EPH - International Journal of Business & Management Science
ISSN (Online): 2208-2190
Volume 01 Issue 03 September 2015

DOI: https://doi.org/10.53555/eijbms.v1i3.37

BUILDING INCLUSIVE DIGITAL SOCIETIES THROUGH THE USE OF OPEN SOURCE TECHNOLOGIES

Petra Turkama*
**Abu Dhabi University, P.O Box 59911,Abu Dhabi, United Arab Emirates*

Corresponding Author:-
E-mail:- petra.turkama@adu.ac.ae

Abstract:-
Digital convergence offers many new opportunities, but also poses architectural and structural issues. One of the most critical obstacles is the 'vertical silos model' that shapes much of today's Internet. The accumulation of money, power and influence create further concern. We propose the use of open source technologies as a partial solution for the identified challenge. These technologies enable scalability of innovations and drive distribution wealth. Open source technologies have been studied extensively from technical view point, but less from adaptation side. Our research took customer view in technology sourcing. Data was collected in a survey and interviews with 120 companies in Europe. The enquiry revealed that open source technology adaptations were limited due to the uncertainties related to sustainability of communities, SLAs and regulations. The study implied that the industry needs to evolve toward increased customer orientation. The study contributes to adaptation of open source technologies.

Keywords:-*Internet Evolution, Open Source Software,* Innovation

1 INTRODUCTION

Internet has evolved significantly during the past few decades. Over the past decade, a flourishing number of concepts and architectural shifts have appeared such as the Internet of Things (IoT), Big Data Cloud Computing, and Software-Defined Networking. The gradual evolution in Internet development brings forward large societal and economic opportunities for reducing various costs for societies, creating efficiencies, increasing the service for the citizens in a vast number of areas, and fostering sustainable economic growth with notable productivity gains. Although these convergent forces offer the potential to create new business models and system designs, they also pose key architectural and structural issues that must be addressed for businesses to benefit, as well as societal and value laden questions that we must address in order to make the future internet serve people and societies as expected.

The main Internet challenges include security for the data collected to cloud from interconnected machines in an Internet of Things (IoT) setting. Increasing the number of connected devices increases the opportunity to exploit security vulnerabilities, as do poorly designed devices, which can expose user data to theft by leaving data streams inadequately protected. In some cases such as implanted, Internet-enabled medical devices and hackable cars people's health and safety can be put at risk. The homogeneity of devices magnifies the potential impact of any single security vulnerability by the sheer number of devices that all have the same characteristics.

Privacy concerns are elevated through integrating data collecting devices into our environments without us consciously using them. However, privacy concerns extend beyond collection of people's personal data. Tracking devices for phones, cars and smart televisions record with voice recognition or vision features can continuously listen to conversations or watch for activity and selectively transmit that data to a cloud service for processing. The collection of this information exposes legal and regulatory challenges facing data protection and privacy law. Legal systems struggle to keep up with the technology developments.

The lack of standardized processes can limit the potential scalability of Internet-enabled innovations and limit reaching its' full potential. Without standardized processes to guide manufacturers, developers design proprietary solutions that can operate in disruptive ways on the Internet domain without full regard to their impact. If poorly designed and configured, such Internet solutions can have negative consequences for the networking resources they connect to and to the broader Internet development. The concept of standardized processes should be expanded to cover not only technologies and interfaces where architectural deficiencies appear, but also operational procedures and data management models to ensure trust.

Legal issues with Internet and IoT devices currently include cross-border data flows; conflicts between law enforcement surveillance and civil rights; data retention and destruction policies; mediating the tension between data ownership and open access; and legal liability for unintended uses, security breaches or privacy lapses. The present situation is not a given state of affairs and there are international business and economic developments already modifying it. Furthermore, the expectations and values of today's digi-natives don't necessarily resonate with the monopolistic and institutionalized approaches, but rather demand support for more distributed, fast moving and dynamic collaborations and interactions. One example of this phenomenon is the interest toward blockchains – the connection of vertical silos horizontally without a platform owner.

