NEAR EAST UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
MARKETING MANAGEMENT
MASTER PROGRAMME

MASTER THESIS

THE PROCESS OF VALUE CO-CREATION

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20147428

NICOSIA
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NICOSIA
2018

NEAR EAST UNIVERSITY

GRADUATE SCHOOL OF SOCIAL SCIENCES

Marketing Master Programme
Thesis Defence

The Process of Value Co-creation

We certify the thesis is satisfactory fort he award of degree of

Master of MARKETING

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ABSTRACT

There is a growing consensus that in order to be successful, firms must embrace value co-creation based business approaches that enable collaboration across the value network including the company, its suppliers, partners, customers and end users. In order for this collaboration to be effective it must support the ability for the end users to co-create value or to effect real change in the products, services and business processes. This research uses empirically derived quantitative methods to study a sample of 287 organizations selected for being representative of the breadth of value co-creation activities. It uses web searches of keywords indicative of value co-creation and applies the Principal Component Analysis technique to extract four components which distinguish value co-creation based practices including: i) using a community driven open dialog, ii) developing partnerships for resource sharing, iii) enabling personalization of offerings through modularity and options and iv) participating in co-production. All four components are described in terms of the relevance of their underlying activities. The analysis of the results identifies two particular value cocreation approaches: i) full scale co-creation including all four components and ii) ecosystem based co-production which excluded the personalization component. Interestingly, the four value cocreation components were also found individually employed. The emergence of the four components is analyzed from two different perspectives - within the context of a potential value cocreation maturity model and as constituents of particular co-creation approaches. The research provides the first empirical identification of the components of value co-creation and formulates insights on the specific practices that should be employed by companies wishing to engage in different approaches to value co-creation. It also identifies sub-samples of companies specializing in different types of value co-creation for future qualitative research. Entrepreneurs could use the research insights in developing and implementing new business activities as part of a given value co-creation approach. The validation of the methodology will be useful for academic researchers and students as a basis for further research focusing on other aspects of co-creation such as user driven innovation, value chain reconfiguration and business ecosystem new niche development.

ÖZ

Başarılı olabilmek için firmaların, şirket, tedarikçileri, ortakları, müşterileri ve son kullanıcıları dahil olmak üzere değer ağında işbirliğini mümkün kılacak değeri birlikte yaratma tabanlı iş yaklaşımlarını benimsemesi gereken artan bir fikir birliği var. Bu işbirliğinin etkili olabilmesi için, son kullanıcıların değer yaratması veya ürünlerde, hizmetlerde ve iş süreçlerinde gerçek değişikliği gerçekleştirebilmelerini desteklemesi gerekir. Bu araştırma, değer yaratan etkinliklerin genişliğini temsil etmek için seçilen 287 kuruluştan bir örneğini incelemek için ampirik olarak türetilen niceliksel yöntemleri kullanmaktadır. Değer eş yaratmanın göstergesi olan anahtar kelimelerin web aramalarını kullanır ve aşağıdakileri içeren değer yaratma-tabanlı oluşturma uygulamalarını birbirinden ayıran dört bileşen çıkarmak için Ana Bileşen Analizi tekniğini uygular: i) Topluluk temelli açık diyalog kullanma, ii) kaynak paylaşımı için ortaklıklar geliştirme, iii) tekliflerin modülerlik ve seçenekler yoluyla kişiselleştirilmesini sağlamak ve iv) birlikte üretime katılmak. Dört bileşenin tamamı, temel faaliyetlerinin önemi açısından açıklanmıştır. Sonuçların analizi, iki değerli kocorasyon yaklaşımını tanımlamaktadır: i) dört bileşen de dahil olmak üzere tam ölçekli ortak yaratım ve ii) kişiselleştirme bileşenini hariç tutan ekosistem tabanlı ortak üretim. İlginç bir şekilde, dört değerli koklama bileşeni ayrı olarak kullanılmıştır. Dört bileşenin ortaya çıkışı, potansiyel bir değer kokrasyon olgunluk modeli bağlamında ve belirli ortak yaratım yaklaşımlarının unsurları olarak iki farklı perspektiften analiz edilir. Araştırma değer eş yaratmanın bileşenlerinin ilk ampirik tanımlamasını sağlar ve birlikte yaratmanın değerine farklı yaklaşımlar getirmek isteyen şirketler tarafından uygulanması gereken özel uygulamalardaki anlayışları formüle eder. Aynı zamanda, gelecekteki nitel araştırma için farklı değerde ortak yaratım türlerinde uzmanlaşmış şirketlerin alt örneklerini de tanımlar. Girişimciler, belirli bir değer yaratma yaklaşımının bir parçası olarak yeni ticari faaliyetleri geliştirirken ve uygularken araştırma anlayışlarını kullanabilirler. Metodolojinin doğrulanması, akademik araştırmacılar ve öğrenciler için, kullanıcı odaklı yenilik, değer zinciri yeniden yapılandırması ve iş ekosistemi yeni niş gelişimi gibi ortak yaratmanın diğer yönlerine odaklanan ileri araştırmaların temelini oluşturmak için yararlı olacaktır.

ACKNOWLEDGEMENTS

My thanks are extended to my parents for giving me the strength to persevere when the going gets tough and all the help that they provided for me throughout my whole life. I'd like to extend a special thank you to my thesis supervisor, Asst. Prof. Dr. Ahmet Ertugan for all his help, advice and patience throught the process of writing my thesis.

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CHAPTER I
ORIENTATION

1. Introduction

Value co-creation is a term that is used to describe an emerging range of business practices in which customers work with firms to co-create value through close collaboration with other members of the value chain and with consumers in the specification, design, manufacturing, distribution and support of products and services. In all of its flavors this new paradigm is associated with the opportunity to gain competitive advantage by developing unique competences, together with the appropriate organizational resources and technological capabilities, aiming at better satisfying customers' demands for personalized products, services and experiences (Prahalad & Ramaswamy, 2004).

While many studies have used qualitative methods and grounded theory construction to examine how value co-creation strategies operate in the market, there have been few attempts to use empirically driven quantitative research methods to uncover the key components of a value cocreation approach. A number of researchers have demonstrated how Exploratory Factor Analysis of web-content found through internet data mining techniques can be used to enable quantitative methods in the study of commercialization strategy (Hicks, Libaers, Porter & Schoeneck, 2006). Motivated by the explanatory power of this approach, this thesis uses a keyword web search tool to acquire the data needed for exploratory factor analysis to find the underlying components of value co-creation in a sample of 287 firms and organizations.

This thesis answers the question:

• What are the distinguishing groups of activities that organizations employ to allow value

co-creation with customers and the person who actually uses a particular product.

1.1 Objectives

This research had three main objectives:

• Using website content analysis techniques to develop and validate a model;

• Find the distinguishing characteristics of the activities companies use to enable value cocreation by their customers;

• Develop and validate a methodology that could be used in future studies of the relationship between value co-creation and innovation.

1.2 Deliverables

The research produced the following deliverables:

• description of value co-creation components

• an analytical process for evaluating the type and degree of value co-creation employed by companies

• a summary of insights for academics and managers interested in value co-creation

• an inventory of groups of companies employing different co-creation strategies that can be used in future research.

1.2 Contributions

The research makes the following contributions to the existing literature:

• providing the first empirical identification of the components of value co-creation, the degree and the combinations of their use employed by a sample of ~ 300 organizations

• formulating insights on the specific practices that should be employed by companies wishing to engage in the different approaches to value co-creation

• identifying sub-samples of companies specializing in specific types of value co-creation that could be further studied in future research

• advancing value co-creation research from a qualitative to a quantitative level by providing an automated method for the categorization of co-creation research constructs.

1.3 Relevance

This research is relevant to two main groups:

• entrepreneurs and management teams will be able to use the classification system to make decisions about the implementation of value co-creation capabilities for the development of new business opportunities

• researchers and students will learn a method of automating the classification of organizations by using data mining techniques to operationalize the distinguishing characteristics of their activities.

1.4 Document Organization

This thesis is organized into six chapters. The first chapter includes the introduction and an overview of the research. The second chapter contains a review of the literature pertaining to value co creation, market segmentation, personalization, website content analysis using keywords and exploratory factor analysis. The research strategy and method are described in chapter three. Chapter four covers the results of the data acquisition and analysis. Chapter five contains a discussion of the results. Finally, chapter six presents the conclusions, limitations and recommendations for future research.

CHAPTER II
LITERATURE REVIEW

2. Literature Review

This chapter is organized into four sections. Section 2.1 reviews the academic literature on the evolution of the understanding of value co-creation theoretical frameworks and concepts. Section 2.2 reviews the literature on internet based data mining and content analysis. Section 2.3 reviews the literature on exploratory factor analysis techniques. Finally, section 2.4 provides lessons learned from the literature study.

The literature was studied in considerable detail not only to gain a strong grasp of the various aspects of the concept of value co-creation but also to build a comprehensive list of the keywords that might be indicative of the presence of value co-creation in the companies included in the research sample. The literature was also used as a valuable source of case studies of companies and organizations providing value co-creation based products and services.

2.1 Value Co-creation

The value co-creation concept seems to have emerged from the literature on co-production. Richard Normann and Rafael Ramirez (1993) first used the term co-production to describe the process where "suppliers, partners, allies and customers *co-produce* value". According to them "It is not at the interface with the supplier that value is manifested for a customer, but at the interface between the customer and the customer's customer" (Normann & Ramirez, 1993). "A company's principal strategic task is the reconfiguration of its relationships and business systems. The goal is not to create value for customers but to mobilize customers to create their own value from the company's various offerings" (Normann & Ramirez, 1993). One of the core concepts of value co-production is that offerings need not only

be based on products or services; company-customer relationships can be just as important.

