea for the application?
	What is the backbone of your application? *What kind of data? Government open data? Or other type of open data?*
	Why did you decide to make an application?
	Is the application a central or complimentary part of your business?
	Are you the central creator? Did you work with a team?
Application Availability and adaptability	
	Did you publish in the Apple/Android store?
	What is download rates of your application?
	How long has the application been available to the public?
	Is your application for free or paid?
	Is the application mainly developed for use in one particular city? How many? How is it adapted?
	Is your application open source? If it is not already adapted for other contexts, could other developers adapt it?
Collaboration with city and developer' community	
	Have you participated in any applications contests or hackathons as part of the applications creation or development?
	Did you have any contact with other developers? Does feedback or other forms of community make an impact or motivate you?
	What is your relationship with the city officials? *Did you meet with anyone to get data? Have you conducted any interviews with city officials, have you attended any city-sponsored open data or hacking events, talks?*
Motivation and Investment	
	How much money did you invest to create the application?
	How long did development of the application take?
	How much ongoing maintenance does the application need? Does the application need constant upgrades/ data refreshing?
	What did you anticipate the returns would be for your effort?
	How much are you currently making from your application?
	Would you like this to become your primary business?
	Can you imagine that this could generate enough returns to make substantial amount of money?
	Are there other opportunities that the application has brought to you? *Like reputation, or a contract from the government, or a job from the city?*

Table 1: Questionnaire Structure

Data Collection

We were cautious to do the interviews (collect data) in as open a manner as possible to avoid any manipulation. At the same time, we believe that if we only directly ask the questions, this also may cause various biases could demolish the data. Therefore, we designed the questionnaire focusing on developers' current and future plans and we decided to conduct "semi-structured interviews" in which we didn't go through each question exactly, but just that from discussion with the developers, we address all of the issues we want to understand. Sometimes during the course of a relaxed talk, we realized that the developer has jumped around the topics and answered many of the questions without being asked directly. Thus, we used the questionnaire as a guide to see if we've missed anything or not. Table 2 represents statistical information of interviews.

	Item	Statistics
About Application	How do they come up with the idea of the application	62% data availability & contest, 24% personal challenge
	Did you use open data	90% open data, 10% collected data or generated by user
	central/complimentary part of business	52% central business, 48% complimentary or not a real business
	Role of interviewee	62% developer, 20% project manager, (18%) designer or marketer
	Do they work in a team	81% team, (19%) just developer
	Idea novelty of the application	33% novel idea, 20% novel in local
Collaboration with ecosystem	Participating in any contests or hackathons	86% participated, (14%) not interested
	Interacting with developers community	62% community of developers,10% utilizing user feedback
	Relationship with city official	48% yes, 24% tried but failed
App. Availability	Store availability	71% iStore, 24% web app, 5% not published
	Duration of the app availability to the public	19% Less than a year, 48% BTW 1 & 2 years, 28% More than 2 years, %5 not published
	Free/paid	81% Free, 14% both, 5% paid
	Apps adaptability to other cities	90% same version just matter of data adaptability, 10% developing adaptable version
	Open source	38% providing platform to other developers, 62% not open source
Motivation and	Amount of investment	62% spare time+ license fee, 38%

Investment	Amount of investment	outsourcing the programing
	Duration of the app development	76% Less than a year, 19% more than a year, 5% Not developed
	Existence of monetary outcome	62% zero, 20% considerable monetary value, 18% contest prizes
	Having potential of becoming primary business	38% optimistic, 20% real business, 42% lack of city support, no user interest
	Other opportunities app has brought	90% good reputation, expanding network, 10% nothing special

Table 2: represents statistical information of samples

Organizing the case Study

We collected 100 contacts of developers participating in hackathons and applications contests using open data in the last 2 years. We also targeted «Apps for X» contests finalist and winners as successful cases in Amsterdam, Barcelona, Berlin, Helsinki, and Rome to get a pan-European view. We contacted developers via emails asking to participate in our study and requesting for a short Skype calls (about 15 minutes) talking about their application and experiences. In fact, the opportunity for pursuing this research involved an opportune interviewing with application developers who were almost at the beginning of their venture. These developers were committed to develop applications providing information and services to citizens or city officials. We got 21% response rate and the interviewees in most cases were developers and designers responsible for developing applications. Interviews lasted between 15 and 20 minutes and were recorded. In addition to the qualitative data, we also collected secondary data about open data statistics of the targeted cities for past three years including:

- Open data download rates per month
- Open data download No. per applications category (city, health care, tourism)
- Open data downloads rates per participant.

We maintained the data integrity by combining all the relevant interviews data to a sampling frame, before submitting it to our analyses. Note that the unit of the analysis is interview and level of analysis is application prototypes that are categorizing based on applications business models. The unit of analysis refers to how data is gathered and subsequently analyzed, while the level of analysis refers to the scope of the phenomena being studied.

4. STATE OF OPEN DATA AND TAXONOMIES OF BUSSINESS MODELS

Challenge of Diversity

Application classification was developed as it became apparent that the scale and scope of application offerings was wide in terms of market opportunity, service category, data accessibility and adaptability. The benefit of using the application classification is to recognize the application model, with each type of application pursuing strategic alliances, value creating/capturing and market opportunities relevant to its own position within the ecosystem.

Introducing different taxonomies of application business models that is divided into two broad constituencies: For-profit and Not-for-profit. The performance criteria may vary across different application types, with data accessibility being a major priority where applications are developed. The research, apart from addressing a generic business model for applications utilizing open data, is also keen on tracking the open data usage and relates the findings to existing open data application challenges.

State of Open Data

At the beginning, Open Data has been published, from the government or public services to make it available to everyone and free to use. Governments believe that open data accessibility would enhance transparency and it makes governments more accountable to citizens and strengthens democracy.