One of the most critical obstacles is the 'vertical silos model' that shapes much of today's Internet service offering. Products and services are increasingly developed on closelycontrolled and increasingly vertically integrated technology platforms, which are controlled by a few major US enterprises. This is a serious impediment for the global co-creation of products and services in the spirit of open innovation, effectively hindering the scalability of Internet-enabled services and new concepts beyond a limited scope of investment criteria, as well as creating concerns regarding the accumulation of money, power and influence.

Internet of the future will trigger the disruption and transformation of the existing value chains. The changes will be faster first in the fields of telecommunications, traffic, healthcare and education, and will reach also sectors such as agriculture and public governance.

Furthermore, digital development paths should reflect our commonly shared values and objectives for *inclusiveness, openness, regional development and successful collaboration of public sector and industries, as well as cross-industry collaboration and enhanced SME empowerment*. Development is being viewed from a general, technology-neutral perspective legal lens, which seeks to prevent unfair or deceptive practices against consumers. From this new human-centric perspective, the Internet should offer *more at the service of people and society***.** It should provide better services, more intelligence, higher involvement and participation - to better embrace the *social and ethical* values that we enjoy in our societies, and contribute to building equal and stable societies.

Internet has proven to be a powerful game changer in many vital functions of society and business. In order to fully utilize the opportunities of Next Generation Internet, it is necessary to include the fundamental principles of society and business in the research. This inclusion should consider:

- Agreed values, processes and rules should guide the development and application of technology and it's applications

- Society and regulation should be able to faster adapt to the development of technology enabling totally novel structures and practices
- Economic sustainability and business logic should drive technology evolution
- Theoretical and scientific research should be brought out of the labs and blended with real life experimentation
- Scalability of concept should drive selection with the convergence of industries

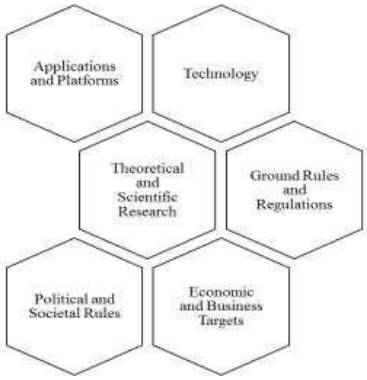

Fig. 1. Internet development landscape

2 Open Source Technologies

OSS technologies have been considered as the major driver for scalability of innovations [1]. Technical concerns in different industry sectors and usage areas have been reported increasingly assimilated, and thus the same general enabling technologies and solutions can be used in a variety of application areas. Only open, standardized interfaces enable scale efficiencies, drive vertical innovation co-creation, and deliver novel customer value. As such OSS technologies can be considered as an enabler for sustainable business practices for the express purposes of leveraging human and non-human resources for the benefits of all the stakeholders of the society.

Open source providers such as Open Stack and Hadoop provide clones for the leading commercial solutions with the same functionality. Feature parity analyses have reported that alternative open source solutions cover the cloud offering extensively in the infrastructure layer, while platform and software layers still have some gaps in the offering [2]. Despite the fast maturing of the technologies, their commercial adaptation remains limited. The main limitations include technical barriers like interoperability, application programming interface (API) compatibility and integration challenges. There are also numerous non-technical challenges like business continuity, reliability and continued support of technologies. Customers are uncomfortable with the lack of clear service level agreements (SLA) and visibility to the future roadmaps. This is particularly true in cloud computing environments where customers expect convenience and turnkey solutions with masked complexity. The solutions are purchased as standardized, modular components 'as-a-service'.

OSS cloud platforms have been studied extensively from technical and developers' point of view. Much of the research focuses on contributors' incentives, service providers' business logic and technical assessments. There are no studies on customers' acceptance of OSS technologies in cloud context, or the broader impacts on society as a driver for more equal, transparent and sustainable future for internet. Our research tapped into this less studied area with an objective to understand cloud customers' relationship value drivers leading to vendor selection, and their implication to the evolution of cloud industry. We assumed service science oriented approach to understanding the customer value in cloud supplier relationships. After an extensive literature review, an online survey with 120 major European companies was conducted, and findings were complemented with interviews with the CTOs of 55 major companies. The collected data was analyzed with an acknowledged framework in order to get a holistic view of the customers' preferences.

