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# HOW DO VALUE CO-CREATION ACTIVITIES RELATE TO THE PERCEPTION OF FIRMS' INNOVATIVENESS?

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## THE VALUE CO-CREATION PARADIGM

Value co-creation is an emerging business, marketing and innovation paradigm describing how customers and end users could be involved as active

participants in the design and development of personalized products, services and experiences (Prahalad, Ramaswamy, 2004; Etgar, 2008; Payne, Storbacka, Frow, 2008). It is based on the design and development of customer participation platforms providing firms with the technological and human resources, tools and mechanisms to benefit from the engagement experiences of individuals and communities as a new basis of value creation. The active participation of customers and end users is enabled through multiple interaction channels, very often by means of specifically designed technological platforms through the Internet (Sawhney, Gianmario, Prandelli, 2005; Nambisan, Nambisan, 2008; Nambisan, Baron, 2009). Indeed, it is the advances in Information and Communications Technologies (ICT) that has enabled customers to be much more active, knowledgeable, globally aware and willing to use interactive virtual environments to personalize the existing and shape new products and services. The ability of value co-creation platforms to enable the personalization of new products services challenges the operational presuppositions of traditional marketing segmentation techniques by promoting a new service-dominant logic (Vargo, Lusch, 2004; von Hippel, 2006a). The new dominant marketing logic enables firms to address broader heterogeneous markets aiming at a better fit between what a customer needs and what the firm does and offers. It entails a new vision of the topology and the dynamics of the entire value creation system including i) a shift from thinking about consumers to thinking about co-creators of value, ii) a shift from thinking about value chains to thinking about value networks, iii) a shift from thinking about product value to thinking about network value, iv) a shift from thinking about simple co-operation or competition to thinking about complex co-opetition, and v) a shift from thinking about individual firm strategy to thinking about strategy in relation to the entire value ecosystem (Hearn, Pace, 2006). Such vision promotes a new understanding of the customer centrality of the traditional value network concept which is now considered dynamically, as a people-driven web of potential value configurations that could be actualized on the basis of specific customer demands (Norman, Ramirez, 1993; Flint, Mentzer, 2006; Prahalad, Krishnan, 2008).

The adoption of value creation practices leads to the need of “changing the very nature of engagement and relationship between the institution of management and its employees, and between them and co-creators of value – customers, stakeholders, partners or other employees” (Ramaswamy, 2009). This ongoing change challenges the management of innovations by promoting a new vision of the nature of innovation itself (Prahalad, Krishnan, 2008; Kristensson, Matthing, Johansson, 2008; Tanev, Knudsen, Gerstlberger, 2009). The new co-creative vision of innovation builds on two key distinctive features. The first one is the truly user-driven aspect of the value co-creation

activities between firms and customers. In this sense, value co-creation platforms represent a natural extension of some of the key aspects of the user-driven innovation paradigm (von Hippel, 2006) by focusing on the development of participation platforms to, literally, multiply the effect of user-driven innovation methods such as the design of innovation toolkits (von Hippel, 2001; Nambisan, Nambisan, 2008; Nambisan, Baron, 2009) and searching for lead users (von Hippel, 2006b; Bilgram, Brem, Voigt, 2008; Droge, Stanko, Pollitte, 2009).

Another distinctive feature is the focus on the co-opetitive (from co-opetition) nature of the interactions between the different stakeholders, including the customers and end users, participating in the value co-creation process. Before competing and negotiating to capture value, the different players in a value co-creation network need to compete and negotiate in order to be able to participate and to contribute value (Tanev, Knudsen, Gerstlberger, 2009). The co-opetitive dimension of value co-creation platforms leads to a more dynamic type of economic mechanisms as underlying driver of the innovation processes. These mechanisms operate on the basis of multiple transactions between customers, partners and suppliers at multiple access points across the value network. They enable customers and end users to control the relationship between price and user experience (Prahalad, Ramaswamy, 2004; Etgar, 2006) by providing them with the opportunity to actualize (i.e., create) specific value chain configurations that would fit their proper need, context and preferences. It is in this context that we could talk about customer value *co-creation*. Although focusing on the proactive role of the customer, such understanding is generically holistic in nature; it embraces all the actors involved in the value creation process providing an opportunity for firms to broaden the boundaries of their open innovation processes.

## **LESSONS LEARNED FROM RESEARCH LITERATURE ON VALUE CO-CREATION AND INNOVATION**

A more systematic search in existing research literature identified several emerging streams in value co-creation research: i) *general management perspective* (Prahalad, Ramaswamy, 2000, 2004; Jaworski, Kohli, 2006; Etgar, 2006, 2008; Nambisan et al., 2008; Payne et al., 2008; Ramaswamy, 2009; Ramaswamy, Gouillart, 2010; Pini, 2010), ii) *new product development and innovation* (Prahalad, Ramaswamy, 2003; Sawhney et al., 2005; Roberts, Bake, Walker, 2005; Prahalad et al., 2008; Franke, Schreier, 2008; Kristenson et al., 2008; Michel, Brown, Gallan, 2008; Midgley, 2009; Romero, Molina, 2009; Tanev et al.,

2009; Nambisan, 2009; Bowonder, Dambal, Kumar, Shirodkar, 2010; O'Hern, Rindfleisch, 2010), iii) *virtual customer environments* (Edvardsson, Enquist, Johnston, 2005; Nambisan et al., 2007, 2008, 2009; Nambisan, 2009; Kohler, Matzler, Füller, 2008; Bonsu, Darmody, 2008; Droge et al., 2009; Füller, 2010), iv) *service science and service-dominant logic (SDL) of marketing* (Vargo, Lusch, 2004; Edvardsson et al., 2005; Vargo, 2008; Ballantyne, Varey, 2008; Cova, Salle, 2008; Dong, Evans, Zou, 2008; Maglio, Spohrer, 2008; Kristenson et al., 2008; Bolton, Saxena-Iyer, 2009; Brohman, Piccoli, Martin, Zulkernine, Parasuraman, Watson, 2009; Ng, Maull, Yip, 2009; Ferguson, Paulin, 2010; Ostrom, Bitner, Brown, Burkhard, Goul, Smith-Daniels, Demirkan, Rabinovich, 2010), v) *international markets and entrepreneurship* (Elenurm, Moisala, 2008; Chandra, Coviello, 2010; Dahan, Doh, Oetzel, Yaziji, 2010; Pitelis, Teece, 2010). A detailed analysis of these research streams is out of the scope of this article. However, a quick glance at the number of publications per year will show a growing body of the literature on value co-creation (Table 1). For the purpose of this article we will briefly discuss some of the key insights of the first two research streams – ‘general management perspective’ and ‘new product development and innovation.’