However, along with publishing the first governmental data, resulted transparency is radically changing the way people live their lives and run their businesses, large amount of government data which has released enabled people to make better choices about the public services they use on daily basis.

The White House under the Obama administration has been a leader in transparency approach and launched one of the first open data websites in 2009. Other countries soon followed: UK, Finland, and Spain. Over the last two years, governments or public sectors made open data significantly easier to access public data. Continued commitment is in the center of open data movement as the data held by the public sector has the potential to transform lives, from increasing transparency to enhancing access and consuming data.

To date, more than 30 countries have created portals for public data around the globe. For instance, The European Union Open Data Portal (open-data.europa.eu), EU agencies (open-data.europa.eu) and the aggregate of national open data portals (publicdata.eu), each offers more than 6,000 datasets. There are some countries such as UK and US that are leading the world in open data with a longer history of releasing open data, with large repositories reaching up to 4900 for data.gov and 7400 for data.gov.uk. While in countries such as Nederland and Finland, open data market is growing exponentially, with small community driven platforms sometimes less than 100 datasets. By looking at pioneer countries in open data, I see that the trend to publish and use Open Data has slowed down significantly compared to initiation period (Figure 1 is presenting trend for US).
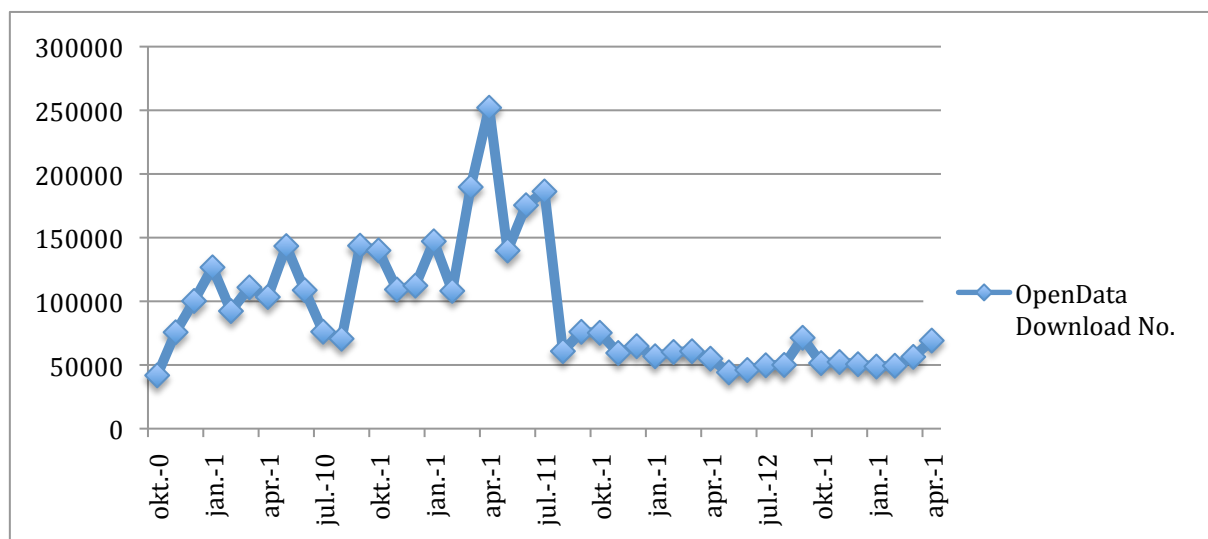

Figure 1: *Average open data trend for US on data.gov*

This change of the trend in more mature markets may have different reasons. Most important reasons are: limitation of possible data bases available, technological and economic constraints in gathering richer data, limitation of new ideas for application, limitation in different dimension of application, fewer tendencies to invest in new application as the market is more saturated and less profitable.

On the other hand, for some countries that unlocked open data later, the market is new and the trend to publish and use Open Data is still strong. As it is shown in Figure 2, open data usage trend is booming up in Amsterdam (on Amsterdam City Council) and Helsinki (On Forum Virium Helsinki). The peak points (Jun-13 & Oct-13) are indicating the existence of national or international applications competition or availability of new open dataset in these cities. For instance, the remarkable increase on March-13 in Helsinki comes from the fact that at that time Helsinki's historical aerial photos has been published and it raised a lot of attention. The significant data growth on Oct-13 in Amsterdam is mainly because of applications for European competition on that date.
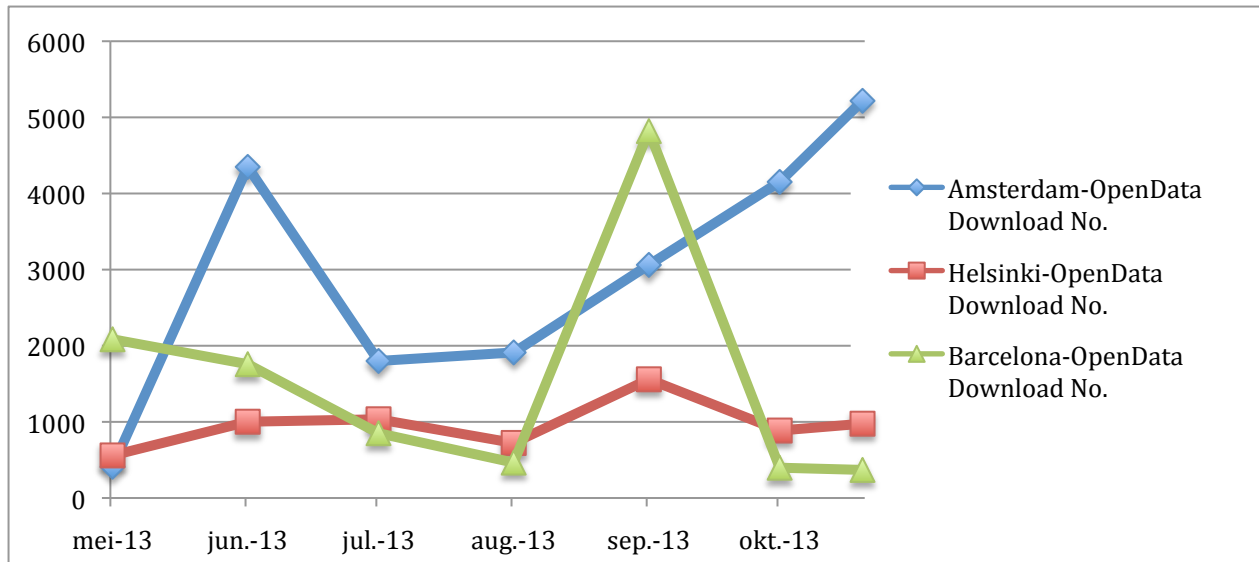