OSS development started to gain momentum in the 1990s. The phenomenon builds on voluntary communities and software developers making their source code available free-of charge to end users and improvers in cumulative context, sometimes subject to license restrictions [3]. The area that was first considered as a hobbyist activity or academic exercise has turned into significant commercial field with participation and support of the world's largest commercial software companies (e.g., Facebook, Google) that are spending billions on open source, with over 50% of OSS communities today being backed up by large companies, or even owned and controlled by them [4], [5]. In order to understand the scale, one of the first movers in the area, Linux statistics state that in 2015 there are 566,665 users and 159,985 machines registered to Linux only, and the estimate for the total number of Linux users exceeds 82 million (Linuxcounter site).

In terms of predictions, Gartner expects that 99% of Global 2000 companies will incorporate open source into their operations by 2016, and IDC predicts that by 2018, 60% of IT solutions originally developed as proprietary, closed solutions, will become open-sourced [6]. To complement these predictions, section 2.1 briefly discusses the business models and communities governing OSS solutions, while section 2.2 provides an in-depth discussion about the pros and cons of using OSS for Cloud Computing.

2.1 Open source business models and communities

Open source business models rely on approximation and complementarity to other resources like human capital or proprietary products and services. This can include supply of support personnel, user toolkits, coordination functions or virtual communities [7], [8]. OSS communities enjoy from network externalities in the same manner as proprietary software [9], which incentivizes building large developer communities. Large communities with industrial support also benefit from perceived credibility and community of choice for top contributors and users. Despite that, most OSS communities remain small with less than 50 contributors [10] although small OSS communities can be very viable in niche areas, as open source software design is modular [11]. Due to its complexity and broad impact, the phenomenon of OSS has been studied extensively by multiple research communities ranging from legal scholars, economists, sociologists, anthropologists to computer scientists. In addition to countless technical studies and reports, the research seeks to explain the developers' motives, rewarding mechanism, signalling and societal impact, as well as IPR questions and business models [10], [12], [13]. Our research focuses on the less studied phenomenon of OSS adaptation in cloud computing context from the customer point of view. The objective is, on the one hand, to better understand the different drivers cloud customers have for service and service provider selection, and on the other hand, to support OSS providers to plan their services and business models accordingly.

The key features of cloud computing are resource pooling, rapid elasticity, on-demand service and guaranteed availability. The customers only pay for the services they use, and can plug and play with different services. When it comes to open source software, these features can be somewhat compromised. The main challenges from customers' viewpoint are:

i) Reliability: the lack of documentation, inability to negotiate contracts and support [14];

ii) Standardization: market is still missing dominant standards for open interfaces, which has led to challenges with interoperability and versioning [15], [16];

iii) Usability: the challenge refers to integration to heritage systems and interoperability with supply network partners' systems.

These challenges are accounted for the developer profiles and valuations. Most of the OSS contributors are IT professionals [12] and rather focus on technologically virtuous technologies for sophisticated users than serving the masses [16]. The developers prefer to work independently with technical challenges, whereas most cloud computing services consists of mature technologies. Developers are also selective with the communities they contribute to, which leads to challenges with sustainability [17], [18]. Given this situation, customer business concerns are left with less attention.

3 Customer Relationship Value Drivers

Cloud computing is essentially an IT procurement model where the on demand technologies are delivered as-a-service. This highlights the importance of customer-service provider relationship and dialogue for joint value creation and mutual benefit. Given this, we adopt a customer relationship value approach to investigating the customers' perception of value in these encounters in an effort to support OSS providers to better target their offering to mass customers. Value to the customer has several dimensions ranging from utility value to social value, and further functional customer experience, i.e. the ease of access, adaptation, development, and use of platform technologies. Section 3.1 provides a general overview of the customer perceived value model, while section 3.2 focuses on the customer value perception of OSS in cloud computing environments.