Table 1 – Number of publications per year dealing with aspects of the value co-creation paradigm

Publication year	Number of publications (as of November 22, 2010)	Percentage of total # of publications (found in the Web of Knowledge)
2010	22	29.73%
2009	20	27.03%
2008	12	16.22%
2007	4	5.41%
2006	2	2.70%
2005	4	5.41%
2004	2	2.70%
2003	4	5.41%
2000	2	2.70%
1998	2	2.70%

### General Management Perspective (GMP)

The GMP provides several frameworks describing the principles, the organizational, management and marketing aspects of value co-creation practices (Prahalad et al., 2004, Payne et al., 2008, Etgar, 2008). From a managerial perspective, the work of Prahalad et al. (2004) is of particular interest

(Payne et al., 2008) as their research suggests a more holistic generative framework describing the fundamental building blocks of value co-creation practices, including Dialog, Access, Risk management and Transparency (thus, DART framework). The open *Dialog* between the multiple actors within the value network encourages knowledge sharing and mutual understanding (Ballantyne, 2004; Jaworski, Kohli, 2006). It provides an opportunity for customers to interject their view of value into the value creation process and helps companies understand the emotional, social, and cultural contexts of end user experiences. The initiation of dialogue during co-creation requires a forum with clear rules of engagement leading to an orderly, productive interaction within emerging thematic communities. The focus on *Access* challenges the notions of openness and ownership (Pralhad et al., 2004; Prahalad et al., 2006, p. 11).

Providing customer access to resources, information, tools, assets and processes at multiple points across the value network provides companies with innovative ideas about new products and services, new business opportunities and new potential markets. As customers become co-creators of value, they become more vulnerable to *Risk* and demand more information about the potential risks associated with the design, manufacturing, delivery and consumption of particular products and services. Proactive risk communication and management offers companies with new opportunities for competitive differentiation. *Transparency* builds trust between both institutions and individuals. It enables a creative dialogue in which trust emerges (Ballantyne, 2004; Romero et al., 2009). When companies make vital business process information available to consumers, they hand over part of the control of the value creation process. Empowering customers with such control becomes a key component of companies' customer relationship management and differentiation strategies.

In addition to the DART framework, Prahalad and Ramaswamy (2004) identified four dimensions of choice that could enable personalized co-creation experiences: i) co-creation across multiple channels that enabling new co-creation horizons, ii) co-creation through multiple options where customers could go beyond the options designed by a company in order to fit its value chain in terms of profitability alone (enabling the possibility for customers to create their own options opens the door for user-driven innovation), iii) co-creation through multiple transactions at multiple points of access across the value network enable customers and end users to affect the way a product or service is designed, to reject unnecessary features, to negotiate a particular price component or decide to get engaged in the value creation process, iv) co-creation through the ability to influence the relationship between price and experience (Etgar, 2006) where customers could associate

their specific choice with the type of experiences they are willing to pay for. While the literature within this stream provides multiple examples of firms that have adopted co-creation principles and useful insights about the specific business and marketing issues that need to be addressed, there is relatively little research on the specific groups of activities that should be undertaken in order to enable the value co-creation processes (Payne et al., 2008). There is a need of more research studies that would contribute to the development of value co-creation platform design rules, transition pathways and maturity implementation models (Warnke, Weber, Leitner, 2008).

### **New Product Development and Innovation (NPDI)**

It should be pointed out that this research stream emerges by means of a terminology that oscillates between the semantics of two other paradigms – user-driven innovation (von Hippel, 2005; Bogers, Afuah, Bastian, 2010) and open innovation (Chesbrough, 2003). User-driven innovation distinguishes itself by promoting a single firm-driven, product-centric, non-transactional and participatory approach to user involvement in the design of new products and services. However, its focus on innovation toolkits (von Hippel, 2001) and innovation communities brings it close to the value co-creation paradigm with its focus on customer participation platforms, personalization of market offers, multiple stakeholder interactions and access to global resources (Prahalad et al., 2008), customer-driven business models, and virtual customer experience environments. On the other hand, the open innovation paradigm promotes a more generic and broader vision of the innovation landscape. It articulates the key mechanisms for inbound and outbound business and innovation processes, intellectual property, knowledge and resource flows used by firms to engage into a more proactive pursuit of new markets and innovations (Chesbrough, 2003).

The participatory platform nature of value co-creation practices enables a broader and more systematic positioning of customers and end users across the entire innovation lifecycle leading to a significant enhancement of the user-driven innovation potential. As a result, the development of value co-creation platforms is increasingly recognized a promising innovation strategy associated with an ongoing change of the nature of innovation itself (Prahalad et al., 2003; Nambisan, 2009; Romero et al., 2009; Midgley, 2009; Bowonder et al., 2010). The co-creation paradigm positions the source of value within the co-creation experience which is actualized through the company-customer interaction events. By co-creating with the network, the customer becomes an active stakeholder in defining both the interaction



and the context of the event including their specific personal meaning (Prahalad et al., 2003). The personal nature of the interactive experiences enables new dimensions of value which are based on the quality and the personal relevance of the interaction events as well as on the opportunity for customers to co-create their own unique end products, services and experiences (Franke et al., 2008).