Figure 2: Open data trend for three European cities

This inconsistency of trend may have different reasons. Most important reasons are: shortage of data base variety, lack of standardized file formats, lack of motivation (less application competition compared to other part of Europe), less incentive for investing in new application as the market is uncertain and risky.

By comparing two successful cases, Amsterdam and Helsinki, two successful examples of open data usage with more mature markets like US, I see that they still are experiencing the first part of the trend, namely strong growth. But there are some unsuccessful countries in open data usage that are not pursuing the mentioned path, such as Spain. By looking at open data trend in Barcelona on Barcelona City Council (Figure 2), I see a downward slope in the graph, which is not compatible with what we have seen in other mature markets at initiation period.

Data Analysis and Creating Business Model Taxonomies

Due to interview data that have been collected around city applications using open data in five European cities, we found other types of business model from capturing value perspective. Based on monetary motives, we classified application business model into tow broad constituencies: for-profit and not-for-profit, each constituency has been classified into different taxonomies. For-profits business models are categorized as gaining monetary value, capturing reputation, creating awareness, testing idea, and personal reputation and no-for-profit taxonomy is classified as gaining reputation, providing service, and crating awareness (Table 3).

App Taxonomy	App Name	Category	City	Relation with city official	App availability	Open Source	Download N...
For-profit gaining monetary value	uClinics	Healthcare	Barcelona	Nothing special	Apple/Android	No	9000
	FGC	Transportation	Barcelona	Limited relation to get data	Apple/Android	No	10000
	Kindergarten-Suche	Education	Berlin	Organizing some events	Apple/Android	Yes	11000
	AmsterdamApp	Geographical	Amsterdam	Relation with national org.	Web-App	Yes	6000
	OpenbaarVervoer	Transportation	Amsterdam	Limited relation to get data	Apple	No	2000
For-profit capturing reputation	Blind Square	Navigation	Helsinki	Collaboration to access data	Apple	No	6000
	BikeDistrict	Transportation	Rome	Unsuccessful effort	Web-App	No	3000
For-profit creating awareness	Huellasolar	Weather Forecast	Barcelona	Tried a lot, no result	Web-App	Yes	6000
	ComunicaPA	Transportation	Roma	Limited collaboration	Android	Yes	5000
For-profit testing idea	OperadorApp	Communication	Barcelona	No need/using CMT	Apple/Android	Yes	4000
	iKringloop	Recycling	Amsterdam	With open data department	Apple/Android	No	5000
For-profit personal reputation	PixHunting	Tourism	Barcelona	No relation	Android	No	2000
	Smart Recycling	Recycling	Barcelona	Tried a lot/But no budget	iTunes	Yes	1000
	Trova Farmacie	Healthcare	Rome	No	Not Published	No	1000
	Mapnificent Berlin	Transportation	Berlin	Tried a lot, no result	Web App	No	5300
Not-for-profit gaining reputation	DoveSiButta	Recycling	Rome	Limited collaboration	Android/Apple	Yes	894
	Commutio	Communication	Barcelona	Tried a lot, no result	Android/Apple	Yes	5000
	Eureka!	Social	Rome	Tried a lot, no result	Android	No	5000
Not-for-profit providing service	Navigatore Museo	Tourism	Rome	Yes, to improve data quality	Web App	No	4000
Not-for-profit creating awareness	Istituto Europeo	Tourism	Barcelona	No	Not published	No	40000
	Spot in Helsinki	Entertainment	Helsinki	Limited collaboration	Android	No	4000