Customer value proposition must provide distinctive, measurable, and sustainable value [19]. Viewing cloud computing from the service science perspective highlights the role of cloud as an orchestration device of value co-creation processes. Supplier must be able to support customers, not only in those processes that are most relevant for customer's businesses, but also in all stages of customer interaction, even during stages that do not directly contribute to the balance sheet such as in sales [20]. Cloud computing service relationship integrates supplier, customer and end-users tangible assets (i.e. technology, people) and intangible assets (i.e. value propositions, shared information) [20]. The key idea is that the underlying technology is invisible for the end-users, clients and developers. The service oriented view supports companies in identifying new horizontal value creation opportunities and business models [21].

3.1 Customer Value Principles

Service providers' ultimate objective is to add value to customers' business, processes and operations. The customer perceived value is defined as value that customer receives in return of investment, which in many cases deviates from the suppliers' intended value creation. In case of services, the value is created in co-creation with the customer [22]. Therefore the supplier relationship value is of greater importance than the customer delivered value. Customer value has been categorised by Smith and Colgate (2007) [23] as follows:

1. Functional value: the attributes that help create value, i.e. cost, quality, reliability, security, and performance [1]
2. Cost/sacrifice value: comparable overall life cycle value [24];
3. Relationship value: the overall customer experience, i.e. product quality, service support, delivery performance, supplier know-how, time-to-market, personal interaction, price, and process costs [25];
4. Co-creation value: the capabilities that enable designing or modifying service or source code [26];
5. Brand value: the social value in peer group [19] ;

The four most common challenges in creating customer value are insufficient wealth, access, skill, and time [27]. The scholars urge for more customer research to validate the points of value creation, to determine new dimensions of value, and to assess the relative importance of each dimension of value from a customer's perspective. The relationship value driver framework introduced by Wolfgang Ulaga's (2003) [25] maps customers' perceived value in service relationships. The authors identified 8 dimensions of value, which correspond to the ones introduced in in Figure 1 (each dimension having sub-categories describing elements of perceived value).

We selected Ulaga's framework for analysing customers' perception of open source cloud software. The different elements of customer reported valuations were mapped under the eight categories in order to have an overall view of customers' drivers in selecting cloud computing services. This would support our understanding of opportunities and limitations of OSS in cloud computing from customers' perspective. The framework applies well to an open source context, because most consumers or end-customers of commercial OSS are businesses [30]. The limitations of the framework relate to little attention given to external environment and context where the value creation takes place.

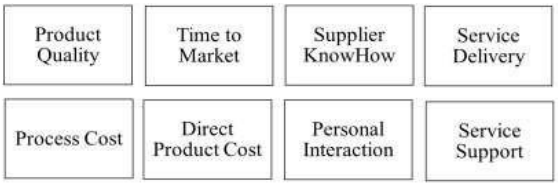

Fig. 2. Ulaga (2003): 8 dimensions of customer relationship value drivers

In this framework, product quality is defined as the extent to which the supplier's product meets the customer's specifications. Service Support refers to the provisioning of the right information, at the right time, as requested by customer. This is related to *Personal Interaction*, which refers to proximity, ease of collaboration and personalized relationship. *Service Delivery* is measured by accuracy, experience and consolidating the supply base, and delivering integrated systems as opposed to single parts. *Supplier know-How* involves resources, skills, and strength in long-term relationships. The aspects in this facet include the supplier's extant knowledge of the supply market, improving existing products, and assisting in developing new products. *Time-To-Market* is measured by design capability, prototype and development efforts. *Direct Product Cost* is the price at time of purchase, as opposite to process and life cycle costs. *Process Costs* include the costs associated with process improvements and other transformation processes.

3.2 Customer Value Perception of Open Source Cloud Software

The literature on customer value creation in OSS is still very new and few authors have addressed the creation of value in the OSS development model, with the exception of West (2007) [3] and Morgan & Finnegan (2008) [1]. The nature of OSS allows users to co-create value by actively participating in the development process, audit the software and change vendors with low switching cost. Therefore, customer value perceptions in OSS will differ from proprietary software. The commoditization of OSS allows suppliers to provide undifferentiated software at a lower price point, thereby increasing the customer perception of value added [28], [26]. The level of formal control that a firm has over its open source resources impacts the extent to which a firm can capture value from OSS [29].