These dimensions are critical for the emergence of experience innovation networks putting the individual at the heart of co-creation experience through the development, access and dynamic reconfiguration of appropriately designed technological, business process and human resource infrastructures (Prahalad et al., 2008). In this sense, the value co-creation paradigm represents a specific market-driven approach to the adoption of an open innovation business philosophy. It provides a dynamic understanding of firms' innovation boundaries which opens the possibility for a better competitive positioning through a better articulation of their innovativeness. Existing literature clearly emphasizes that customer participation in value co-creation activities should impact their innovation outcomes, such as innovation cost, time-to-market, new product/service quality and development capacity (Kristensson et al., 2008; Prahalad et al., 2008; Nambisan, 2009; Midgley, 2009; Romero et al., 2009; Bowonder et al., 2010; Ramaswamy et al., 2010). It also points out that firms tend to measure the performance of co-creation practices from an innovation perspective alone neglecting the remarkable side effects, such as brand perception or customer-firm relationship quality, which may even exceed in value the actual innovation performance (Nambisan et al., 2007, 2008).

Online co-creation platforms or virtual customer environments serving the purpose of co-innovating with external stakeholders can be considered as massive interactive marketing campaigns due to the sheer number of contact points with potential customers. In light of these additional benefits, collaborative innovation with consumers, if properly managed, may become a cost-efficient or even costless way of innovating. However, most of the existing studies are case-based and there is little quantitative research focusing on the relationship between the degree and the scope of firms' involvement in value co-creation activities and their innovation related outcomes. This gap could be explained by the emerging nature of value co-creation paradigm; however, its emergence has gained enough momentum to enable more systematic studies of the relationship between co-creation and innovation. The aim of the present article is to partially fill this gap by pointing out some of the innovation related outcomes of the value co-creation paradigm.

## OBJECTIVE

The objective of this article is to suggest and validate an empirically-derived quantitative model describing the relationship between the degree of firms' value co-creation activities and the perception of their innovativeness. It identifies the key components of value co-creation based on a methodology using web search generated data and Principal Component Analysis (PCA) techniques and applies a similar, web search-based approach to evaluate the perception of firms' innovativeness; finally, it uses linear regression analysis to examine the relationship between the degrees of value co-creation activities and the perception of firms' innovativeness which is measured by the frequency of firms' online comments about their new products, processes and services. The underlying hypothesis of this research was developed on the basis of the insights discussed in the brief summary of the literature on value co-creation: *firms with a higher degree of involvement in co-creation activities are in a better position to articulate the innovative aspects of their new products, processes and services*. The testing of this hypothesis is particularly relevant within the context of an increasingly global competitive environment where firms are struggling with the limits of their innovation capacity through investments in greater product variety and in traditional marketing techniques that do not necessarily lead to a better competitive positioning or differentiation (Prahalad et al., 2004, 2008).

## RESEARCH METHODOLOGY

Hicks et al. (2006) and Ferrier (2001) pioneered the concept that an analysis of the frequency of use of specific keywords on public websites and corporate news releases can be an adequate representation of the degree of importance the firms place on the concepts those keywords were chosen to represent. Allen et al. (2009ab) and Tanev et al. (2010ab) provided preliminary results demonstrating that this concept could be applied to classify value co-creation practices and articulated the key steps of the data gathering and analysis work flow. These research studies show that factor analysis of the frequencies of a specifically designed set of keywords can be used to extract the key components of value co-creation in a large sample of firms. The research methodology employed in this work added an additional step focusing on: i) examining the perception of firms' innovativeness by measuring the frequency of firms' online comments about their new products processes and services, ii) applying linear regression analysis to test the initial hypothesis about the existence of a positive association between the degree of firms' involvement in value co-creation activities and the degree of articulation of their innovativeness.

## Research steps

The key steps in our research process can be summarized as follows:

*Step # 1:* We started with a detailed study of the research literature on value co-creation to identify its key characteristics and activities.

*Step # 2:* The next step consists in using the insights from the literature review to develop a set of value co-creation-related, customer action-oriented keywords that are expected to be found on companies' websites.

*Step # 3:* The sample selection (selection of firms' websites) included firms that are well known for being active in employing co-creation practices: i) firms used as cases in value co-creation research publications, ii) firms involved in open source projects.

*Step # 4:* The data collection step consisted in using a Goggle-based web search tool to measure the rate of use of each of the co-creation-related keywords (Step # 2) on each firm website. The collected data can be visualized as matrix the first dimension of which is provided by firms' websites and the second by the rate of use of each of the keywords on each of these websites.

*Step # 5:* This step consisted in the application of PCA to the data collected in the previous to identify a small number of value co-creation components – independent groups of keywords (and co-creation activities associated to these keywords) that tend to appear together on firms' websites. The meaning of components was interpreted on the basis of the relative relevance (loading values) of the specific keywords within a given component (Field, 2005).

*Step # 6:* The keyword composition of each of the components was used to construct the value co-creation component variables for each of the firms in the sample by summing up the rating of each of the keywords weighted by their specific loadings.

*Step # 7:* The data collection procedure described in Step # 4 was replicated to gather data on the perception of firms' innovativeness by means of a new keyword measuring the frequency of their online comments about new products, processes and services.<sup>1</sup>

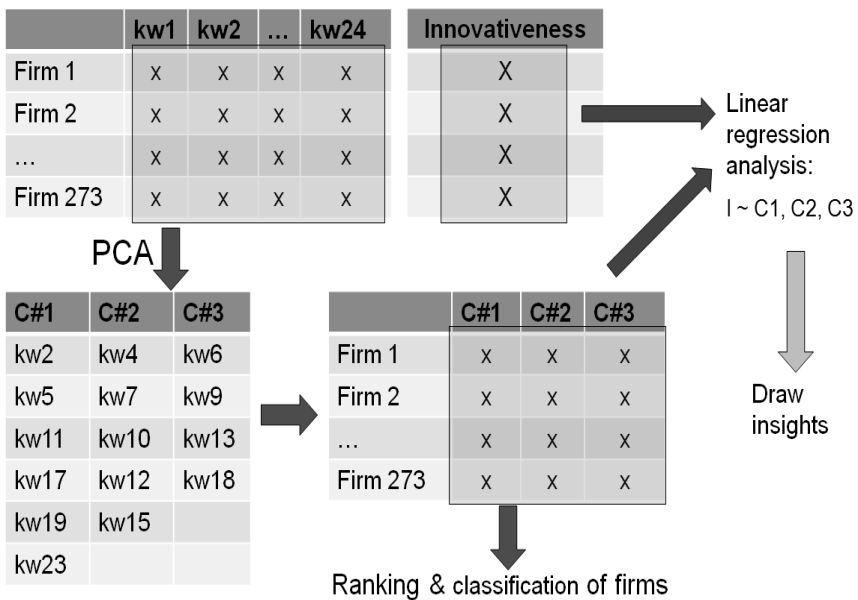
*Step # 8:* The next step consisted in using the SPSS stepwise linear regression procedure to examine the relationship between the value co-creation component variables (Step # 6) and the degree of firms' articulation of their innovativeness. Figure 1 provides a visual representation of the entire data processing procedure.