Table 3: Taxonomies representative of all Apps

Figure 3 illustrates the apps across the business model taxonomies.
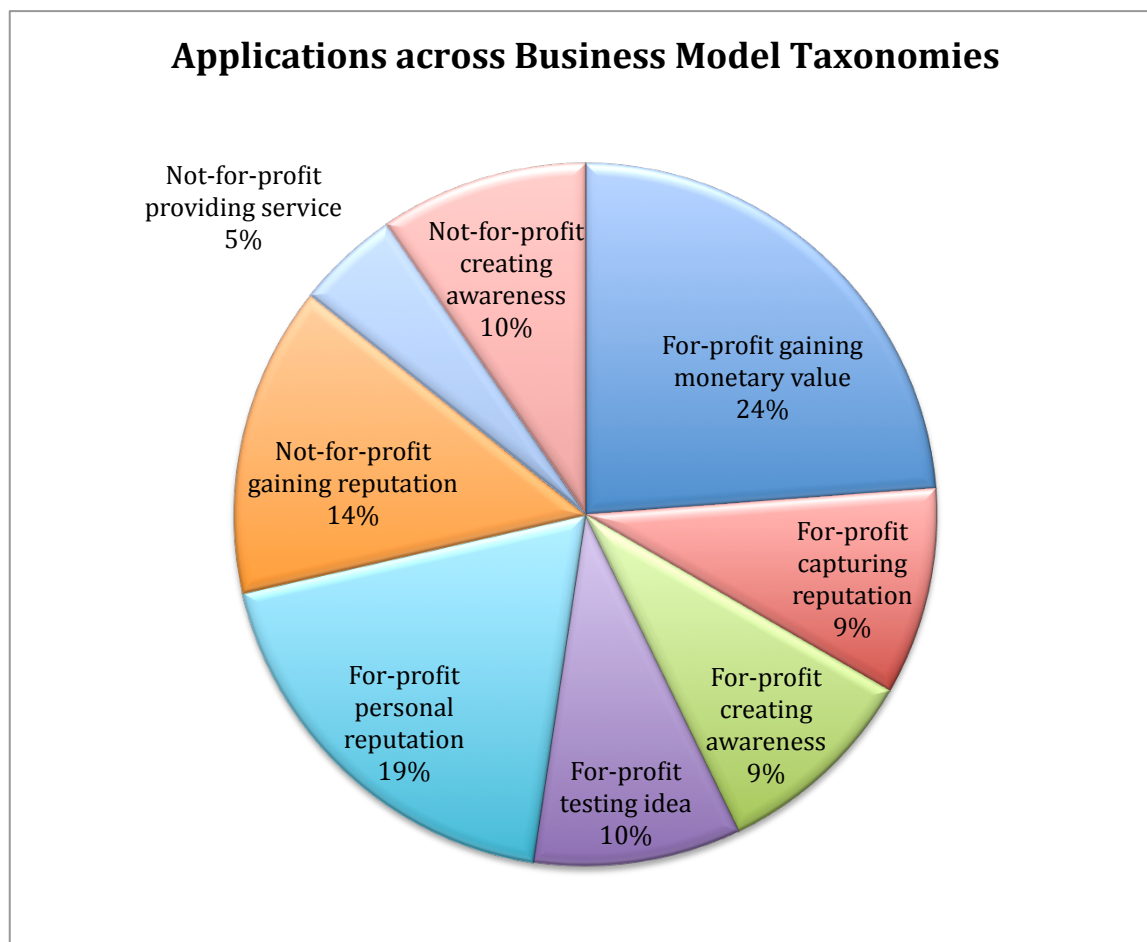

Figure 3: Apps across Business Model Taxonomies

For-Profit Taxonomies

For-profit taxonomies are companies that seeking revenue. Among these businesses, there are three different way of capturing value: the ones who manage to generate revenue, the ones who manage to create awareness and the ones who manage to build reputation (Figure 4).
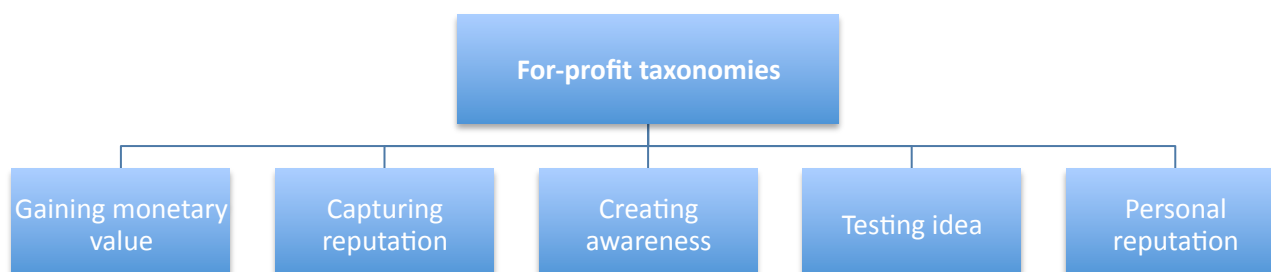

Figure 4: For-profit taxonomies

A. **_Gaining monetary value:_** The main objective of these businesses is to capture monetary value through satisfying real existing needs. Hence, R&D has significant share in application development cycle.

Kindergarten-Suche (tursics.de/kindergarten/de) is a decent successful example of this business model. Application is aiming to satisfy citizens' needs using open data. They knew about the difficulties and importance of finding kindergartens in Germany, specifically in Berlin. Because there is large number of kindergartens in Germany and finding the suitable one in terms of different factors such as location, facilities, opening hours and etc. was not easy for parents. First, they developed the application and published it on iStores as paid app for Berlin and afterwards they expand the market and publish it all around Germany.

B. **_Capturing reputation:_** Applications that are classified in this taxonomy, are re-announcing a way to generate revenue. Because they realized that the application market is so small and there are not enough customers to get money through advertising. In result, this type applications work as an advertisement for big companies.

As successful example of this taxonomy, ParkShark is a parking information and parking space sharing application. At the initiation phase, Park Shark won some prize at the Rotterdamse Verkeersonderneming Open Data session and attracted some attention. The Park Shark applications are free but supported by Glimworm who have generated growing revenue by providing consultancy, implementation, integration and hosting services to private companies in need of investment and plan to expand their services across Europe in the coming year.

C. **_Creating awareness:_** This taxonomy consists of small companies that want to test that the proposition of the application is viable or not. There are two different kinds of thinking behind this: in the first stage businesses are developing applications to create awareness through mentioning in press, participating in various contests, and application availability. So if they could create enough awareness, in the second stage they try to get reputation and generate revenue. This taxonomy is similar to "Capturing reputation" that is trying to create awareness as something valuable, mainly because they didn't find a way to capture monetary value. Also in some cases, big companies like Coca Cola are financing applications to just create awareness.

OperadorApp application (operadorapp.com) discovers mobile operators of the destination call and regarding to mobile operators policies determines the cost of call. First they publish the free version on as many as possible iStore (Android, Apple, Blackberry and Symbian). After creating enough awareness (reaching to a substantial amount of download No.), they publish the premium version of app with more features on iStores.

D. **_Testing idea:_** Mostly are single developers that have an idea and want to know if it's good enough to fly or they need to invest more. These developers are at first level of establishing a start-up business and they test the business case to see if it's viable or not.