Cloud computing has changed the way open source technologies are distributed. Much of OSS is available on a SaaS basis, which makes it convenient for customers without the need to deploy software on their own servers. Many of open source projects, in turn, take place in cloud, or focus on developing infrastructure and management software that makes cloud computing possible. These tools are used by public cloud computing providers and by organizations that want to set up private or hybrid clouds. These tools and the enhanced collaboration opportunities increase customer relationship value and make cloud based OSS technologies more appealing for customers than the traditional open source technologies. The concept of open source also conveys a collaborative approach to innovation. This provides customers increased perception of value and opportunities for innovation. OSS can be combined with complementary assets such as support, customization, integration, or upgrades [28] in hybrid set ups. This will impact the process value of the technologies and provide opportunities for developing sponsored open source projects, where specialists develop OSS modules to their needs.

Adaptation of open source cloud software creates opportunities, but also risks related to intellectual property infringement. Cloud based delivery has created newer cloud-driven restrictive open-source licenses (e.g., AGPL) that have changed the traditional open-source compliance mechanisms. The subsequent development of remedial open-source licenses can impact users' data management policies and risk infringement. Open source communities have tools for detecting software components with license obligations that are provided as a service.

4 Methodology

Our research project studied customers' value drivers in cloud environments with a special focus on OSS technologies. The project is built on the assumption that the use cases for cloud computing have converged, and Iota and M2M visions drive the development of the future Webs, namely the Web 3.0 (also known as the *Semantic Web*) and the Web 4.0 (also known as the *Meta Web*). Consumers' interests are increasingly in applications and services, thus requiring a completely

transparent and heterogeneous network. We further investigated how open source cloud technologies impact the evolution and maturing of cloud computing industry, and differentiation of various ecosystem actors' roles as the industry matures. In order to verify this assumption, we investigated the customers' value drivers for adapting cloud services and selecting vendors. Data collection was done predominantly in Finland, which is the number one cloud computing adaptor in Europe, and avid supporter of the OSS movement, represents mature and specialized cloud computing environment. Finnish customers also have specific demands due to regulations, data proximity and language, which make it an ideal environment for analyzing the opportunities for regional provider roles.

Data regarding customer preferences, perceived adaptation opportunities, implementation barriers and valuations was collected from leading Finnish companies in form of online survey and interviews. The survey reached 122 respondents from various industries in Finland, including 34 responses from companies offering cloud computing services. The collected data was complemented with 52 interviews with leading Finnish companies Chief Technology or Information Officers. Data collection was done in April-July 2015.

The collected data was analyzed applying Ulaga's relationship model in order to categorize and organize the findings in logical order. In our computation, we organized the interview questions under the 8 relationship value categories introduced in Figure 1. The findings were then analyzed in order to describe their implications and contribution to the research community and practitioners. This analysis is presented in the next section.

5 Results

The survey collected 122 respondents from different fields of business, including energy, forestry, finance, ICT, logistics, media and public sector. 75% of the respondents represented large organizations (over 150 employees). 58% of the companies operated internationally, while the rest solely on national markets. 33 of the respondents represented cloud service user-providers and 89 organizations were cloud service users. Section 5.1 presents the trends identified from the survey for adopting cloud services, while Section 5.2 focuses on identifying the relationship value drivers.

5.1 Trends for Adopting Cloud Services

The multi-sided view to the service use and user preferences provided a holistic view of the situation. The most commonly used services were standard communication services like email, website and blogs. Other commonly used services were business support services like enterprise resource planning systems, customer relationship management software, as well as human resources and finance and control services and data storage.

As emphasized, the main drivers for using cloud computing included flexibility and scalability of IT resources, which were reported as the major driver by over 40% of the respondents. With this, capital expenditure to IT was reduced and overall cost reduced. Improvements were sought through improved business processes and modernization of user interfaces and systems. The results also highlighted the interesting feature in cloud adaptation statistics. While the cloud user base is wide, the extent to which services are used is overall very small, less than 5% of IT budget for over 90% of the organizations. All respondents reported plans to increase use of cloud services in the future.