Normann and Ramirez (1993) extended the notion of offerings within the context of co-production - an offering can be defined as the link between actions of both supplier and customers (Normann & Ramirez, 1993). The value of offerings is established only partially in terms of the activity which the supplier has poured into these. Two other conditions are also required for the offering to be of value: i) the labor or cost saving value which an offering represents for the customer, and ii) the 'enabling' value which the offering represents for the customers, which equals the enhanced ease, productivity, safety, elegance, and/or effectiveness in their own value-creating action and interaction that utilizing it brings for them. Co-produced offerings could be described with the following five elements:

• physically tangible entities ('goods')
• human activities ('services' and 'self-service') carried out by and shared among, at least supplier and customer persons
• risk-sharing and risk-taking formulae among interacting parties
• access to infrastructure systems and infrastructure
• information, manifested orally, tacitly - often based on previous experience, or in written or numeric or other symbol systems.

2.1.1 Prahalad and Ramaswamy's Framework

C. K. Prahalad and Venkat Ramaswamy (2004) build on the work of Normann and Ramirez (1993) to provide a more comprehensive description of the important features and processes required for successful implementation of value co-creation. They developed a framework to support their ideas of how companies should use value co-creation to build relationships with customers and strengthen brand loyalty. Most of the value co-creation literature published since 2004 cites Prahalad's work as a primary source (Payne, Storbacka & Frow, 2008).

DART Model

Prahalad and Ramaswamy (2004) propose the so-called DART model including four basic "building blocks of co-creation". While each building block alone can be used to enable different co-creation business strategies, combined they

can produce specific value creation strategies (Prahalad & Ramaswamy, 2004). The four building blocks are:

Dialogue: For value co-creation to occur there must be mechanisms for meaningful interactive dialogue to occur at all stages along the value chain. The resulting interactions often result in formation of user communities with a high degree of loyalty to firms in the value network. Specific features of dialog are: i) focus on issues that interest both the customer and the company, ii) provides a forum in which dialogue can take place, and iii) defined rules of engagement for orderly, productive interactions. Innovation is often sparked by having a conversation between like and diverse parties around shared interests. Firms "need a diversity of talent wherever it is in the world" (Chesbrough, 2003).

Access: Co-creation demands that the firm provide "deep" access into the company's resources and processes enabling a range of experiences for the customer. The goal is to provide an experience optimized to each customer's personalized needs. Access should include the option of renting services instead of purchasing a product (Prahalad & Ramaswamy, 2004). *Risk Assessment.* Traditionally companies manage all the risks inherent in the use of their offerings. As customers take on a greater role in value co-creation they become willing to take some responsibility for managing risk. A precondition to customers accepting responsibility for risk is the firm's willingness to enable customers to make informed risk-benefit tradeoffs through transparency about the various risks associated with the products and services on offer (Prahalad & Ramaswamy, 2004).

Transparency. Transparency of information is required to develop the trust between companies and customers necessary to build the close relationships that enable value co-creation to occur.

Traditionally, firms have closely guarded internal cost and process information from their customers. When companies make these data visible they relinquish control of aspects of the value creation process and customers to choose where to engage in exchange at multiple points along the value chain (Prahalad & Ramaswamy, 2004).

Companies may use the four co-creation building blocks individually or in combination. For example, the combination of transparency with risk assessment leads to the co-development of trust between customers and the firm (Prahalad & Ramaswamy, 2004). Dialog enables trust which 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 pathsto market (channels) from external sources (customer/ supplier/ partner/ competitor) in the search for new innovations. Openness assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the firm, to generate additional value.

Dimension of Choice

While the DART model forms the foundation for a value co-creation framework it may not be enough to produce compelling personalized experiences of value co-creation. The goal of value co-creation is to enable the company and customer to actively interact along multiple dimension of choice enabling "personalized" experiences. Prahalad and Ramaswamy identify four main dimensions of choice (Prahalad & Ramaswamy, 2004):*Co-creation across multiple channels:* New information communications technology (ICT) infrastructure has revolutionized distribution channel structures across industries. The value cocreation experience can take place over a range of channels from traditional brick-and-mortar storefront operations to web-based direct on-line sales to third-party channels such as Amazon or eBay (Prahalad & Ramaswamy, 2004).

Co-creation through Options: Customers demand a choice of products/services that reflect their personal view of value. Companies should provide options that reflect those values by accommodating customer's personal context, needs, preferences, sophistication, and desires. It should be possible to inject the customer's personal view of value into the menu of options rather than accept the company's view (Prahalad & Ramaswamy, 2004).

Co-creation through Transactions: Transactions are defined as activities "that encompass logistics, information, channels, and the associated costs and effort on both sides." "Ease and transparency of transactions leads to trust which leads to satisfying experiences and brand loyalty" (Prahalad & Ramaswamy, 2004). Companies should strive to support as diverse a customer base as possible to enhance and broaden their portfolio of products and services.

The Price-Experience Relationship in Co-creation: Traditionally companies set the price of products and services based on internal cost structures with little regard for value as perceived by customers. Customers associate choice with experiences they are willing to pay for and want the price to be fair. The firm should focus on the price/experience relationship from the customer's point of view. Products rich with features that most customers will seldom if ever use should be avoided in favor of products that can be customized (and priced) to provide only the features that an individual customer will value (Prahalad & Ramaswamy, 2004).

When heterogeneity of user needs is combined with a willingness to pay for better products or services, "the strategy of "a few sizes fit all" will leave many users somewhat dissatisfied with the commercial products on offer and probably will leave some users seriously dissatisfied" (Von Hippel, 2006). The importance of each customer's unique circumstances must be considered when designing offerings. A "jobs to be done" view of the market is a superior way of designing systems to engage customers in the innovation process (Christensen, Anthony, Berstell, & Nitterhouse, 2007).

Some of the key differences between the company-customer interactions in traditional and cocreation companies are compared in Table 1.

Table 1: Comparison of company-customer interaction in Traditional vs. Co-creation firms

	Traditional Exchange	Value Co-creation
Goal of interaction	Extraction of economic value	Co-creation of value through compelling experiences as well as extraction of economic value
Locus of interaction	Once at the end of the value chain	Repeatedly anywhere across the value network
Company-customer relationship	Transaction based	Based on the quality of the interactions and transactions focused on co-creation experiences
View of choice	Variety of products and services	Experiences based on interactions across multiple channels, options, transactions and the price-experience relationship
Pattern of interaction	Passive, firm initiated, one-to-one	Active, initiated by either firm or customer, one-to-one or one-to-many
Focus of quality	Quality of products, services and processes	Quality of customer-company interactions and co-creation experiences

Source: Prahalad & Ramaswamy, 2004.

Experience Innovation

The value co-creation environments built on the basis of various combinations of building blocks and dimensions of choice (Prahalad & Ramaswamy, 2004) should enable the innovation of experiences by:

• offering opportunities for customers to co-construct their own experience on demand

• accommodating a heterogeneous group of customers, from the very sophisticated and active to the very unsophisticated and passive

• recognizing that some customers do not always want to co-create, sometimes they just want to consume passively

• facilitating new opportunities afforded by the evolution of emerging technologies

• accommodating the involvement of customer communities

• engaging the customer emotionally and intellectually

• explicitly recognizing both the social & technical aspects of co-creation experiences.

Personalizing the Value Co-creation Experience

Personalization of the experience is a key aspect of value co-creation (Prahalad & Ramaswamy, 2004). The experience is the result of the interaction of a single customer with the firm in an environment constructed by the firm. The higher the degree of personalization, the more engaged the customer will feel with the firm's

products and services. There are four basic dimensions of personalization (Prahalad & Ramaswamy, 2004).

Events: Firms should enable customers to experience offerings at their desired level of engagement but should try to increase that level of engagement wherever possible.

Context of events: Firms must understand the heterogeneity of experiences and build environments that enable a range of personalized experiences in terms of time, place and cultural context.

Personalized involvement: Firms should create environments that support a range of customer involvement

Derivation of personal meaning: Firms should structure experiences to support customers with arange of levels of commitment.

Experience networks

The company, its suppliers and customers and the end users must collaborate to develop an "experience network". Firms that contribute intellectual leadership, build coalitions and forge pathways for products, information and expertise become the "nodal firms" in the network. Nodal firms can make the rules and enable the free flow of innovation throughout the network with adequate constraints. Their primary role is the maintenance of the ongoing health and growth of the network through intellectual leadership and influence. Nodal firms are optimally positioned to capture and monetize value from the products and services created within the network (Prahalad & Ramaswamy, 2004; Normann & Ramirez, 1993; Wallin, 2006; Fung, Fung & Wind, 2008). A change in focus this radical results in significant changes in the "locus of core competencies" necessary for the company's success. Instead of the competitive space being focused on the firm's resources, products or services; value is associated with a customer's experiences and products or services serve as enablers of those experiences. The primary role of the firm is to engage the customer in defining and co-creating value personalized to their own particular needs. Core competence shifts from product development and manufacturing to managing the network to ensure that customers can access as rich and rewarding a range of experiences as possible. Managers need the capacity to reconfigure resources flexibly and quickly in response to learning events (Prahalad & Ramaswamy, 2004). The

ability to construct and manage efficient business processes and capabilities by exploiting new ICT infrastructure has become an important core competence for firms engaging in value co-creation. These integrated online services allow the development of analytics enabling line managers to react in real-time to optimize experiences for customers (Prahalad & Krishnan 2008).