Huellasolar application (appcircus.com/apps/huellasolar), projects a map, indicating different factors related to sun such as sun affect on building and neighbours and number of sunny hours. Developers knew that _there are only general maps, but not specific weather map. So they established a small start-up to develop the app and see if the idea is viable enough to commercialize._

E. **_Personal reputation:_** Single developers who are working in highly visible open source projects. Essentially, they want to improve their skills in order to gain reputation in community to get better positions in big companies like Google. It's a typical case, because big companies are usually present in open source projects to hire successful individuals. This is taxonomy of for-profit model if the individual manage to find a better position.

Recycling application (appcircus.com/apps/smart-recycling) provides service in which people could easily find recycle points or time table of trash drop off. It is an open source project and the designer tried a lot to

gather relevant data sets, as at the moment of app development it was not available. This effort and success of app designer helped to find new connections and at the end find a good job

Not-for-profit Taxonomies

Not-for-profit business models include any public or private organization that finances an application for community and they create application to create some positive changes in society (Figure 5).
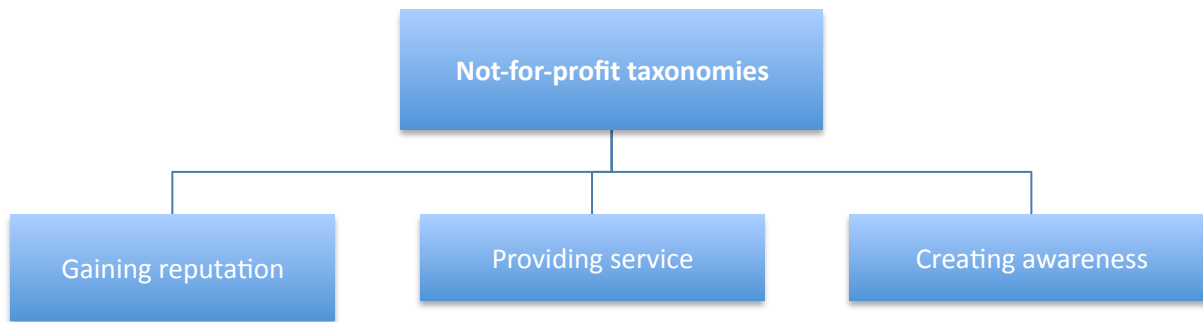
Managing Figure 5: No-for-profit Taxonomies

A. Gaining reputation: This kind is consisting of any type of not-for-profit organizations that are trying to create peace. This means that applications are aiming to focus on peacefulness of organization activities to create more social value.
B. Providing a service: Applications that are classified in this category are financed to provide a service to a community or making a petition to create a change in society. Developing an application for museum to provide a better experience to visitors is a well-known example of this taxonomy.
C. Creating awareness: All not-for-profit organizations are investing on apps to make positive changes in the society. But majority of these organizations that are specialized in certain fields can be included in this category. This extensive experience leads them to develop applications to create awareness related to their involved area.

Possible Arrangement of Applications Based on Value Captured

In Figure 6, the vertical axis is value captured and the horizontal axis is application name. In order to develop the vertical axis, we used 4 main constructs which previously introduced in Figure 3 and Figure 4, namely monetary value, creating awareness, reputation, and successfulness. The idea here is to integrate the essence of the whole value created and introduce a single dimensional scale through basic statistics. The detail of these constructs is as follow:

- *Criteria 1*: Through three sections in the questionnaire (Mentioning in press, participating in various contests, application availability), I measured creating awareness (Mentioning in press is measured through a dummy variable which takes 1 when the App is mentioned in press and zero otherwise; participating in various contests is measured through a dummy variable which takes 1 when the App has won any contest and zero otherwise; application availability can take three possible values, 1 when the App is available both in Apple and Android, 0.5 when the App is available in either Apple or Android, and 0 otherwise).
- *Criteria 2*: Through two sections in the questionnaire (Interacting with community of developers, relationship with city officials), I measured reputation (Interacting with community of developers is measured through a dummy variable which takes 1 when there is an interaction and zero otherwise; relationship with city officials is measured through a dummy variable which takes 1 when there is a relation and zero otherwise).
- *Criteria 3*: I measured monetary capture as following (hourly wage benchmark is set 10 euro as an average pay for freelancer developers) (Table 4):

Monetary capture = download number * App price + prize won – costs (License+ Time invested to develop the app*benchmark hourly wage) (The average salary of an application developer (coder) with a permanent job in US is 1600 \$/month. Converting this average to euro in an hourly basis would be around 10).[2]

- *Criteria 4*: download number of application as factor of successfulness, which is retrieved from data analytics provided by app developers.

Finally in order to create this scale, I gave each of four above criterion the same weight (each criteria has 25% weight) and aggregated them to one number that represents the value captured by the application. I normalized criteria 3 and criteria 4. This is the formula used:

Value Captured =(0.25*(sum first criteria/3))+(0.25*(sum second criteria/2))+(0.25*(third criteria/129238))+(0.25*(fourth criteria/11000)) (Table 5)

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[2] http://www.glassdoor.com/GD/Intern-Salary/Siemens-USA-Internship-Salary-E13578.htm?filter.jobTitleFTS=Software+Engineer