The main criterion for selecting cloud service providers was the fit for business needs. Regional, EU based providers were considered too add business value through knowledge on the local legislation, culture and norms. Price, operability and service level were rated second in importance, followed by data center location and reputation of the vendor. Local language support was not among the main criteria as could have been expected. The communicated barriers for using cloud services highlighted the earlier identified concerns related to control over own data. Privacy, confidentiality and access to own data caused concern, amplified by the fear of regulatory changes. Experienced user also reported difficulties with service integration to existing systems and hardware, which undermined the initial objectives to reduce investment in in-house ICT competency.

As previously mentioned, the survey results were complemented by a set of 55 interviews with the major Finnish companies. The interviews elaborated on the survey questions, and raised the question of open source cloud technology and platform use. The companies used both international cloud service providers like Microsoft, Fujitsu and Amazon, but also regional providers like Nordic Cloud and Appelsiini. Preference was for national or EU based suppliers due to language, specific knowledge, politics and proximity. Challenges were caused by the lack of suitable regional providers, or gaps in their offering and incompatibility with SLAs and companies' objectives.

5.2 Relationship Value Drivers

The interviews revealed that the companies were reluctant to adapt OSS due to the uncertainty related to their sustainability, usability, customer support and future regulations. There were also concerns with the usability of the systems, and risks of running parallel systems for different purposes, with need for training users to the interfaces. Somewhat surprisingly, the expected issues related to privacy and securities were not listed among the main barriers for the use of open source technologies. Energy efficiency and related standards were raised several times in discussion. The interviewees reported supplier reputation as among the main selection criteria, along with the data center location. Even for companies not operating with the public sector, the geographical location of the data center was a major risk management issue in terms of changing regulations and security. Regional and EU supplier would be given preference,

providing there were enough alternative suppliers. The respondents also mentioned energy efficiency and sustainability related concerns weighting in decision making.

The interviews included explicit questions related to the use of open source cloud software. None of the respondents had preference for OSS, even some of them used OSS in small scale. The reasons for the aversion mirrored the earlier reported concerns with business continuity, support capabilities and required efforts for integration to in-house heritage systems. Customers valued regional suppliers with contextual knowledge, geographical proximity and customized support services. In the analysis reliability and support were the major criteria for supplier selection. Several respondents reported using regional small-scale providers form their own administrative services delivery, while they preferred reputable international players as channel partners for distributing own services and applications. Service pricing was considered moderate to fair across all respondents.

The collected data was next analyzed using the Ulaga's 2003 relationship value framework. In our operationalization the survey question were grouped to the most suitable categories. Time to market dimension was dismissed since this was not in the scope of the questionnaire. In this computation, cost is raised as the main driver for selecting cloud services. Other major drivers are product quality, service support and process cost. Business drivers impact strongly the cloud service selection, along with total cost (direct cost and operational costs). Time to market was not considered as a major driver since the objectives with cloud adaptation were mostly cost related.

Fig. 3. Customer Value Drivers in Cloud Computing Services

The results supported earlier results on customers' valuation of both product and service attributes in cloud computing service context. Customers consider the total cost of ownership resulting from initial service purchase, integration to heritage systems, and continuous operations support and maintenance when making selections on applied technologies and vendors. The importance of service support is highlighted in cloud context, where the solutions are sourced as a service. The results also showed that the major customer value drivers were the service quality, support and supplier know-how, referring to the suppliers' knowledge of their context and specific requirements. All informants were satisfied with the price levels for the service. With significant improvements to current situations, cost was not considered a major driver in vendor selection. Cloud customers preferred local or EU based service providers with knowledge of local culture, customs and regulations. Also data centre location and instant support were considered among the main vendor selection criteria. OSS were considered cumbersome due to required in-house integration, requirements for user training and concerns regarding future availability and updates to the software.