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1. The combination of innovation-related keyword was designed on the basis of insights from the Oslo Manual, Organization for Economic Co-operation and Development <http://www.oecd.org/dataoecd/35/61/2367580.pdf>

Step # 9: The last step consisted in the analysis of the results, summarizing the limitations and formulating suggestions for future research.

Figure 1 – Visualization of the data processing procedure starting with a matrix containing the web search hits for 24 keywords for each of the 273 firms. The PCA analysis identifies 3 value co-creation components enabling the ranking of the firms in terms of the degree of their value co-creation activities.



### Unit of analysis and sample selection

The results are based on a convenience sample of 273 firms that were selected for being representative of the breadth of their value co-creation activities. 23.8% of the firms were selected in between cases found in the reviewed value co-creation literature. The rest 76.2% of the firms in the research sample were selected between firms engaged (i.e., having revenue from involvement) in OSS projects. The majority of them were selected between the members of the Eclipse OS Foundation<sup>2</sup> (Table 2). The rest of the OSS firms were selected by using two sources of information about OS

2. <http://www.eclipse.org/>

firms: [www.opensourceexperts.com](http://www.opensourceexperts.com) and the Canadian Companies Capabilities Directory of OS Companies database maintained by Industry Canada ([http://strategis.ic.gc.ca/epic/site/ict-tic.nsf/en/h\\_it07356e.html](http://strategis.ic.gc.ca/epic/site/ict-tic.nsf/en/h_it07356e.html)). All firms involved in OSS projects were then investigated to determine if part of their revenue relied on OSS.

*Table 2 – Breakdown of sample organizations: ECL – firms members of the Eclipse Foundation, OSS – open source software firms, OSS+ECL – open source software firms members of the Eclipse Foundation, GEN – firms that are not open source and non-members of the Eclipse Foundation*

Type of firms		Frequency	Percent	Cumulative Percent
1	GEN	65	23.8	23.8
2	ECL	133	48.7	72.5
3	OSS	75	27.5	100.00
	Total	273	100.0	

The reason to focus on firms involved in OSS projects was driven by the realization that value co-creation platforms can be considered as a type of participation architectures similar to firm-driven open source platforms (West, O'Mahony, 2008). In addition, OSS firms are good representatives of firms mastering the DART building blocks of value co-creation (Prahalad et al., 2004) since they: i) actively contribute to the development OSS participation platforms and engage in dialogue with multiple external contributors who are most often the end users, ii) provide access to their source code, to their internal resources and development processes, iii) they share IP management and development risk with external contributors and end users, iv) they enable a high degree of transparency through development forums and newsgroups.

## SUMMARY OF RESEARCH RESULTS

### List of keywords

The association of the key aspects of value co-creation practices with specific combinations of keywords was the most important step in the research process. It started with the selection of keywords from research publications and was complemented by a keyword verification and enrichment procedure based on visual inspection of particular websites ([www.tsmc.com](http://www.tsmc.com), [www.facebook.com](http://www.facebook.com), [www.secondlife.com](http://www.secondlife.com)) including their customer blogs, developer

Tableau 3 – List of the combination of keywords used in the web search

No	List of keyword combination	Co-creation aspect	Source
	<b>Keywords used in the Principal Component Analysis</b>		
1	customer+OR+user+dialog+OR+dialogue+OR+conversation+OR+feedback+OR+call+OR+interact+OR+"information+exchange"+OR+"information+sharing"+OR+"information+access"+OR+engage	Dialogue, Transparency, Information access	Prahalad et al., 2004; Ballantyne, 2004; Jaworski et al., 2006;
2	customer+OR+user+OR+forum+OR+connect+OR+network+OR+networking	Dialogue, Transparency, Networking	Prahalad et al., 2004; Ballantyne, 2004; Jaworski et al., 2006; Nambisan, 2009
3	lease+OR+rent+OR+license+OR+"self+serve"+OR+"self+service"	Access	TSMC website; Prahalad et al., 2004
4	customer+OR+user+cooperate+OR+cooperation+OR+collaboration+OR+partnership	Access, Activism, Experimentation	Prahalad et al., 2004
5	customer+OR+user+suggest+OR+suggestion+OR+input+OR+request+OR+demand	Dialogue, Access	Prahalad et al., 2004
6	internal+expertise+OR+resource	Access	TSMC website
7	customer+OR+user+risk+manage+OR+management+OR+control+OR+assess+OR+reduce+OR+reduction+OR+potential+OR+exposure	Risk assessment	Prahalad et al., 2004
8	customer+OR+user+IP+OR+"intellectual+property"	Risk, Access	Prahalad et al., 2004
9	customer+OR+user+learn+OR+learning	Dialogue	Prahalad et al., 2004
10	product+OR+process+OR+service+evolution+OR+evolve	Evolvability, Transformability	Prahalad et al., 2003, 2004
11	customer+OR+user+experience	Experience environments, customer experience	Prahalad et al., 2003, 2004
12	customer+OR+user+test+OR+trial+OR+beta	Experience environments, Activism, Experimentation	TSMC website; Prahalad et al., 2003, 2004
13	integrated+online+services	Access, Experience environments	Prahalad et al., 2003, 2004
14	simulation+OR+simulate+OR+model+OR+modelling+OR+"virtual+world"+OR+"reference+design"+OR+"reference+flow"+OR+"demo+application"+OR+toolkit+OR+tutorial+OR+sdk+OR+"software+development+kit"	Experience environments, Access	TSMC website; Prahalad et al., 2003, 2004