App Name	Download No.	App price (Euro)	Prize won (Euro)	Time (hour)	Hourly wage	Cost (Euro)	Monetary Capture	Monetary Capture (Normalized)
Huellasolar	6000	6	0	600	10	0	36000	51738
PixHunting	1000	0	5000	480	10	0	5000	20738
FGC	10000	0	0	240	10	0	-500	15238
OperadorApp	4000	13	5000	720	10	500	56500	72238
uClinics	9000	13	0	80	10	500	116500	132238
Smart Recycling	1000	0	0	160	10	4000	-4000	11738
Commutio	1000	0	0	240	10	9000	-9000	6738
Istituto Europeo	4000	0	0	240	10	0	0	15738
ComunicaPA	5000	0	0	160	10	0	0	15738
DoveSiButta	894	0	5000	240	10	500	450	20238
Eureka!	5000	0	0	30	10	0	0	15738
Trova Farmacie	1000	0	0	480	10	0	0	15738
Navigatore Museo	4000	0	0	80	10	0	0	15738
BikeDistrict	3000	0	5000	240	10	0	5000	20738
Spot in Helsinki	4000	0	0	100	10	0	0	15738
Blind Square	6000	19	0	160	10	500	113500	129238
Kindergarten-Suche	11000	0	5000	30	10	0	5000	20738
Mapnificent Berlin	5300	0	0	80	10	0	0	15738
Amsterdam App	6000	6	0	30	10	0	36000	51738
Openbaar Vervoer	1500	19	5000	30	10	500	33000	48738
iKringloop	5000	0	0	240	10	2000	-2000	13738

Table 4: Apps monetary capture calculation (Criteria 3)

App Name	Creating awareness	Reputation	Monetary capture	Download No.	Total
	Criteria1	Criteria2	Criteria3	Criteria4	
Huellasolar	1.5	2	51738	6000	0.611446429
PixHunting	2.5	0	20738	1000	0.271176516
FGC	1	1	15238	10000	0.465082685
OperadorApp	3	1	72238	4000	0.605647403
uClinics	2	0	132238	9000	0.627015368
Smart Recycling	1	1	11738	1000	0.253766776
Commutio	2	2	6738	1000	0.452428032
Istituto Europeo	2	0	15738	4000	0.28801959
ComunicaPA	2.5	1	15738	5000	0.477413529
DoveSiButta	2	1	20238	894	0.351133551
Eureka!	2.5	2	15738	5000	0.602413529
Trova Farmacie	1	0	15738	1000	0.136504438
Navigatore Museo	1.5	1	15738	4000	0.371352923
BikeDistrict	2.5	1	20738	3000	0.441631062
Spot in Helsinki	1.5	1	15738	4000	0.371352923
Blind Square	3	2	129238	6000	0.886363636
Kindergarten-Suche	2.5	2	20738	11000	0.748449244
Mapnificent Berlin	0.5	2	15738	5300	0.442565044
Amsterdam App	0.5	0	51738	6000	0.278113096
Openbaar Vervoer	2.5	2	48738	1500	0.586703789
iKringloop	2	2	13738	5000	0.556878031

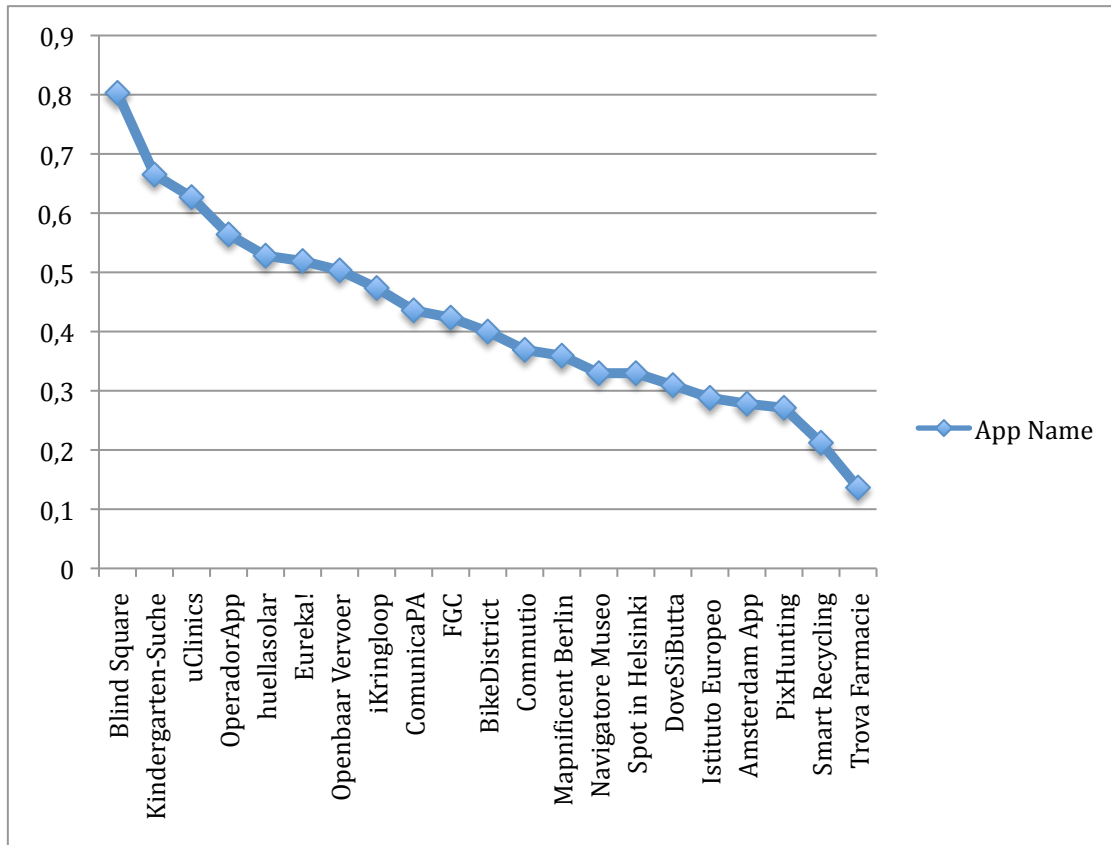*Table 5: Apps value captured calculation*

Figure 6: Application ordered by captured value

As in above figure the vertical axis is the value captured, we expect the applications with more value captured (tangible and intangible) be located in the left side of the graph. The applications that are in top of value captured listed mostly belong to "gaining monetary value" taxonomy. As we move more toward the right side tail of the graph value captured by the application decrease significantly. Some of these applications are example of real failure. The application that are in bottom of value captured list mostly belong to "personal reputation" taxonomy which are developers who wished to find a better position through application development that obviously fail to reach the goal. At the end we have to explicitly mention that the scale for creating value (vertical axis) is not rigorous and we included this graph to show a possible arrangement of these applications in a common sensible way.