The findings highlighted new opportunities for niche players and smaller regional actors, and overrode the dominant thinking on the economies of scale driven cost advantages and savings as major drivers for the selection of cloud vendors. The increased emphasis on support capabilities and need for differentiated service roles was further highlighted with large organizations moving to cloud in incremental steps. OSS providers have their niche in cloud markets, and could improve their position significantly through increased customer focus.

6 Conclusion

Our research revealed a mismatch between open source cloud providers intended, and customers' perceived relationship value. While OSS providers aim to deliver superior software to respond to the customers' needs, the customers perceive non-technical relationship values as important as the technical features. This leads to loss of business opportunities for OSS providers, as companies prefer to fulfil their need with suitable service with no additional integration or further development.

As to summarize, OSS providers typically conceptualize their offering as an infrastructure or software. The value is considered to accumulate with the service functionalities and regular new releases. This is also the dominant view in technology-oriented research. However, marketing and service science approaches adopt broader understanding of

customer value, and conceptualize software as services, or even further, value co-creation venues. In this respect, we conceptualise open source software as a service system, where value is created downstream, originated from the customers' requirements and added value. Service providers position themselves to this customer value network with their own value offering. Obviously, both engineering and service-oriented views are needed, and they are complementary.

The main contribution of the paper is the recommendation that with increased customer focus and understanding of adaptation barriers, OSS companies can fulfil the role of transformers of the future of internet business evolution, moving away from the proprietary technology platform based value creation now controlled by the likes of IOS and Android, contributing to more equal, accessible and interoperable web for the benefit of societies, environment and citizens.

7 Discussion

This paper discussed the less studied area of customer perception of open source technologies. It reviewed related literature and conducted an empirical enquiry in order to further understand the value drivers in software procurement context. Increased awareness of customer preferences helps designing service models that respond to customer needs, and drive adaptation of open standards and pave away for Internet of Things, open interfaces, and interoperability, and consequently scalable innovations, distributed systems and new business opportunities for SMEs.

Open source technologies have potential to accelerate the much discussed industrialization of services, and drive open innovation in virtual venues. Our enquiry on customer value drivers and OSS technologies was limited both in terms of scope and sample, but served to draw attention to this critical trajectory in the evolution of open source software markets. With the global characteristics of internet services, the authors believe that the results can be considered valid also on broader context. However, more research would be needed on the opportunities of OSS technologies and customer dynamics with these user-developer communities specifically in open source context, and their impacts on markets, regulations and business models, as well as society as a whole.

References

[1].Morgan, L. and P. Finnegan (2008). "Deciding on open innovation. An Exploration of How Firms Create and Capture Value with Open Source Software." In Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion. Ed. By. L.Gonzalo. p. 228-247.

[2].Heljanko, K. and A. Hussnain (2015). State of the art survey of open source cloud platform components, Tekes Publications, Finland (in print).

[3].Lerner, J. and J. Tirole (2004). The Economics of Technology Sharing: Open Source and Beyond, NBER Working Paper 10956.

[4].Schweik, C.M., English, R. and S. Haire (2008). "Factors leading to success or abandonment of open source commons: An empirical analysis of Sourceforge.net projects." The Free and Open Source Software for Geospatial Conference.

[5].Capra E., Francalanci C., Merlo F. and C.R. Lamastra (2009). "A survey on firms' participation in open source community projects." IFIP International Federation for Information Processing, p. 225–236.

[6].Hughes, A. (2015) IDC Reveals Worldwide Internet of Things Predictions for 2015: https://www.idc.com/getdoc.jsp?containerId=prUS25291514

[7].West, J. and S. Gallagher (2004). Key Challenges of Open Innovation: Lessons from Open Source Software. San Jose State College of Business Mimeo.

[8].West, J. and S. O'Mahoney (2005). "Contrasting Community Building in Sponsored and Community Founded Open Source Projects." in IEEE Proceedings of the 38th Annual Hawaii International Conference on System Sciences, IEEE Computer Society Press, Los Alamitos CA.

[9]. Varian, H.R. and C. Shapiro (2003). Linux Adoption in the Public Sector: An Economic Analysis, University of California Haas School of Business Mimeo.