2.1.2 Voice of the Customer Framework

Jaworski and Kohli (2006) extend the definition of co-production from "the customer performing some of the work traditionally done by a producer" to the front end of the value-creation chain: i.e. to the customer needs-identification process, to capture the "voice of the customer" (Jaworski & Kohli 2006). With this goal in mind they construct a framework to show that in the cocreation process, both the firm and the customer are engaged in learning and the subject of the learning goes across the interface between them. Co-creation "requires an open dialog between the firm and the customer" (Jaworski & Kohli, 2006).

Dialog is defined as an "interactive process of learning together" (Ballantyne, 2004). The chances of a productive co-creation conversation are higher if both the firm and customer agree upon a series of rules of engagementprior to commencing the conversation (Jaworski & Kohli, 2006; Prahalad & Ramaswamy, 2004).

Dialog enabling value co-creation has three main differences from traditional firm-customer communications:

• both the firm and the customer are engaged in the learning

• the needs/wants/capabilities and priorities of the customer and the firm are the subject of learning

• the firm and the customer jointly decide what part of the design and production process each will participate in.

There are six main aspects of open dialog: trust, value placed on the other's insights, complementary skills and perspectives, depth of knowledge and experience, adventure seeking and exploration and setting of the conversation.

2.1.3 Service Co-production Model

Etgar (2006) presents a model of the co-production of services which describes value co-creation as set of activities that can be interchanged between

customers and firms (Etgar, 2006). The model shows how consumers make strategic decisions to minimize the costs of performing value creating activities. To do so it relies on seven assumptions:

• the value chain creation process is composed of distinct activities to be performed that can be separated from each other (modularization)

• the performance of these activities requires the use of various resources, e.g. labor, machines, equipment and supplies which bear costs for their use

• the consumer is aware of their role as manager in the production-consumption process

• value creating activities are divisible: they can be divided along some attribute

• the consumer/manager can use two kinds of performers: members of their household or specialist firms in the market (value network)

• these activities can be moved from one type of performer to another without transfer costs

• it is the consumer/manager who eventually bears all the costs of performing the activities.

Conclusions derived from the model include:

• producers choose and undertake activities in a way that maximizes value and minimizes cost

• customers will also try to maximize value and minimize cost for activities undertaken by them and their household members

• differences in consumers (age, income, culture) were important factors in the cost/value tradeoffs made as to which if any activities were taken on by the consumer

• differences in activities (complexity, technological innovations, specialist equipment or knowledge) were also strong determinants of the cost/value tradeoffs.

2.1.4 Integrated Value Chain Management Model

Flint and Mentzer (2006) use an integrative value chain model to address the business to business perspectives of value co-creation. The main elements of their model are based on the three fundamental premises of the service dominant logic (Vargo & Lusch, 2004):

• the customer is always a co-producer

• the firm can make only value propositions and the real value production involves the customer who ultimately actualizes the value propositions

• knowledge is the fundamental source of competitive advantage

The critical differentiating roles of a service oriented integrated value chain management context are (Flint & Mentzer, 2006):

• knowledge: (innovative, cultural, learning capacity)
• supply chain partnerships (co-production)
• services

There is a shift towards a process orientation in which differentiation and the resulting revenue generation come from knowledge about:

• processes such co-production and innovation with business customers
• similarities and differences between a large variety of cultures and subcultures
• processes for customer learning and translation of that knowledge into marketing strategies
• processes for linking firms together around the glob to develop efficient and effective supply chains
• value propositions now involve products, services, processes, experience (history), and network of relationships all aimed at superior value creation
• in many cases customers are partners as well as suppliers, exchanging and modifying value propositions within a dynamic web of constantly changing needs.

Supply change management is defined as "the strategic management of all the traditional business functions that are involved in any flows, upstream or downstream, across any aspect of the supply chain system." It involves coordination and cooperation across functions for greater than two organizations. Such integration requires extensive exchange of: information, products, services, finances and risk (Flint & Mentzer, 2006).

One of the biggest challenges in supply chain management is building trust - trust is a core enabler of sustainable supply chain relationships: It is important to note that trust needs to go beyond the individual. It must extend to the organization and to the level of supply chain partners including all other levels of network relationships. Without the relationship cornerstones of trust, commitment and dependence, supply chain partners cannot develop the close, coordinated ties that lead to effective and efficient value co-production (Flint & Mentzer, 2006). Trust is therefore an inherent aspect of the partnerships that form across the value network.

2.1.5 Co-producers and Co-participants in the Satisfaction Process

Oliver (2006) presents a model examining the roles of co-producers in the level of customer satisfaction perceived by the participants in value creation. He examines the effects that the new bidirectional nature of the relationships between customers and providers has on the mutual satisfaction levels of both customer and firm and the loyalty resulting from satisfying relationships. The study was focused on the provider-consumer relationship and the aspects of the provider and the consumer. An important aspect of consumer based markets is the fact that in some cases, consumers act as independent agents while in others they act as a collective (Oliver, 2006). The key aspect of the provider was the importance of the firm's persona: one must view the firm as a human persona, having expectations for its customers or constituency and fulfillment criteria that are visible to the firm so that the performance of customers can be measured.

2.1.6 Value Co-creation Management Model

Payne et al. (2008) developed a conceptual framework for understanding and managing the value co-creation process and then applied the framework in the context of a series of management workshops to gain additional insights into the firms' customer-firm relationships.

They definethese relationships as "a longitudinal, dynamic interactive set of experiences and activities performed by the provider and the customer within a context using tools and practices that are partly overt and deliberate and partly based on routine and unconscious behaviour" (Payne et al; 2008). The framework consists of three main components:

- customer value-creating processes: processes, resources and practices which customers use to manage activities
- firm value-creating processes: processes, resources and practices the firm uses to manage its business and relationships
- encounter processes: processes and practices of interaction and exchange within the customer and firm relationships which need to be managed.

The authors highlight the importance of core competences such as learning that occur during the encounter processes leading to the development of knowledge both within the customer and the firm. They draw five main conclusions:

• value co-creation requires the ability to engage the extended enterprise by managing across and within customer and firm's value creation processes

• managers and customers should be encouraged to consider innovative co-development of new offerings

• each and every customer-firm encounter is important and these encounters have a cumulative contribution to co-created value

• communications need to be focused on all relevant channels and careful thought as to which types of encounters support cognition, emotion and action based learning within them

• value co-creation opportunities can be identified by the firm teaching the customer cocreation behaviours. Managers need to seek new ways of involving the customer in cocreation behaviours.

2.1.7 Value Chains, Constellations and Networks

In order to empower customers to engage in co-creation the traditional value chain thinking as described by Porter M. (1985) must be expanded from the simple "assembly line" concept to a more complex value network consisting of not only the firm and its direct suppliers but encompassing the whole range of possible contributors and co-creators of value including customers and end users (Normann & Ramirez, 1993; Prahalad & Ramaswamy, 2004). The shift from ownership of resources to access and sharing of resources drives much of the shift to value networks (Prahalad & Krishnan, 2008).

The nodal or keystone firm within a value network is able to extract value through orchestration of the many companies and customers in the network. Network management tools are important to both assess the overall health of the network and the positions of the various firms within it. The ongoing health and growth of the network is critical to the health of the firms within it (Normann & Ramirez, 1993; Wallin, 2006; Fung, Fung & Wind, 2008). These ideas support Prahalad & Ramaswamy's views on the importance of experience networks to enable value co-creation.

The importance of trust for the development of partnerships between the members of value cocreation chain is critical for involving customers in value co-creation (Flint & Mentzer, 2006).

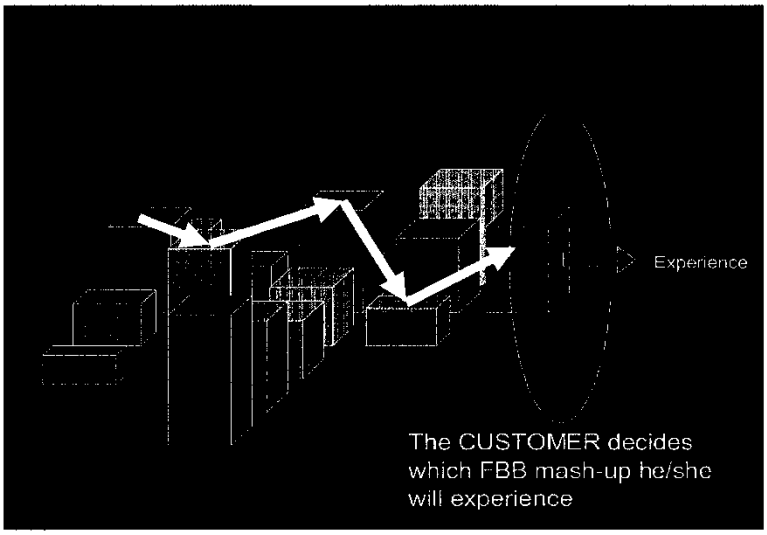

Figure 1: Experience Network (van der Klein, 2008)

Rainer Van der Klein (2008) offers a good illustration of an experience network as described by Prahalad and Ramaswamy (2004) shown in Figure 1. Notice how adding the 3rd dimension describes the richness of choices that customers can access through the multiple "levels of service" made available across the network. "Access also implies the ability to reach multiple firms in the value network to tailor offerings to the customer's specific needs" (Prahalad & Ramaswamy, 2004).