Mapping Taxonomies into Business Model Frameworks

In Figure 7 and Figure 8, we mapped choices and consequences framework developed by Casadesus-Masanell and Ricart (2010) into for-profit and no-for-profit reputation taxonomies as an interesting special case. As it is shown, the both Figures (for-profit and no-for-profit constituencies) indicate the importance of capturing reputation in both constituencies and how gaining reputation reinforce the other loop to invest and develop new applications.
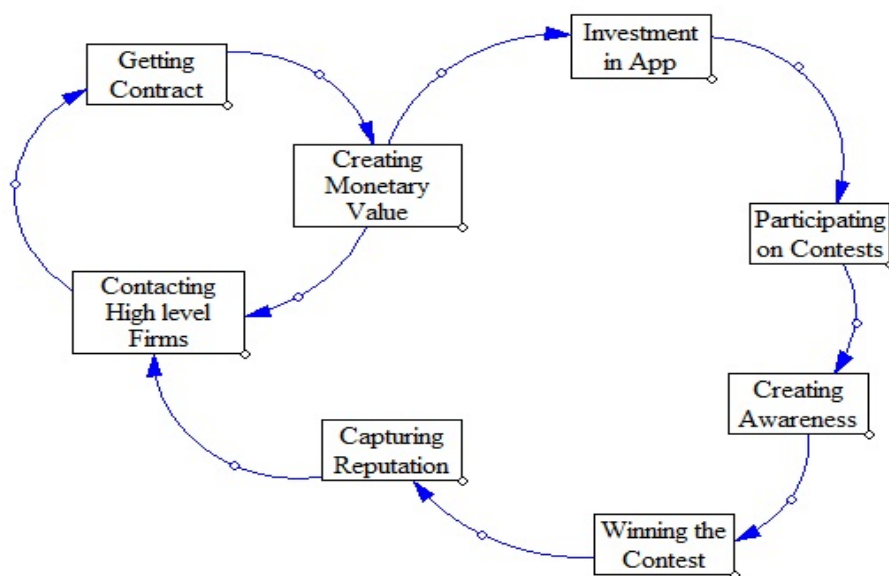
Figure 7: Choices and consequences framework for for-profit and no-for-profit reputation taxonomy
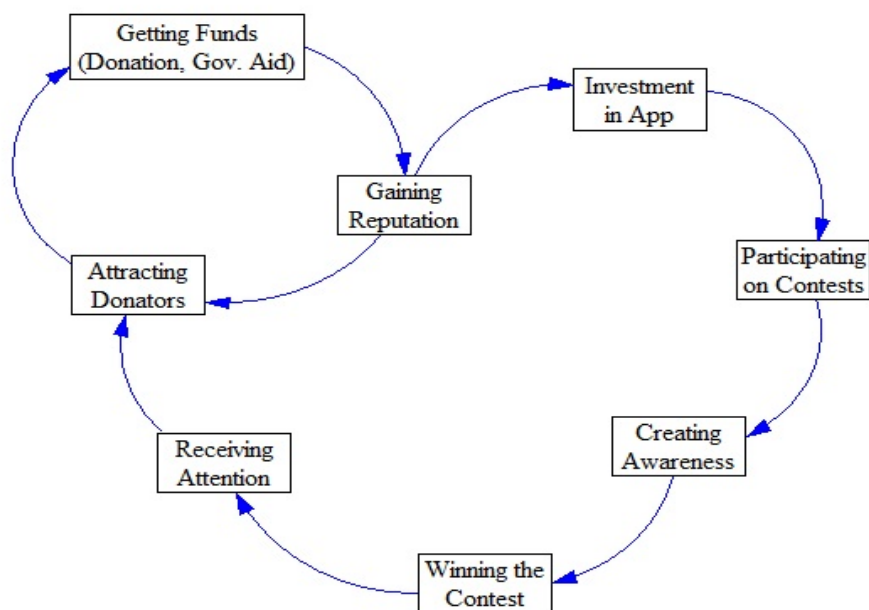

Figure 8: Choices and consequences framework for Not-for-profit reputation taxonomy