No	List of keyword combination	Co-creation aspect	Source
15	product+OR+process+modularity+OR+modular+OR+module	Extensibility, Modularity	Prahalad et al., 2003, 2004
16	customer+OR+user+produce+OR+assemble+OR+manufacture	Options, co-production	Prahalad et al., 2003; Payne et al., 2008
17	customer+OR+user+options+OR+choice+OR+choose	Options, Multiple choice	Prahalad et al., 2003, 2004
18	design+OR+process+flexibility+OR+flexible+OR+adaptable	Options, Adaptability, co-design	Prahalad et al., 2004
19	customer+partnerships+OR+interaction+OR+relationship+OR+participate+OR+participation+OR+activity+OR+action	Experimentation, Activism, Personalization	Prahalad et al., 2004; Second Life website
20	cost+reduce+OR+reduction+OR+saving	Price-experience relationship	Prahalad et al., 2004; Etgar, 2006
21	customer+OR+user+survey+OR+review+OR+voting+OR+vote+OR+rate+OR+rating	Transparency, Information sharing, Activism	Prahalad et al., 2004
22	trust+OR+honesty+OR+integrity+OR+transparency	Transparency, Trust	TSMC website; Prahalad et al., 2004; Ballantyne, 2004; Romero et al., 2009
23	customer+OR+user+disclose+OR+inform+OR+disseminate+OR+reveal	Transparency, Information sharing	Prahalad et al., 2004; von Hippel, 2006
24	customer+OR+user+dashboard+OR+statistics	Transparency	Facebook website; Prahalad et al., 2008
	<b>Keywords discarded after the initial screening based on the statistical significance of their correlation coefficients</b>		
25	customization+OR+customize+OR+customize+OR+personalize+OR+individualize+OR+add+feature+OR+added+feature	Personalization	TSMC website; Prahalad et al., 2004
26	customer+OR+user+negotiate+OR+negotiation	Price-experience relationship	Prahalad et al., 2004; Etgar, 2006
27	ecosystem+OR+value+network+OR+value+constellation+OR+multiple+partners+OR+external+contributor+OR+external+source	Transactions; Value network	Prahalad et al., 2004; Norman et al., 1993
28	customer+OR+user+language+translation	Transactions, Dialogue	Prahalad et al., 2004
29	customer+OR+user+address+concern	Transparency, Dialogue	Prahalad et al., 2004; Jaworksi et al., 2006

sites and/or community forums. The construction of the final combinations of keywords was driven by a test-and-trail correlation analysis of the individual keyword frequency rates on firms' websites which helped to estimate the online relevance of specific individual keywords for a given keyword combination. This process resulted in a set of 29 keywords that are shown in Table 3 together with their corresponding value co-creation aspects and the source for their identification. Table 3 also shows that five of the keywords were eventually removed from this initial set since their correlation with the rest of the keyword combinations did not meet the initial statistical significance requirements of the PCA (Field, 2005).

### **Principal component extraction**

The starting point of the factor extraction process consists in the examination of the determinant of correlation matrix between the online frequencies of all keyword combinations. In our case determinant was found to be greater than  $1.0 \times 10^{-5}$  which ensured the effective extraction of three principal components (Field, 2005) by means of Varimax rotation and 0.5 threshold for the min loading of each of the keywords within a given principal component. This min value (0.5) of the loadings ensured minimal cross-loading between the three components. However, as a result, the total number of keywords used in the final composition of the components was reduced to 18. Table 4 shows the specific composition of the extracted principal value co-creation components that was used to construct three value co-creation component variables for each of the firms in the sample.

### **Principal component interpretation**

The interpretation of the principal value co-creation components was done on the basis of the results provided in Table 4 after checking for the specific contextual manifestation of the keywords. Based on these results, the first co-creation component was interpreted as "Resources, processes, tools and mechanisms enabling customer and user involvement in production, assembly, manufacturing and self-service aiming at design and process flexibility based on product modularity and sharing of internal expertise, resources and IP." The second co-creation component was interpreted as "Customer relationships enabled through partnerships and cooperation aiming at cost reduction, design and process flexibility, and leading to better customer and end user experiences based on risk management, transparency and trust." The third co-creation component was interpreted as "Mutual learning mechanisms based on the existence of user networking forums enabling customer suggestions, input, demands and requests, and leading to multiple options for users through involvement in test and beta trials."



Table 4 – Composition of the three principal value co-creation components

Component/keyword	Principal value co-creation components	Loadings		
		C1	C2	C3
C1/KW1	Keyword combinations customer+OR+user+produce+OR+assemble+OR+manufacture	.727	-	-
C1/KW2	product+OR+process+modularity+OR+modular+OR+module	.705	-	-
C1/KW3	customer+OR+user+IP+OR+ "intellectual+property"	.669	-	-
C1/KW4	design+OR+process+flexibility+OR+flexible+OR+adaptable	.599	.524	-
C1/KW5	internal+expertise+OR+resource	.554	-	-
C1/KW6	lease+OR+rent+OR+license+OR+ "self+serve" +OR+ "self+service"	.550	-	-
C1/KW7	product+OR+process+OR+service+evolution+OR+evolve	.521	-	-
C2/KW1	customer+partnerships+OR+interaction+OR+relationship+OR+participate+OR+participation+OR+activity+OR+action	-	.778	-
C2/KW2	customer+OR+user+risk+manage+OR+management+OR+control+OR+assess+OR+reduce+OR+reduction+OR+potential+OR+Exposure	-	.698	-
C2/KW3	customer+OR+user+cooperate+OR+cooperation+OR+collaboration+OR+partnership	-	.691	-
C2/KW4	cost+reduce+OR+reduction+OR+saving	-	.685	-
C2/KW5	trust+OR+honesty+OR+integrity+OR+transparency	-	.647	-
C2/KW6	customer+OR+user+experience	-	.627	-
C3/KW1	customer+OR+user+learn+OR+learning	-	-	.752
C3/KW2	customer+OR+user+suggest+OR+suggestion+OR+input+OR+request+OR+demand	-	-	.737
C3/KW3	customer+OR+user+forum+OR+connect+OR+network+OR+networking	-	-	.716
C3/KW4	customer+OR+user+options+OR+choice+OR+choose	-	-	.524
C3/KW5	customer+OR+user+test+OR+trial+OR+beta	-	-	.512

### Identification of firms most active in co-creation

This section provides the results for the classification of the firms based on the application of K-Means Cluster analysis to the three value co-creation variables. A test and trial approach led to the decision that there were 4 distinctive clusters one of which consisted in one single firm, obviously an outlier in terms of the high degree of its value co-creation. Table 5 shows the number of cases in each the three clusters (excluding the one with a single firm in it).