[10]. Ghosh, R., Glott, R., Kriger, B. and G. Robles (2002). Free/Libre and Open Source Software: Survey and Study. University of Maastricht Institute of Infonomics and Berlecon Research GmbH Mimeo.

[11]. Maurer S. and S. Scotchmer (2006). "Open source software: The new intellectual property paradigm." In: Economics and Information Systems. Ed. By: A. Whinston. Vol. 1. Amsterdam. pp. 285–322.

[12]. Lakhani, K. and R. Wolf (2005). "Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects." In: Perspectives in Free and Open Source Software. Ed. By. J. Feller, B. Fitzgerald, S. Hissam, and K. Lakhani. MIT, Cambridge and London.

[13]. Von Krogh, G., Haefliger, S., Spaeth, S and M. Wallin (2008). "Open source software: What we know (and do not know) about motivations to contribute." The DRUID Conference: 17 June 2008; Copenhagen, Denmark.

[14]. Mockus A., Fielding, R.T. and J.D. Herbsleb (2002). "Two case studies of open source software development: Apache and Mozilla". ACM Transactions on Software Engineering and Methodology, 11:309–346.

[15]. Henkel, J. and M. Tins (2004). Development of Embedded Linux. University of Munich Institute for Innovation Research, Technology Management, and Entrepreneurship Mimeo. Johnson, Christiansen, and Kagermann (2008)

[16]. Lerner, J. and J. Tirole (2002). "Some Simple Economics of Open Source. " Journal of Industrial Economics, 52, 197.

[17]. Shah, S.K. (2006). "Motivation, governance, and the viability of hybrid forms in open source software Development." Management Science, 52:1000.

[18]. Fang Y. and D. Neufeld (2009). “Understanding sustained participation in open source software projects.” Journal of Management Information Systems, 25, 9–50.
[19]. Anderson, J.C., Narus, J.A., and W. Van Rossum (2006). “Customer Value Propositions in Business Markets.” Harvard Business Review.
[20]. Grönroos, C. (2008). “Service Logic Revisited: Who Creates Value? And Who Co-creates? “European Business Review, 20(4), 298–314.
[21]. Haynie, M. (2009). Enterprise cloud services: Deriving business value from Cloud Computing, Technical Report Micro Focus.
[22]. Gustafsson, A., Kristensson, P. and L.Witell, (2012). "Customer co-creation in service innovation: a matter of communication?". Journal of Service Management, Vol. 23 Iss: 3, pp.311 – 327.
[23]. Smith, J.B. and M. Colgate (2007),”Customer Value Creation: A Practical Framework.” Journal of Marketing Theory and Practice, Volume 15, Issue 1, Taylor Francis online.
[24]. Zeithaml, V.A. (1988). “Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence.” Journal of Marketing, Vol. 52, No. 3, p. 2-22, American Marketing Association.
[25]. Ulaga, W. (2003). “Capturing value creation in business relationships: A customer perspective.” Industrial Marketing Management 32, 677– 693.
[26]. O’Cass, A. and L.V. Ngo (2011). “Examining the Firm's Value Creation Process: A Managerial Perspective of the Firm's Value Offering Strategy and Performance.” British Journal of Management, Vol. 22, Issue 4, p. 646-671.
[27]. Johnson, M, Christensen, C. and H. Kagermann (2008). Reinventing your business model. Harvard Business Review.
[28]. West, J. (2007). “Value Capture and Value Networks in Open Source Vendor Strategies, System Sciences.” HICSS 2007. IEEE Proceedings of the 40th Hawaii International Conference on System Sciences (HICSS 2007). IEEE Computer Society Press, Los Alamitos CA.
[29]. Bonnacorsi, A. and C. Rossi (2003). Licensing Schemes in the Production and Distribution of Open Source Software: An Empirical Investigation, Sant’ Ana School for Advanced Studies Institute for Informatics and Telematics Mimeo.
[30]. Shanker, A. (2012). “A Customer Value Creation Framework for Businesses That Generate Revenue with Open Source Software.” Technology Innovation Management Review, 3.