Here we used Business model Canvas framework developed by Osterwalder (2010).
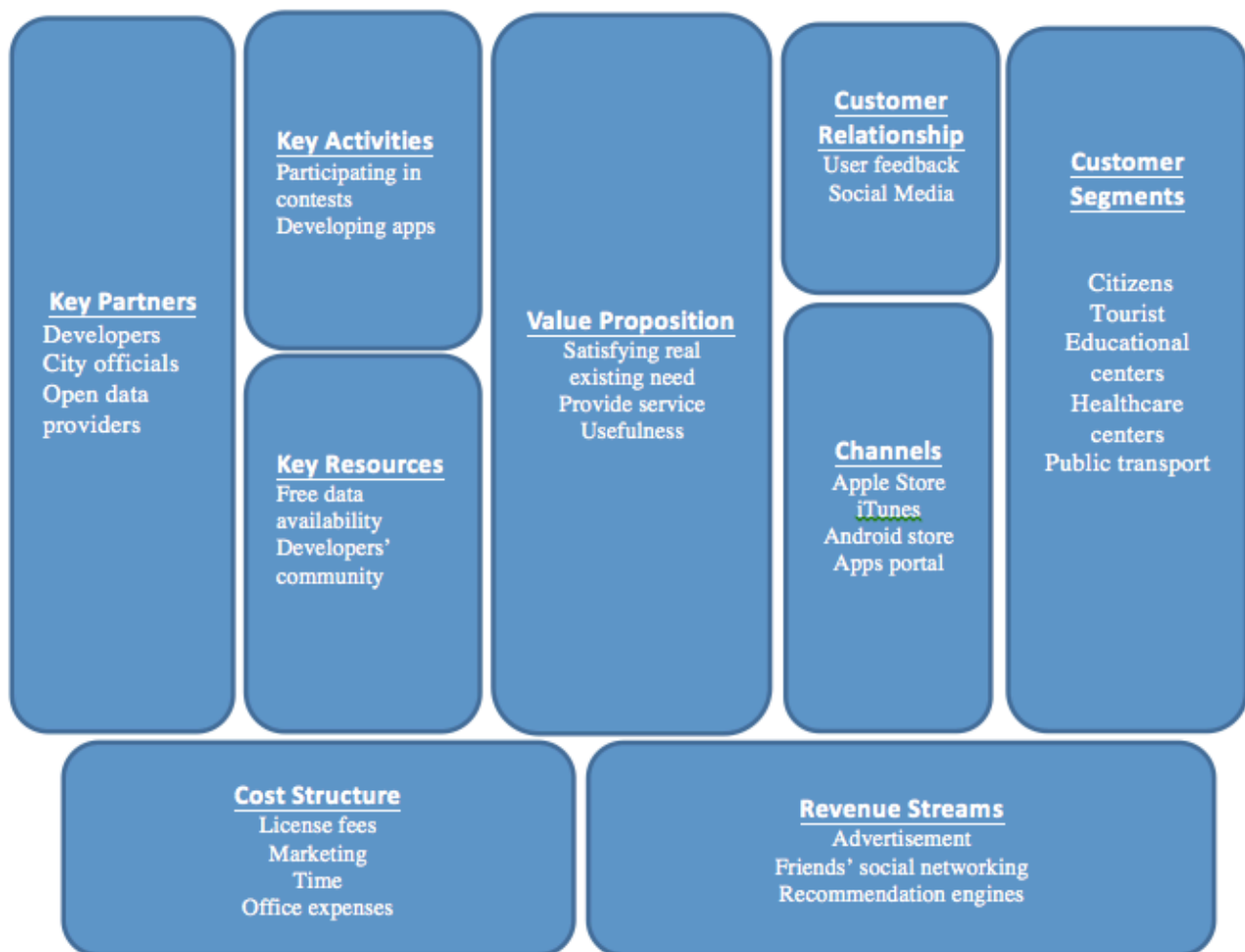

Figure 9: Generic Canvas modelling of taxonomies

Instead of creating 8 different business models corresponding to each of the 8 taxonomies, below we present one generic business model by aggregating corresponding logic behind all taxonomies to illustrate big picture of city application ecosystem business model (Figure 9).

5. TAXONOMIES MOTIVES AND INCETIVES

Based on taxonomies presented in previous section, there are various motivations and incentives for developing an application. Due to our classification, here we'll focus more on the taxonomies containing more number of applications in the sample and we'll suggest some tailored solution to help developers toward success.

Substantial numbers of applications in our study are companies that are managed to capture monetary value. These businesses have to invest a great amount of time and energy on market research to derive real existing needs of citizens, in some cases the time spent on obtaining market data is twice or three times of the development time for application. A possible solution to help developers shorten this research period is through creation of some portals with complementary data about the market or possible markets for the available data.

Capturing reputation taxonomy in both constituencies contains considerable number of businesses. These businesses are trying to gain reputation by winning the contests, as the market is so small to monetize apps through advertising. Winning the contest is a short-term goal in these business models; the ultimate goal is to create monetary value that at the end most of the developers are not able to achieve it. A possible solution for for-profit businesses is through settings to facilitate the collaboration and networking with high-level firms in the same sector. Moreover, inviting some high level firms in related sectors to get involved in contests and offer positions will help both for-profit and not-for-profit business to thrive. Here is a quote from project manager of one the companies:

"We spoke with city officials. They were happy with the application*, but they explicitly said that they are not going to invest on the* application*. But now, we are doing some studies to find out user behavioral patterns and trying to build a partnership with city halls via this channel."*

The third taxonomy is companies with the goal of creating awareness. These companies are mainly focused on participating in different contests or being part of related communities. A possible solution here is stimulating communities through funding or more involvement in database developments. Furthermore, allocating web pages or websites to developers by city officials would help them to introduce and commercialize their applications more effectively and obtain more visibility with lowest possible cost. Here is a quote from one of the developers:

"*It is not easy to get in to* application*s contests or developers' ecosystem. First we need to have at least one successful* application *and then it would be possible to enter into this world. I believe that the main factor of my failure is lack of sponsor and support from contests*."

6. CONCLUSION: APPLICATIONS BUSINESS MODEL TAXONOMIES

We discussed the Application development environment through ecosystem approach. Despite all effort and support from the governments, the social success of applications, and the value created for the customers, the application ecosystem as a whole is a case of failure. This failure is generally not because of the lack of innovation or creativity. Some underlying explanations for this failure are: first, that market of applications using open data is small and fragmented. There are not so many contests both national and international for these applications. Furthermore, from contest to contest and from country to country there are different standards, which the developers need to understand and adapt the application to each of these standards. Second, there is a lack of managerial knowledge of application developers toward the possible business model behind the application (and the business as a whole). Most of developers are only focusing on freshness and innovativeness of the ideas for the application that is a critical aspect for the success of the application per se. But there are some other central aspects in business model, which they neglect generally. This aspect is capturing value as well as creating value. This is very common issue in most Internet based businesses.

This is a clear message for the collaborators and investors of the ecosystems like city officials. Now it is not enough to provide open data for free to encourage innovation and enhance transparency, they also need to invest on ecosystem management. It is difficult to see the whole ecosystem and leading the whole system toward creating more social and economical value.

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