2.1.8 Value Co-creation in New Product Development (NPD)

There is a small body of the literature on new product development that addresses value cocreation. Two frameworks found were Kohlbacher's (2008) study on fostering innovation through knowledge co-creation and a paper on the use of the internet as a platform for customer engagement in product innovation by Sawhney, Verona & Prandelli (2005).

Knowledge Based New Product Development(NPD)

Kohlbacher (2008) studied the role of knowledge within in the context of new product development. Two cases of large multinational corporations engaged in

manufacturing were studied: Maekawa Manufacturing - a manufacturer of industrial freezers and the Mazda Motor Corporation. These firms were selected because they engage customers in the new product development process to a high degree (Kohlbacker, 2008).

Key findings of the study included (Kohlbacker, 2008):

• knowledge can be identified as the decisive factor in NPD

• much of the knowledge is tacit and resides with entities outside the boundaries of the

firm; it is mainly with customers but also with other stakeholders such as suppliers, partners and competitors

• the knowledge is not simply "out there" but actually needs to be created at least in part.

The Internet as a Platform for Customer Engagement in NPD

Sawhney, Verona, & Prandelli (2005) studied the role of the internet as a platform for customer engagement, including interactivity enhanced reach, persistence, speed and flexibility and suggest that firms can use these capabilities to engage customers in collaborative product innovation. They highlight the value of the use of virtual environments to increase the speed and persistence of customer engagement. Virtual environments enhance the firm's capacity to tap into the social dimension of customer knowledge by enabling the creation of virtual communities of consumption. Firms can allow customers to interact with them at different levels of commitment based on their interests and perceived payoffs from interaction and they can modify their level of participation as their level of commitment increases (Sawhney et al; 2005). Virtual environments combine to produce three key benefits for collaborative innovation with customers:

• the direction of communication

• the intensity and richness of the interaction

• the size and scope of the audience

The case studies reveal three themes in internet based collaboration:

• the internet should be used as an integrated platform for engaging customers in multiple ways for different purposes e.g. virtual communities can be used to enhance idea generation followed by polling to validate the various ideas

• companies often have to undergo significant transformation as they embrace collaborative innovation

• an artifact of web-based collaboration is the emergence of third parties such as the idea markets of Innocentive and Ninesigma as intermediaries in facilitating collaborative innovation (Sawhney et al; 2005).

2.1.9 User Toolkits and Lead Users

The implementation of user toolkits is an important technique often used by firms to stimulate user innovation. A powerful technique is to use idea competition based toolkits to gather innovative designs from lead users in a range of applications (Piller & Walcher, 2006). User toolkits give all users freedom to innovate, allowing them to develop customized products viaiterative trial and error (von Hippel, 2001).

Toolkits for Idea Competitions

Internet based Toolkits for Idea Competitions (TIC) are a novel method to integrate users into the new product development process. The hypothesis is that by incorporating a large variety of ideas and knowledge into the NPD process, the performance of the process should have a much better fit with the market (Piller & Walcher, 2006). The study focuses on engaging customers and users into the innovation process. It provides a rich case study where an idea competition was used by a sporting goods company to solicit new product innovations from a group of lead users recruited from the most active members of an established customer population. Of the 774 customers invited to participate in the study 57 submitted 82 new designs. The resulting designs were rated for innovativeness by the user community and a panel of expert judges from the firm's design staff. Innovativeness was judged on a scale ranging from minimal value (comments) to high value (new ideas). A histogram of the resulting distribution of the submissions is shown in Figure 2.

The conclusion of the study was that internet based user toolkits for idea competitions are "a capable response to the difficulties and uncertainties that are faced by many new product development initiatives" (Piller and Walcher, 2006).

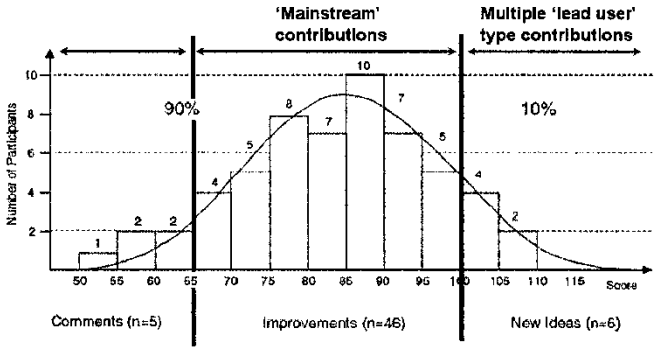

Figure 2: Distribution of customer innovative ideas with degree of creativity (Piller and Walcher, 2006)

User Toolkits for Innovation

Outsourcing key need-related innovation tasks to users by equipping them with appropriate "user toolkits for innovation" was identified as one of the possible solutions to the ongoing failure of conventional custom manufacturing processes and techniques (Von Hippel, 2001). User toolkits for innovation make the process of developing new products and services better and faster because they:

• provide access to sticky, costly-to-transfer information about a user's need and detailed situation

• eliminate the need to shift problem solving back-and-forth between user and manufacturer during the trial-and-error cycles involved in learning by doing.

An effective toolkit for user innovation provides a technological platform that:

• enables users to carry out complete cycles of trial-and-error learning

• offers users a "solution space" that encompasses the designs they want to create

• enables users to operate them with their customary design language and skills

• contains libraries of commonly used modules allowing the user to focus his or her design efforts on the truly unique elements of that design

• ensures that the user-designed products and services will be producible on manufacturer's production equipment without requiring revisions by manufacturerbased engineers.

One of the major differences between user innovation toolkits and the lead user technique is that user innovation toolkits open the innovation space to all users

addressing the needs of the widest range of market segments instead of addressing the relatively narrow range represented by a select group of lead users.

2.1.10 Open Source Software (OSS)

Open source software represents an exemplary case of a value co-creation business model because it is possible to easily map the features of the open source software movement as described by Raymond (2001) onto Prahalad & Ramaswamy's (2004) value co-creation framework. Lessons learned from open source software developer communities show that users are motivated to participate in programming efforts and to contribute to the open source code as a public good, and because they can directly benefit from a customized product variant, but also due to factors of intrinsic motivation, as well as the peer recognition and reputation they can gain in the community (Piller, Schubert, Koch & Moslein, 2008).

Business ecosystems that form around the foundations set up to support Open source software like the Eclipse platform represent ideal examples of the value networks described by Normann & Ramirez (1994) or Prahalad and Ramaswamy (2004).

2.2 Web Content Data Mining

A number of researchers have recently used keyword based search techniques to build theory and/or test hypotheses in the field of management science (Ferrier, 2001; Hicks et al; 2006; Opoku, 2005; Lombardi, 2008; McGinnis, 2008).

Ferrier (2001) conducted an exhaustive manual search of keywords in thousands of press releases of sixteen firms over seven years to study the aspects and performance of different classes of competitive attacks within a population of high tech firms. Hicks, Libaers, Porter & Schoeneck (2006) used web mining techniques to gather data on the commercialization strategies of innovative small high tech firms. "The corporate website can be used as a valuable tool by researchers for collecting information. Data are much more readily available than using interviews or questionnaires and can be gathered quickly and efficiently using harvesting tools" (Hicks et al; 2006). Opoku (2005) studied brand personality of US business schools using a dictionary of terms representative of the dimensions of brand personality. The frequencies of the words on the schools' websites were obtained and the pattern of occurrence assessed to classify the schools.

Lombardi (2009) used web content analysis of keywords to assess and classify the interactions between Eclipse Foundation Members and Eclipse Projects. He gathered frequencies of 43 keywords on each of the 163 Eclipse member organizations. Keywords were selected as being representative of the firms' interactions with Eclipse code. Four classes of interaction were found which corresponded well with the theoretical basis of the research.

McGinnis (2008) used web content analysis of keywords to assess and classify the competitive actions of companies reliant on open source software for revenue. While the study was similar in structure to Ferrier's study of competitive actions he used web data mining to gather the keyword frequencies on the firm websites instead of manually scanning press releases. The resulting sample of 55 keyword frequencies on 77 company websites resulted in successful extraction of fourteen factors representative of the competitive actions used by OSS firms.

Data mining techniques can be particularly effective for research into open source software firms (Lombardi, 2009). Like open sources firms, as a rule value co-creation based firms leverage the internet as a primary channel to engage customers in value creation.

Various tools are available to support the web searches required to gather the data for these analyses. Of the many commonly available search engines, those with the most readily available and adaptable Application Programming Interfaces (API) include Google's Ajax API (Google, 2009; Lombardi, 2009) and the Microsoft Live Search API (McGinnis, 2008).

2.3 Exploratory Factor Analysis for the Classification of Firms

Exploratory Factor Analysis (EFA) has a long history in the social sciences. While it has been used most often for research on human psychology, recently it has been shown to be an effective tool to reduce the large volumes of data gathered through internet mining by extracting the base constructs underlying how small and medium firms do business (Hicks et al; 2006; Lombardi, 2009; McGinnis, 2008). In simple terms, factor analysis is used to discover patterns in the relationships among a number of variables. It specifically seeks to explain these relationships using a much smaller set of variables called factors. A successful factor analysis will provide answers to the following 4 questions (Darlington, 2008):

• How many different factors are needed to explain the pattern of relationships among these variables?
• What is the nature of those factors?
• How well do the hypothesized factors explain the observed data?
• How much purely random or unique variance does each observed variable include?