Table 5 – Number of cases in each of the three clusters.

Cluster	1	149
	2	96
	3	27
Total		272

Table 6 provides the three cluster centers showing the mean values of the value co-creation components in each of the clusters. Obviously, cluster 3 is with the largest mean values for each of the three components and cluster 2 is with the second largest means. Table 7 includes examples of firms that were found to be most active in co-creation (cluster 3). These are the firms that were used to examine the contextual manifestation of the keywords in support of the specific component interpretation provided in one of the previous sections.

Table 6 – Cluster centers

	Cluster 1	Cluster 2	Cluster 3
Component 1	9.996	19.653	43.384
Component 2	8.545	21.614	63.950
Component 3	19.403	58.707	98.971

Table 7 – Examples of firms that were found as most active in co-creation.

(GEN – general type firms; OSS – OSS firms; ECL – firms members of the Eclipse Foundation)

No	Firm name	Firm type
1	<a href="http://www.compiere.com">http://www.compiere.com</a>	OSS
2	<a href="http://www.knowledgetree.com">http://www.knowledgetree.com</a>	OSS
3	<a href="http://www.radview.com">http://www.radview.com</a>	OSS
4	<a href="http://www.convergys.com/">http://www.convergys.com/</a>	GEN
5	<a href="http://www.latticesemi.com/">http://www.latticesemi.com/</a>	GEN
6	<a href="http://www.altera.com/">http://www.altera.com/</a>	GEN
7	<a href="http://www.iwaysoftware.com/">http://www.iwaysoftware.com/</a>	ECL
8	<a href="http://www.tibco.com/">http://www.tibco.com/</a>	ECL
9	<a href="http://www.compuware.com/">http://www.compuware.com/</a>	ECL

## Relationship between degree of value co-creation and perception of firms' innovativeness

This section includes the results from the statistical procedure testing the hypothesis for a positive association between the degree of value co-creation activities and the perception of firms' innovativeness which was measured by the frequency of online comments about new products, processes and services. Table 8 shows the normalized variable descriptive statistics for all four co-creation variables. A variable was considered to be normally distributed when their Skewness and Kurtosis statistics were less than twice their standard errors.

Table 8 – Normalized variable descriptive statistics  
in the case of three principal components  
(Component\_All = Component\_1 + Component\_2 + Component\_3)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Component_1** {1/3}	273	2.290	.821	.087	.147	-.105	.294
Component_2** {1/4}	273	1.857	.556	.028	.147	.251	.294
Component_3** {1/2}	273	5.984	2.457	.264	.147	-.126	.294
Component_All** {1/3}	273	3.973	1.105	-.078	.147	-.238	.294

The specific choice for the selection of the innovation-related metric was driven by insights from previous innovation research indicating that the measurement of innovation performance should equally include product, process and service types of innovation (Weerawardena, McColl-Kennedy, 2002; Soutaris, 2002). Table 9 shows the combination of keywords that was used to measure the frequency of online comments about new products, processes and services. It was devised by an iterative approach indicating that this combination of keywords provides access to product related company web pages discussing new products, new product features, versions, releases etc. Table 9 also shows the normalized descriptive statistics of the innovation metric.

Table 9 – a) Combination of keywords related to the innovation perception metric. b) Normalized descriptive statistics of the innovation perception metric

a) new AND product OR service OR process OR application OR solution OR feature OR release OR version OR launch OR introduction OR introduce OR "new product" OR "new service" OR "new process" OR "new solution" OR "product launch"

b)	N	Mean	Std. Dev.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Innovation** (1/2)	273	4.745	1.760	-.126	.147	-.286	.294

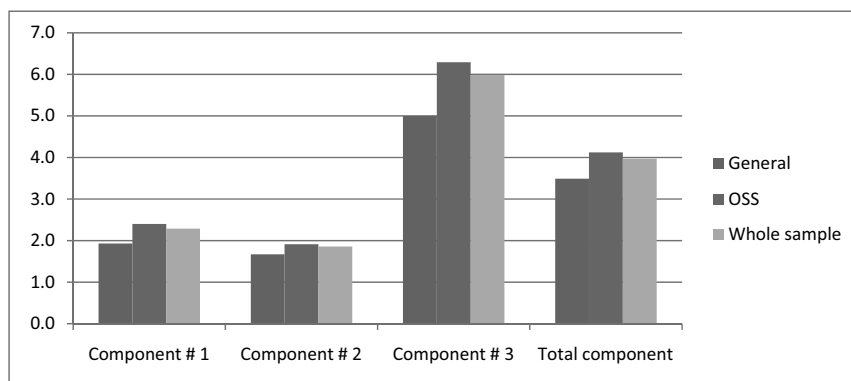
The results from the linear regression analysis are presented in Table 10 including three different cases: the whole sample, the general type firms alone, and the firms involved in OSS projects alone. In the case of simple linear regression models the explanatory power is determined by the R square value; in the case of multiple linear regression models – by the adjusted R square value.

Table 10 – Summary of results from the linear regression analysis including the linear models and their explanatory power per type of firm

Type of firm	Linear regression model	Explanatory power
Whole sample	Newness = const + 0.505 * C#2 + 0.264 * C#3	49.0%
	Newness = const + 0.672 * C#2	45.2%
General type firms	Newness = const + 0.657 * C#2	43.1%
Firms engaged in OSS projects	Newness = const + 0.696 * (C#1+C#2+C#3)	48.5%

All the linear regression models shown in Table 10 suggest that in all cases there is a statistically significant positive association between particular value co-creation components and the perception of firms' innovativeness. The second value co-creation component "Customer relationships enabled through partnerships and cooperation" appears consistently in all the models. In some of the models it is the only statistically significant independent variable. The linear regression model associated with the firms engaged in OSS projects has a higher explanatory power as compared to the model associated with the general type forms and a similar explanatory power when compared to one of the models associated with the whole sample.

Figure 2 – Average rate of use of the various co-creation components per type of firm



## ANALYSIS OF RESULTS

### Rate of use of co-creation components

Figure 2 provides a visual comparison of the average rate of use of the three different value co-creation components per type of firm. The results suggest that firms involved in OSS projects are more active in all three value co-creation components than general type firms. The association of OSS, and especially Eclipse firms, with a higher degree of activity in all co-creation components could be explained by the platform nature of the OSS and business ecosystem development and operation processes. A key characteristic of OSS business ecosystems is the active role of customers and end users as co-developers of the final market offers (West, O'Mahony, 2008), as well as a much higher degree of interactivity within the ecosystem leading to dynamic knowledge exchange, access to business process tools and resource sharing.<sup>3</sup>

On the other hand, as a whole, the results suggest (see Fig. 2) that the third component “*Mutual learning mechanisms*” is most prevalently used by both types of firms and in average for the whole sample, while the second component “*Customer relationships enabled through partnerships and cooperation*” has the lowest rate of use under the same conditions. The first value co-creation component “*Resources and processes for user involvement in produc-*

3. <http://www.osbr.ca/ojs/index.php/osbr/article/view/352/313>.

tion” stays consistently in the middle between the first and the second one in terms of its rate of use. The overall statistical dominance of co-creation activities related to the development of mutual learning mechanisms could probably be explained by assuming that these activities are among the easiest to develop by means of contemporary Web 2.0 based technologies. Such activities can be easily implemented by the majority of the firms as a starting point in the development of value co-creation platforms. The lower (second) ranking of the first co-creation component, i.e. of activities related to the development of resources and processes for user involvement in production, could be explained by the higher degree of their operational complexity. A higher degree of users’ involvement and access to firms’ internal resources leads to their ability to affect the final product or service design as well as to the need to deal with Intellectual Property (IP) issues. This additionally complicates the practical implementation of the first co-creation component and suggests the most probable explanation of its lower rate of use as compared to the third one.

The lowest rate of use of the second component, i.e. activities enabling stronger relationships with customers through the development of project-driven partnerships and cooperation, could be explained by realizing that this is the component that appears to be the most intense in terms of the combination of co-creative resources which are required to develop the proper and transparent mechanisms for cost reduction, risk management and mutual trust development. These mechanisms take time to emerge as an efficient source of constructive interactivity within the value network including the firm, its partners, its customers and customer communities. An open dialog is a prerequisite for active cooperation which enables the emergence of trust and strengthens the community: “mutual trust is not an exogenous factor affecting the quality of the dialog; rather, the emerging dialog gives birth to, engenders and further strengthens trust in the community including the firm and the customer” (Ballantyne, 2004). Trust between customer and firm emerges through open dialog (Jaworski, Kohli, 2006). On the other hand, openness and transparency allow firms to capture ideas for new product features and new paths to market from external sources in the search for new innovations. The second co-creation component also includes cost reduction activities which could be associated with the presence of mechanisms for customer negotiation in relation to a specific price level, experience and degree of engagement in the design process. According to Etgar (2006), cost reduction is a key driver for customer’s decision to involve in a specific type of co-creation activities.

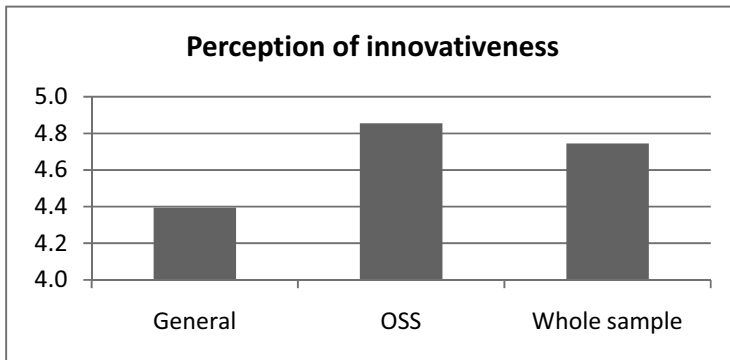
The development of the proper mechanisms for multiple transactions (Pralhad, Ramswami, 2004) and price negotiation requires a certain maturity of the value co-creation network which may need time to emerge as an efficient tool in the customer-partners-firm interaction process. Interestingly enough, the 'design and process flexibility' appears as a cross-loaded item in both the first and the second component. It has a larger loading in the first component where it appears in combination with product modularity, process modularity and self-service. In the second component it appears in combination with 'customer and user experience'. The difference in the loadings may be related to the different level and nature of the design activities related to these two different components: in the case of component one these activities seem to be related to the presence of multiple options, while in the case of component two they seem to be related to experience design. This difference could be also associated with the lowest rate of use of the second component which, however, seems to be the richest in terms of its innovation outcomes.

The finding that co-creation activities aiming at building stronger customer relationships appear to have the lowest average rate of use in all firms in the sample and, at the same time, happen to be the most statistically significant in the linear models describing the relationship between firms' co-creation and perception of innovativeness, is quite interesting and needs to be further studied. Although it needs to become the subject of additional research, it already suggests that the innovation outcomes of value co-creation platforms could be explained by their ability to systematically manage the enhancement of user-driven input. In other words, it appears to be beneficial considering value co-creation platforms as platforms for user-driven innovation. This is a point that was already suggested in the introduction of this paper and which could be partially supported by the results of the linear regression analysis. In addition, the analysis of the rate of use of the different co-creation components provided here in association with their specific composition suggests that the three components could be considered in the natural order of their logical development and maturity evolution – from # 3, to # 1, to # 2. This order corresponds to the rate of their use and is inversely proportional to the sophistication of the value co-creation processes built in each of the components. However, the specific nature of our (online) data collection process did not allow us to collect data that could be directly used to test such hypothesis. Nevertheless, the detailed information about the composition of the value co-creation components could be used as a starting point of more systematic research studies focusing on the development of value co-creation platform design rules.