A number of recent texts and papers provide excellent treatments of how to perform exploratory factor analysis using SPSS (Darlington, 2008; Field, 2005; Costello & Osborne, 2005; Reinard, 2006; Stevens, 2009). Reinard (2006) in particular demonstrates how to apply the resulting factors to the original data to assess the levels of activity of the various constructs.

2.4 Lessons Learned from the Literature

The following are the major insights gained from the examination of the literature. There is growing interest in value co-creation which corresponds to its emerging relevance for corporate business and marketing strategies. At the same time, there is a surprising lack of research directed at providing operationalized frameworks to help organizations manage the cocreation process (Payne et al; 2008). Organizations that support value co-creation have distinguishing characteristics that can be measured. However, there is very little literature on the development of measurable constructs related to co-creation (Zhang, Chen & Li, 2007). Value co-creation is expressed in terms of an exchange of activities; traditional value exchange relies on transactions of goods or services for money (Etgar, 2006). Therefore, the components of value co-creation strategies should be described in terms of the distinguishing characteristics of these activities.

Value co-creation implies a focus on open dialog across a modular value network, partnerships enabling access to resources and tools, personalization and customization of designs, and products, services and experiences for customers or end users (Prahalad & Ramaswamy, 2004; Jaworski & Kohli, 2006). Therefore, any classification of value co-creation strategies should include components involving such constituents.

Trust, risk and IP management are keys to the development of effective value co-creation approaches. However, they are not a prerequisite for co-creation; rather, they emerge in time (Jaworksi & Kohli, 2006; Ballantyne, 2004). This could make the interpretation of empirical results challenging.

An effective ICT infrastructure including business oriented online services is a prerequisite for the formation of value co-creation networks; however in order to be effective the engineering aspects of its functionality should be developed in close association with the firm's specific business management processes (Prahalad & Krishnan, 2008).

Web search techniques based on a comprehensive set of keywords in combination with exploratory factor analysis can be efficiently used to extract the factors underlying the commercialization strategies of firms (Hicks et al; 2006). Such an approach may be expected to work in the case of value co-creation strategies. Factor analysis has a variety of options that can be used. The best option is the one that makes most sense within the specific research context (Reinard, 2006).

CHAPTER III

3. Research Strategy and Method

This chapter is organized into ten sections. Section one describes the research strategy. Section two provides a step by step overview of the method used. Sections three through ten provide a short description of how each step was undertaken.

3.1 Research Strategy

This research employed a strategy based on the use of data mining techniques and website content analysis to develop an empirically driven, quantitative method for the identification of the distinguishing components of the approaches used by organizations involved in value cocreation. A web search of a sample of publicly available websites for keywords associated with value cocreation produced a large dataset which enabled the use of exploratory factor analysis (EFA) methods for the identification of the underlying dimensions that distinguish the various types of value co-creation. This approach builds on the earlier keyword based research of Ferrier (2001) and the web data mining techniques of Hicks et al; (2006), McGinnis (2008), and Lombardi (2009).

3.2 Research Steps

Table 2 shows a step-by-step description of how the research was conducted:

Table 2: Research Method

Research method step		**Activity**
1	Literature review	Identify a spectrum of distinguishing characteristics typical of value co-creation: Select and review co-creation literature: a) academic articles and books addressing co-creation b) value co-creation blogs and web-sites. Define keywords representative of the different characteristics of value co-creation. Build an inventory of companies active in value co-creation and using it provide market offerings: a) from academic and other literature on value co-creation b) McGinnis (2008) research sample of Open Source Software companies c) Lombardi (2009) research sample of companies associated with the Eclipse foundation. Study data mining methods and statistical techniques used to identify key dimensions underlying large datasets: a) Google Ajax search API b) Exploratory factor analysis
2	Lessons Learned	Develop lessons learned derived from studying the literature
3	Select sample	Websites: target ~300 Selection criteria: Known adopters of co-creation practices

Research method step		Activity
		50-1.55 million web pages Sources: 86 firms from co-creation literature - e.g. LAMP, Facebook, Android, TSMC, SecondLife 61 firms deriving revenue from OSS (McGinnis, 2008) 140 firms from Eclipse ecosystem (Lombardi, 2009)
4	Select keywords	Keywords selection based on: Concepts extracted from literature study Theoretically informed reading of websites: - Facebook, Android, TSMC, Second Life Rationalize keyword list: Eliminate redundant/ubiquitous/rare keywords Combine words using logical AND/ OR operations
5	Data acquisition	Search websites using Research Keyword Search Tool (Google Ajax API): Capture keyword frequencies/website = Keyword count/number of web-pages at site
6	Validate data	Adjust variables until SPSS factor analysis satisfies validity criteria: Correlation table determinant > 1.0×10^{-5} KMO sampling adequacy test > 0.5 Bartlett's significance test < 0.05. Iterate steps 5-6 until validity criteria are satisfied
7	Factor Extraction	Use SPSS to analyze keyword frequency data by: Extracting factors Comparing results and select best extraction method: Principal Component Analysis Common factor analysis

Research method step		Activity
		Unweighted Least squares Generalized Least squares Alpha factoring Maximum likelihood Principal Axis factoring Selecting best number of factors: Kaiser criterion to determine number of factors Scree plot Selecting best rotation method: Varimax Quartimax Equamax Promax Direct Oblimin
8	Rank firms using factors	Apply factor variables to website data: calculate each firm's factor scores: Compare company factor scores Compare factor scores for different types of firm (OSS/Eclipse) Compare adoption rates of factor combinations
9	Validate results:	Repeat steps 5 to-7 for independent sample: 2007 Fortune 1000 firms Websites with 50 - 1.55 million pages
10	Interpret factors	Interpret factors using variables (keywords) and component loadings: Criteria: Minimum 3 variables with loadings > 0.5 Excluded variables with loadings < 0.44
11	Draw conclusions	Synthesize conclusions and insights

3.3 Sample Selection

The unit of analysis is the website of an organization actively engaged in value co-creation. The following criteria were used to select the sample:

• the company represented a good example of firms engaged in using value co-creation as an important part of their business model

• contained between 50 and 1,550,000 pages.

The literature on exploratory factor analysis strongly recommends that sample sizes be as large as possible with ~300 cases being a reasonable goal for a study of phenomena in the social and management sciences (Field, 2005; Reinard, 2006). A large sample size is especially important where the population exhibits a high degree of diversity in terms of the dimensions that are being studied.

Finding a representative sample of companies engaged in value co-creation comprised a significant part of the initial research effort. Sample organizations were selected from 3 main sources:

• organizations described in value co-creation literature
• organizations reliant on Open Source Software
• organizations associated with the Eclipse foundation.

The literature search on value co-creation (academic articles, books, news articles and blogs) provided an inventory of companies used by various authors as case studies to illustrate the various aspects of value co-creation. This search resulted in 86 co-creation organizations.

Open Source Software companies are considered to be good representatives of firms using multiple aspects of value co-creation. Using the dimensions of Prahalad and Ramaswamy's (2004) DART model shows that:

• OSS firms are contributors to OSS projects and so engage in dialogue with external contributors who are most often end users
• OSS firms provide access to their source code and development processes
• OSS firms share IP management risk with external contributors and end users
• a high degree of transparency is required to allow external developers to contribute to the OSS project.

McGinnis (2008) has recently compiled a list of 77 companies reliant on Open Source Software to study their competitive behavior. This list became the source of a second sub-sample of firms. Members of OSS-driven business ecosystems such as the Eclipse Foundation are also considered to be good representatives of the value co-creation model because they engage in many of the aspects of value co-creation:

• business ecosystems conduct an ongoing dialogue with other members of the ecosystem to nurture growth
• they provide access to internal resources and complementary assets to other members of the ecosystem to bring new products and services to market
• they manage risk through clearly defined intellectual property rights and
• they provide a degree of transparency within the ecosystem to build the trust necessary for other members of the eco-system to co-develop new capabilities.

A list of 163 Eclipse Foundation member firms compiled by Steven Lombardi (2009) for his Master's thesis in the Carleton TIM program was the source of the third sub-sample of organizations sampled for the research.

**Data were acquired over the timeframe of November-December 2015.*

3.4 Keyword Selection

The development of the final list of keywords that were used as search terms for our study represents one of the key contributions of this research. The keywords are intended to represent as many of the aspects of value co-creation as possible to allow the exploratory factor analysis to detect which aspects are practically relevant for companies. Keywords were collected through an exhaustive search of the literature and supplemented with additional words found through a theoretically informed contextual search of the corporate web pages and developer's forums of four selected organizations (Hicks et al; 2006): Facebook, Android/ Open Handset Alliance, Taiwan Semiconductor Manufacturing Corporation (TSMC), and the Second Life on-line game. The initial comprehensive set consisting of more than 170 keywords were rationalized to eliminate words that either produced negligible successful searches or were found to be ubiquitous(Hicks et al; 2006).

Since the Google Ajax search API supports logical "OR" operations, it was possible to combine many keywords with similar definitions. The resulting list of keywords consisted of 29 word sets at the end of the keyword definition phase of the research.

3.5 Data Acquisition

The data mining technique used a web search approach similar to that described by Hicks et al; (2006) and Opoku (2005) to search the public internet for

the use of keywords as indicators of the presence of value co-creation. The Research Keyword Search Tool used to perform the web searches was developed by Steven Lombardi to support his research into the interactions of Eclipse member firms and is based on the Google Ajax search API. Similar to the IFAPI tool developed by Diana Hicks and her team at Georgia Tech, it uses text files containing lists of keywords and website URLs to automate the search of the millions of applicable web-pages for the presence of the desired keywords (Hicks et al; 2006). The output is an Excel readable comma separated variable (csv) file containing counts of "hits" for each search term at each website normalized by the total number of web pages present at the website. The speed of the Google search engine enables the tool to search more than 900 websites with over 11 million web pages in less than 5 minutes allowing researchers to optimize results by iterating with new search parameters in near real-time. The only modification to the search tool as used in Lombardi's research was the ability to limit searches to English language pages. This change was considered necessary because many of the firms searched maintain a global presence and since the search terms were comprised of only English language words, web pages in other languages artificially lowered the keyword frequencies reported for those global firms. Figure 3 shows the user interface of the Research Keyword Search Tool.

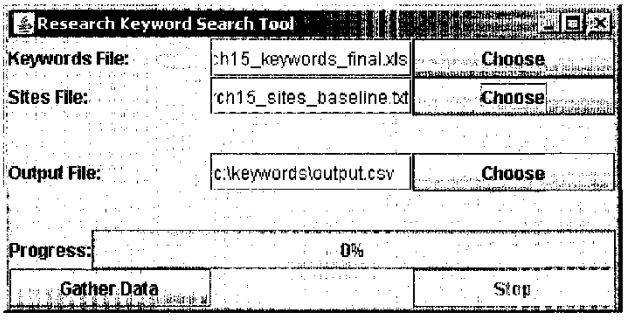

Figure 3: The Research Keyword Search Tool

3.6 Validate Data

Successful exploratory factor analysis demands that the data set meet specific criteria for correlation, sampling adequacy and statistical significance (Field, 2005). The statistical analysis program SPSS was used to perform these validity tests on the data. SPSS also provided the correlation matrix used to identify variables (keyword frequencies) that might cause specific test failures. For runs that failed to meet the

validation criteria (Table 3), the correlation matrix was analyzed to find variables with high correlation (> 0.9) or with high average significance (> 0.025). Usually when two variables (keyword frequencies) were highly correlated, the keywords had similar definitions within the value co-creation context and so were logically combined to form a new variable and a new iteration of the web search performed. In cases where highly correlated variables did not represent similar aspects of value co-creation, one of the variables had to be dropped from the analysis. After several iterations all validity criteria were met with 29 variables remaining.

An example of a variable dropped from the analysis to allow the correlation table determinant to meet the validity criteria (1.0 x 10"5)was: "open standard" OR "open source" OR "open content" OR "open architecture".

Table 3: Factor Analysis Data Validity Test Criteria

Metric	Limit
Correlation table determinant	> 1.0×10^{-5}
Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy.	> 0.5
Bartlett's test of Sphericity Significance test	< 0.05

3.7 Factor Extraction

Extraction of the key factors underlying the variation of the data is the main point of Exploratory Factor Analysis research. SPSS supports a range of factor extraction methods including:

- Principal Component Analysis
- Common factor analysis that could be based on
- Unweighted Least squares
- Generalized Least squares
- Alpha factoring
- Maximum likelihood
- Principal Axis factoring.

While the literature differs on the strengths of the various extraction methods, most authors agree that a large sample size =300 will result in similar results regardless of extraction technique. In this sense researchers should choose the method providing the clearest structure and the best fit with theory (Reinard, 2006).

SPSS allows the researcher to specify the number of factors to extract. Kaiser's criterion and examination of the scree plot are the two main approaches suggested in the literature for determining the number of factors to extract. Kaiser's criterion is assumes that since all factors with Eigenvalues >1.0 represent a significant contribution to the overall variation in the data. The scree plot can be used to identify a threshold for factor selection because only factors that contribute a relatively high degree of variation are above the knee. Like selecting the optimal extraction method, many recent authors recommend that researchers examine the results of extraction with a range of factors and select the set that provides the best structure (Darlington, 2008).

Rotation is used to "find the best distribution of factor loadings in terms of the meanings of the factors" (Reinard, 2006). SPSS supports the five distinct factor rotation methods: Varimax, Quartimax, Equamax, Promax and Direct Oblimin.

Orthogonal rotation such as Varimax should be used for factors which are expected to be independent (uncorrelated); oblique rotation such as Direct Oblimin is recommended for factors which may be related (Field, 2005). Reinard (2006) quotes Loehlin and points out that "oblique solutions tend to be ... more vulnerable to idiosyncrasies in the data and generally are more likely to go extravagantly awry than orthogonal ones."

3.8 Company Ranking

The factor extraction step provides a set of solid factors together with their constituent variables (i.e. combinations of particular keywords). This information enables the calculation of the score for each of the factors of each company in the research sample in terms of level of activity of the value co-creation dimension that the factor represents. The simplest method sums the frequencies for all variables within a factor to attain a score for each of the factors for a given firm (Reinard, 2006). The resulting factor scores can be averaged over the sample to compare the relative adoption levels and gain insights into which factors are more prevalent in practice.

Since many of the companies in the sample were selected from specific groups of firm (OSS and Eclipse) it was also possible to assess the relative adoption rates within each specific population and gain insights into how different sub-

populations might employ different value co-creation strategies. Lastly, the individual factor scoring enables the sample set to be ranked by degree of activity to find the subset of firms most active in a given factor. The scores of these "active firms" can then be studied by grouping the firms by dimension adoption level and by examining the emerging combinations of factors enabling specific value co-creation strategies.

3.9 Validate Results: Fortune 1000 Firms

Hicks et al (2006) suggest that it is critically important to establish that the results obtained are "not purely a result of a statistical technique seeking a factor solution" i.e. that have nothing to do with reality. To accomplish this they constructed a control sample of firms and attempted to extract factors using the same set of keywords used in the data analysis. Their failure to reproduce similar results was interpreted as a validation that their research had found a real structure underlying how the firms in their sample build strategies for the commercialization of technology (Hicks et al; 2006).

There is no readily available database of firms "which do not engage in value co-creation" but since value co-creation is a relatively new business phenomenon it was felt that any large sample of firms would be unlikely to demonstrate the same structure of keyword use. It was a matter of a simple web search to find a list of the URLs for the 2007 set of Fortune 1000 firms. The Fortune 1000 list of sites was vetted using the same 50 to 1.55 million web page criteria resulting in a total Fortune 1000 sample of 904 sites. The factor extraction method was applied to the Fortune 100 sample with the value co-creation keywords and the results assessed for correlation, sampling validity and statistical significance.

3.10 Factor Interpretation

The final step was the interpretation of the extracted factors using the variables/loadings which make up each factor together with the researcher's knowledge of value co-creation gained from the literature. Reinard recommends that variables with loadings value less than 0.6 and crossloadings value larger than 0.4 be excluded from the interpretation process (Reinard, 2006). Costello and Osborne (2005) recommend a minimum loading of 0.32 and suggest that researchers consider dropping cross-loadings for factors with "several adequate to strong loaders (0.50 or

better)." Stevens suggests that only variables with loadings values larger than 0.4 should be considered for the purpose of interpretation (Stevens, 2009). For the purposes of this research we chose the following criteria:

• minimum 3 variables with loading values larger than 0.5

• only variables with loading values greater than 0.44 were considered.

CHAPTER IV

4. Research Results

This chapter is organized into eight sections. The first section describes the sources of the organizations sampled for this research. The second section presents the list of keywords developed by studying the literature and reference websites. The third section describes how the correlation table and statistical validity tests were used to refine the initial web search terms and rationalize the number of keywords. The fourth section provides the details of how Principal Component Analysis was chosen to extract components from the keyword frequency data. The fifth section described the results of the extraction process and lists the resulting variables associated with each component. The sixth section describes how the resulting componentswere applied to calculate the degree of co creation activities associated with each organization in the sample. The seventh section provides the results of an analysis examining how value cocreation strategies (i.e., the combination of value co-creation components) are used by the firms that are most active in value co-creation. The eighth section presents the results of how the data were validated through application of the keywords to a sample of companies chosen from the 2007 list of Fortune 1000 firms.

4.1 Research Sample

The final research sample consisted of 287 organizations. The list of organizations and their website URL and business type (OSS, Eclipse member or other) is provided in Appendix A. Selected organizations were chosen to represent as wide a range of businesses models as possible to ensure as generalized a theory as possible given the time and resource constraints for completion of the research (Eisenhardt, 1989). There were a number of instances where Eclipse organizations or Value co-creation derived firms were found to overlap with the Open Source Software based firms (e.g. Red Hat Linux). When compiling the dataset, a firm was identified as Open Source Software if the majority of its revenue was associated with their involvement in open source project(s) by default.

Organizations having websites with less than 50 and more than 1.55 million web pages were excluded from the sample to avoid spurious results caused by sites with minimal content (i.e. few keyword hits) or those dominated by non-commercial content (e.g. Facebook). Certain cases like on-line games and social networking websites were rejected in favor of the associated developer's forums where discussion of collaboration and co-creation dominate over interpersonal trivia. The final breakdown of sample organizations is shown in Table 4 below:

Table 4: Breakdown of Sample Organization Source

Organization Source	Number	Percent of total
Value Co-creation Cases (Allen)	86	30%
Open Source Software companies (McGinnis)	61	21%
Eclipse Foundation organizations (Lombardi)	140	49%

4.2 Keyword Selection

Several statistics texts (Field, 2005; Reinard, 2006) recommend that the ratio of variables (keywords) to samples (websites) be between 6 and 10. Initially, keywords were selected based on the researcher's reading of the value co-creation literature including published academic works as well as books, news articles and blogs; these keywords were validated and augmented by scanning the websites of a set of four diverse firms keyword presence and context. The four firms were selected based on their identification in the literature as being exemplary cases of value co-creation to verify the in which the keywords are used: TSMC Inc., SecondLife, Facebook, and the Android Open Handset Alliance.