### Value co-creation and the perception of firms' innovativeness

The perception of firms' innovativeness was measured by the frequency of online comments about firms' new products, processes and services. It should be pointed out right from the start that this is not a traditional innovation metric since it does not directly count the number of new products, processes and services but the frequency of online comments about them. It could be expected that this frequency will be proportional to the number of new products, processes and services, however we have no data to support such hypothesis. We could however, hypothesize about the ability of co-creative firms to articulate their innovativeness. Before doing that it is worth comparing the two types of firms in terms of the degree of their online comments about new products, processes and services. Fig. 3 shows the results of such comparison suggesting that firms involved in OSS projects are in a better position to articulate their innovativeness.

Figure 3 – Average frequency of online comments about new products, processes and services



A closer examination of the linear regression results leads to a number of interesting findings. *First*, in all cases there is a positive relationship between the innovation perception metric and particular value co-creation components with an explanatory power between 43% and 49%. This is an important finding suggesting the existence of a positive association between the degree of value co-creation activities and the perception of firms' innovativeness.

*Second*, the second value co-creation component "Customer relationships enabled through partnerships and cooperation" appears prevalently in the models as one of the key independent variables. Interestingly enough, this component has the lowest rate of use as compared to the other 2 co-cre-



ation components. However, it happens to be the component that provides the statistical evidence in support of our initial hypothesis about the existence of a positive relationship between the perception of firms' innovativeness and the extent of their value co-creation activities. It could be also used to suggest the possibility for the existence of a maturity model for the design and implementation of value co-creation platforms that is based on the evolution from component # 3, to # 1, to # 2. In such model the innovative capacity of the co-creation platform would emerge in parallel to the implementation of the second co-creation component. However, such interpretation cannot be directly supported by our results and needs to be further studied.

*Third*, the firms involved in OSS projects appear to be more proficient in terms of the breadth of their co-creation activities since in their case the positive relationship between value co-creation and the perception of innovativeness involves the sum of all co-creation components; its regression coefficient has the largest value as compared to all the other models; their linear regression model manifests an explanatory power of 48.5%. This conclusion correlates well with the results shown in Fig. 2.

*Fourth*, the linear regression model associated with the general type of firms manifests a lower degree of explanatory power (43.1%) as compared to firms involved in OSS projects and includes as independent variable only the second value co-creation component. It should be pointed out that this lower degree of explanatory power, together with the lower perception of innovativeness which is shown in Fig. 3, should not be used in concluding that general type firms have a lower innovation capacity. It could only suggest that general type firms spend less effort discussing online the innovative aspects of their new products, processes or services. Such conclusion could be interpreted in two different ways: i) the specifics of the R&D and innovation processes of general type firms, such as for example the dominant IP protection regime, does not allow them to publicly discuss all the innovative aspects of their new products, processes and services, ii) the nature of the business processes and the operational principles of such firms makes it difficult for them to use customer participation platforms similar to the ones used by firms involved in OSS projects. In all cases, this finding suggests that it would be worth for such firms to explore the ways OSS business ecosystem platforms operate. It also shows that further research would be needed if one wants to learn more about the direct relationship between of value co-creation and the innovation capacity of firms.

*Fifth*, one of the linear regression models for the whole sample has the highest explanatory power of 49.0% and involves as independent variables both the second (Customer relationships enabled through partnerships and

cooperation) and the third (mutual learning mechanisms) value co-creation components. This is probably the key finding of this paper suggesting that: i) the conceptualization of value co-creation platforms should be done in terms of their innovation-related outcomes (Kristensson et al, 2008; Prahalad et al., 2008; Nambisan, 2009; Midgley, 2009; Romero et al., 2009; Tanev et al., 2009; Bowonder et al., 2010); ii) firms adopting value co-creation strategies appear to be in a better position to differentiate themselves by clearly articulating the innovative aspects of their new products, processes and services.

The summary of the results given above supports our initial hypothesis about the existence of a positive association between value co-creation and the perception of innovation. It is in line with our initial expectations that firms involved in OSS projects represent particular interest in terms of their value co-creation practices.

## **LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH**

This research results presented in this paper are based on a convenience sample of firms that were expected to possess a certain degree of co-creation. The reason for this particular choice can be found in the emerging nature of the value co-creation paradigm which makes it very difficult to use the traditional random sampling techniques. The use of a convenience sample was also driven by the nature of the specific research problematic which focused on the emerging patterns of value co-creation practices and their relationship to the perception of firms' innovativeness. It should be admitted that a more rigorous approach would have used a second reference sample of less co-creative firms to check for the robustness of the final results. However, the specific nature of the suggested research methodology would have made such approach very difficult to follow since in that case the principal component analysis would never converge in producing any meaningful value co-creation components. This would have made the application of linear regression analysis impossible. Nevertheless, future studies could explore more sophisticated research designs that would lead to more robust final conclusions. Another suggestion for future research would be to complement the methodology by a qualitative component that would provide additional and contextually substantial insights about the specific nature of the value co-creation practices and the technological infrastructures enabling these practices. A third suggestion would be to develop a more systematic procedure for the construction and final selection of the set of keywords used in the web search. This would be a critically important extension of the sug-

gested methodology of high relevance for the development future business intelligence and online data collection research tools.

## CONCLUSIONS

To the best of our knowledge this research study provides the first empirically-driven results from a quantitative research approach based on a large sample of firms suggesting the existence of a positive association between the degree of value co-creation activities and firms' perception of innovativeness. Although, it is impossible to claim the existence of a causal relationship, the results provide a first statistically significant quantitative indication about some of the innovation-related outcomes of value co-creation practices. One of the specifics of the research methodology was the use of web search tools and online data on firms' websites. Two of the key research findings include: i) the identification of three emerging value co-creation components including mutual learning mechanisms, customer relationships enabled through partnerships and cooperation, and resources and processes for user involvement in production; ii) the insight that firms adopting value co-creation strategies appear to be in a better position to differentiate themselves by clearly articulating the innovative aspects of their new products, processes and services. The research insights presented here should be of interest to both academic researchers and business executives. We hope that the validation of the methodology will contribute to the future development of business intelligence tools for the benefit of both research scholars and practitioners.

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