Individual keywords were grouped into sets of synonyms using logical OR operations. In cases where a unique phrase was required instead of a single keyword, the phrase was delimited with quotation marks (""). In cases where keywords were often used on web pages in contexts unrelated to value co-creation, logical AND operations were used to ensure that the Research Keyword Search tool returned results that were specific to the desired value co-creation context. After the preliminary 39 sets of keywords were defined, the list was rationalized by performing a series of trial factor extractions in which the determinant of the

correlation matrix and the results of the KMO tests were optimized. In each trial, the correlation matrix was carefully inspected to identify and eliminate keyword pairs with high correlation scores (collinearity). After several iterations, the list of keywords was reduced to 29 word combinations with a correlation matrix determinant of 1.0 x 10"3.

Table 5 shows a breakdown of a keyword set, the source of each word and an example extracted from the source showing the context in which each word was used.

Table 5: Example Keyword Set Structure, Source and Example Context

(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)		
Keyword	**Source**	**Context**
customer OR user	Researcher	Qualifier used to eliminate pages which do not describe activities involving customers or users
suggest suggestion	Facebook Developers' Forum	"You can **suggest** your idea through the **suggestion** form on the Help Centre."
input	TSMC on-line newsletter	"TSMC will be even more diligent in seeking **customer input**. This dialog will cover a plethora of issues including process technologies, quality and reliability, delivery, capacity, and overall service and collaboration. "
request	Secondlife Grid Developers' forum	"To submit a **request** to participate in the Reg API program..."
demand	Facebook Developers' Forum	"...but still maintaining the sense of security **users demand** when they ..."

**Appendix B provides the full list of keywords, source and context.*

The Research Keyword Search Tool uses the Google Ajax search Application Programming Interface (API) to count the number of instances that each of the logical combinations of the keywords is found in all the web-pages at each site specified in the sample list. The Ajax API also returns the total number of pages at each site allowing the tool to record the "normalized keyword frequency" by dividing the keyword counts by the number of pages at each organization's website.

It should be noted that the Ajax search API counts all instances of the defined keyword combinations. In cases where multiple instances of a keyword combination are found on a webpage this can lead to "normalized keyword frequency" results of more than 100%. This is not an issue since the factor extraction is only concerned with correlations and not with the specific value of an individual keyword frequency.

4.3 Descriptive Statistics

Table 6 shows the descriptive statistics of the keywords frequencies and number of pages/website recorded for the set of 287 websites captured on March 15, 2009. The statistics show the ranges and variation of keyword frequencies found in the sample.

Table 6: Descriptive statistics for the keyword frequencies

Item (Search Keyword combination)	Min	Max	Mean	Std. Dev
Site Size	52	1,550,000	47,405	150,733
(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)	0	44.3	3.65	5.92
internal AND (expertise OR resource)	0	875.9	10.89	53.25
(customer OR user) AND (dialog OR dialogue OR communicate OR communication OR conversation OR contact OR feedback OR call OR interact OR "information exchange" OR "information sharing" OR connect OR access OR engage)	0	8.6	1.15	1.62
(customer OR user) AND (communities OR community OR network OR networking OR forum)	0.05	407.6	18.84	27.40
(customer OR user) AND (learn OR learning)	0	86.5	12.37	13.10
(customer OR user) AND experience	0	118.6	7.17	11.87
(customer OR user) AND (test OR trial OR beta)	0	315.3	5.56	19.23
ecosystem OR "value network" OR "value constellation" OR "multiple partners" OR "external contributor" OR "external source"	0	92.0	5.69	9.79
integrated AND online AND services	0	60.3	2.27	6.60
(product OR process) AND (modularity OR modular OR module)	0	46.3	1.58	3.71
(product OR process OR service) AND (evolution OR evolve)	0	37.6	2.64	4.40
(customer OR user) AND (produce OR assemble OR manufacture)	0	23.0	1.00	1.94
(customer OR user) AND (options OR choice OR choose)	0	16.1	1.77	2.15
design OR process AND (flexibility OR flexible OR adaptable)	0	89.3	6.16	8.46
lease OR rent OR license OR "self serve" OR "self service"	0	18.0	2.90	3.60
cost AND (reduce OR reduction OR saving)	0	562.5	12.63	38.20
(customer OR user) AND (negotiate OR negotiation)	0	27.5	2.41	3.62
(customer OR user) AND risk AND (manage OR management OR control OR assess OR reduce OR reduction OR potential OR exposure)	0	11.8	0.36	1.03
(customer OR user) AND (IP OR "intellectual property")	0	51.4	2.47	5.40

(customer OR user) AND language AND translation	0	118.6	3.19	8.80
(customer OR user) AND address AND concern	0	12.6	0.27	0.93
(customer OR user) AND (survey OR review OR voting OR vote OR rate OR rating)	0	8.6	0.35	0.77
trust OR honesty OR integrity	0	47.2	4.64	6.63
(customer OR user) AND (dashboard OR statistics)	0	39.7	3.19	5.28
customer AND (partnerships OR interaction OR relationship OR participate OR participation OR activity OR action)	0	33.5	1.36	3.61
customization OR customize OR customized OR personalize OR individualize OR "add feature" OR "added feature "	0	48.4	3.77	6.00
simulation OR simulate OR model OR modeling OR "virtual world" OR "reference design "OR "reference flow" OR "demo application "OR toolkit OR tutorial OR SDK OR "software development kit"	0	76.8	4.53	8.23
(customer OR user) AND (disclose OR inform OR disseminate OR reveal)	0	323.5	15.54	24.15
(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)	0	10.1	0.92	1.26

4.4 Correlation table

Table 7 shows the determinant of the correlation table and the results of the Kaiser-Meyer-Olkin (KMO) and Bartlett's significance tests. For successful factor extraction it is critical to avoid singularities (multicollinearity) in the correlation table as indicated by its determinant. The determinant must be greater than 1.0 x 10"5 for effective factor extraction (Field, 2005). At 1.0 x 10"3, the determinant of the co-creation data indicates that the correlation data are of adequate quality for good factor extraction.

For the results to be considered statistically valid, the KMO measure of sampling adequacy must be larger than 0.50 (Field, 2005). The KMO of 0.796 calculated for the co-creation data is in the 0.6-0.8 range commonly considered to be "good" (Field, 2005). The Bartlett's test of sphericity must show a significance of less than 0.05 indicative of an adequate degree ofcorrelation for the factor analysis to converge (Field, 2005). The result (0.000) indicates that the data are well within an acceptable range to permit extraction of good factors.

Table 7: Validity tests

Metric		Actual	Limit
Correlation table determinant		1.0×10^{-3}	$>1.0 \times 10^{-5}$
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.796	>0.5
Bartlett's Test of Sphericity	**Approx. Chi-Square**	1,874.204	
	Df	406	
	Sig.	0.000	<0.05

4.5 Component Extraction

Common Factor Analysis (CFA) and Principal Component Analysis (PCA) are two statistical techniques used by researchers conducting exploratory factor analysis to uncover the dimensions underlying the variation of a large number of variables. PCA is intended to reduce a set of variables to the smallest number of components possible by focusing attention on total variance, whereas CFA divides the variance into common variance shared among variables and unique variance derived from a particular observed variable and its error component (Reinard, 2006). Recent publications on factor analysis generally recommend the use of CFA over PCA although most acknowledge that usually both PCA and CFA produce equally valid results and suggest that researchers try multiple approaches and select the one that produces the "best fit" of results to theory (Stevens, 2009).

Trial analyses were run using each of the seven different extraction techniques available within the SPSS software package. While all seven options produced similar factor/component structures, the PCA option was selected for component extraction as it provided the cleanest component loading table with relatively high loading values and minimal cross-loadings as well as the best fit with prevalent theory.

Most statistics texts suggest that researchers use either Kaiser's criterion (select factors with Eigenvalues larger than 1.0) or the scree plot (select all factors above the point at which the curve bends to form a knee) when selecting the number of factors to extract. (Darlington, 2008; Field, 2005; Costello & Osborne, 2005; Reinard, 2006; Stevens, 2009). Field (2005) offers the following recommendations:

• "If there are fewer than 30 variables, and communalities after extraction are greater than 0.7; or if the sample size exceeds 250 and the average communality is greater than 0.6, then retain all factors with Eigenvalues above 1.0 (Kaiser's criterion)."

• If none of the above criteria apply, a scree plot can be used when the sample size is large (around 300 or more cases)."

In our case, while there are only 29 variables (i.e., less than 30) and a sample size of 287 (larger than 250), the diversity of the firms sampled resulted in an average communality of only 0.37 (Table 8) so the scree plot was used to determine the number of components to extract.

Figure 4 shows the scree plot of the extracted components. Although there is a distinct knee in the curve after 2 components, the curve shows a clear secondary slope down to component 5 so four components were selected for interpretation. To validate Field's recommendations the analysis was repeated for each extraction setting from 2 through 9 for completeness: in each case the resulting component matrix suffered from lower component loadings and/or excessive cross-loadings and the rotated factor loading table did not match theory as well as was found in the four component case.

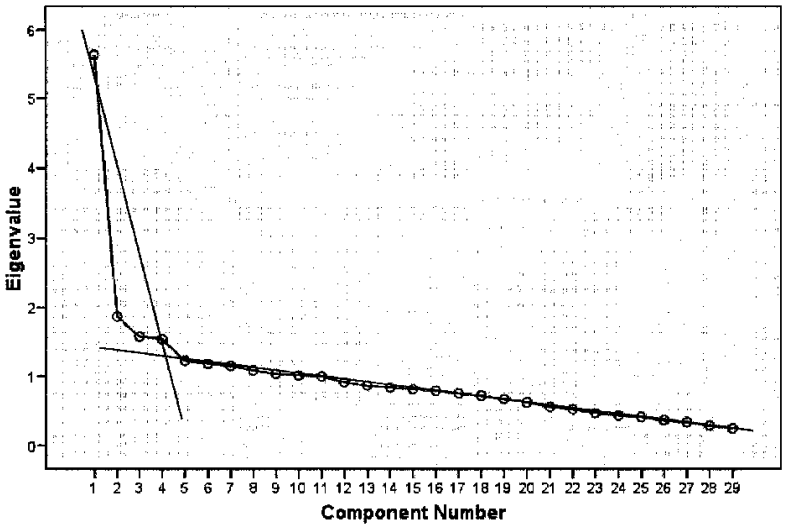

Figure 4: Scree plot of dataset

Table 8: Communalities for the Variables Used: Principal Component Analysis

Variable (Keyword combination)	Extraction
lease OR rent OR license OR "self serve" OR "self service"	0.03
(customer OR user) AND experience	0.05
simulation OR simulate OR model OR modeling OR "virtual world" OR "reference design "OR "reference flow" OR "demo application "OR toolkit OR tutorial OR SDK OR "software development kit"	0.08
(product OR process OR service) AND (evolution OR evolve)	0.15
(customer OR user) AND (negotiate OR negotiation)	0.18
(customer OR user) AND language AND translation	0.18
(customer OR user) AND address AND concern	0.19
(customer OR user) AND (dashboard OR statistics)	0.20
(customer OR user) AND (IP OR "intellectual property")	0.27
(customer OR user) AND (test OR trial OR beta)	0.32
ecosystem OR "value network" OR "value constellation" OR "multiple partners" OR "external contributor" OR "external source"	0.34
trust OR honesty OR integrity	0.34
(customer OR user) AND risk AND (manage OR management OR control OR assess OR reduce OR reduction OR potential OR exposure)	0.35
customization OR customize OR customized OR personalize OR individualize OR "add feature" OR "added feature "	0.35
(customer OR user) AND (disclose OR inform OR disseminate OR reveal)	0.36
(customer OR user) AND (cooperate OR cooperation OR collaboration OR partnership)	0.38
(customer OR user) AND (produce OR assemble OR manufacture)	0.40
(product OR process) AND (modularity OR modular OR module)	0.42
(customer OR user) AND (dialog OR dialogue OR communicate OR communication OR conversation OR contact OR feedback OR call OR interact OR "information exchange" OR "information sharing" OR connect OR access OR engage)	0.44
(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)	0.45
(customer OR user) AND (survey OR review OR voting OR vote OR rate OR rating)	0.47
integrated AND online AND services	0.50
customer AND (partnerships OR interaction OR relationship OR participate OR participation OR activity OR action)	0.55
design OR process AND (flexibility OR flexible OR adaptable)	0.56
(customer OR user) AND (options OR choice OR choose)	0.59
internal AND (expertise OR resource)	0.60
(customer OR user) AND (learn OR learning)	0.61
cost AND (reduce OR reduction OR saving)	0.61
(customer OR user) AND (communities OR community OR network OR networking OR forum)	0.65
Average communality	**0.37**

Table 9 shows that 36.7% of the sample's total variance was explained by the four extracted components. While this is a fairly low percentage of the overall total variation in the data, it is not surprising given the diverse range of business models employed by the many organizations in the sample.

Table 9: Total Variance Explained by Extracted Components

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var	Cum %	Total	% of Var	Cum %	Total	% of Var	Cum %
1	1.87	6.44	6.44	1.87	6.44	6.44	2.50	8.61	8.61
2	5.64	19.44	25.89	5.64	19.44	25.89	3.38	11.67	20.27
3	1.54	5.32	31.20	1.54	5.32	31.20	2.26	7.79	28.06
4	1.58	5.46	36.66	1.58	5.46	36.66	2.49	8.60	36.66
5	1.23	4.23	40.88						

Rotation is used to maximize the loadings of the variables of all components without affecting the relative loadings of the variables. Most texts recommend the use of Varimax (orthogonal) rotation for uncorrelated components (Field, 2005).

Reinard recommends excluding variables with loadings less than 0.6 and cross-loadings larger than 0.4 from being used when interpreting the meaning of a component or factor (Reinard, 2006). Costello and Osborne (2005) recommend a minimum loading of 0.32 and suggest that researchers consider dropping cross-loadings for factors with "several adequate to strong loaders (0.50 or better)".

Stevens (2009) suggests that only variables with loadings larger than 0.4 should be considered for interpretation purposes based on the suggestion that a variable should "share at least 15% of its variance with the construct (factor) it will be used to help name" For the purposes of this research a minimum loading threshold of 0.44 was chosen. This threshold highlights the strength of the factors and eliminated all cross-loaded variables.

Table 10 shows the resulting components with their associated variables (keywords) and loadings. The components have been ranked in accordance with their prevalence in the market as indicated by their average keyword frequency score. This differs from the SPSS output which ranked them in accordance with the sums of their loadings: using our component designations, the SPSS ranking was: 2-1-4-3.

Table 10: Rotated Component Variables and Loadings: Rotation – Varimax with Kaiser Normalization

Component 1	**Loading**
(customer OR user) AND (learn OR learning)	0.74
(customer OR user) AND (communities OR community OR network OR networking OR forum)	0.71
(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)	0.67
(customer OR user) AND (dialog OR dialogue OR communicate OR communication OR conversation OR contact OR feedback OR call OR interact OR "information sharing " OR engage)	0.56
Component 2	
internal AND (expertise OR resource)	0.72
cost AND (reduce OR reduction OR saving)	0.70
customer AND (partnerships OR interaction OR relationship OR participate OR participation OR activity OR action)	0.65
(design OR process) AND (flexibility OR flexible OR adaptable)	0.65
(customer OR user) AND (cooperate OR cooperation OR collaboration OR partnership)	0.55
(customer OR user) AND (risk manage OR management OR control OR assess OR reduce OR reduction OR potential OR exposure)	0.53
trust OR honesty OR integrity	0.53
Component 3	
(customer OR user) AND (options OR choice OR choose)	0.68
integrated AND online AND services	0.66

customization OR customize OR customized OR personalize OR individualize OR "add feature " OR "added feature "	0.59
(product OR process) AND (modularity OR modular OR module)	0.46
ecosystem OR "value network" OR "value constellation" OR "multiple partners" OR "external contributor" OR "external source"	0.46
Component 4	
(customer OR user) AND (disclose OR inform OR disseminate OR reveal)	0.58
(customer OR user) AND (produce OR assemble OR manufacture)	0.57
(customer OR user) AND (IP OR "intellectual property ")	0.50
(customer OR user) AND (test OR trial OR beta)	0.44

All four components have at least three variables with loadings of 0.5 or greater. According to Costello & Osborne (2005) this indicates that the factors are "solid" (Costello & Osborne, 2005). Stevens (2009) states "when the average of the four largest loadings is larger than 0.6 then the factors will be reliable." We conclude that components 1 through 3 are strong and component 4 is of medium strength.

Based on the component analysis above, nine of the variables in the dataset had loadings too low to be used for interpretation of the components. These included the eight variables with the lowest communalities (<0.2) as well as the "customer survey" variable which had a component 4 loading of 0.43 (almost adequate for consideration.) The list of excluded keywords is provided in Table 11. It should be noted that even though these keywords were not used for component interpretation they cannot be dropped from the dataset either. When any of the keywords were dropped from the analysis either the KMO, Bartlett's sphericity or correlation table determinant validity tests failed or the resulting rotated component table changed significantly.

Table 11: Excluded keywords

Keywords excluded from Interpretation	Communality
lease **OR** rent **OR** license **OR** "self serve" **OR** "self service"	0.03
(customer **OR** user) **AND** experience	0.05
simulation **OR** simulate **OR** model **OR** modeling **OR** "virtual world" **OR** "reference design "**OR** "reference flow" **OR** "demo application "**OR** toolkit **OR** tutorial **OR** SDK **OR** "software development kit"	0.08
(product **OR** process **OR** service) **AND** (evolution **OR** evolve)	0.15
(customer **OR** user) **AND** language **AND** translation	0.18
(customer OR user) AND (negotiate OR negotiation)	0.18
(customer **OR** user) **AND** address **AND** concern	0.18
(customer **OR** user) **AND** (dashboard **OR** statistics)	0.19
(customer OR user) AND (survey OR review OR voting OR vote OR rate OR rating)	0.20

4.6 Company Website Component Scoring

The variables of each component were used to calculate component scores for each website in the keyword frequency table. Reinard (2006) recommends that researchers either simply sum the values of the variables loaded on a specific component or scale the values based on the associated communalities before summing (Reinard, 2006). Both approaches were used; since there wasn't a significant variation in the resulting distribution a simple sum of the variables was used.

The component scores were averaged over the complete sample of firms to allow the components to be ranked in terms of the corresponding level of activity found in our sample. Component 1 (Community forums) was found to be the dominant with over twice the average scores of the other 3 components; followed by components 2, 3 and 4 respectively. Figure 5 shows the averaged component scores:

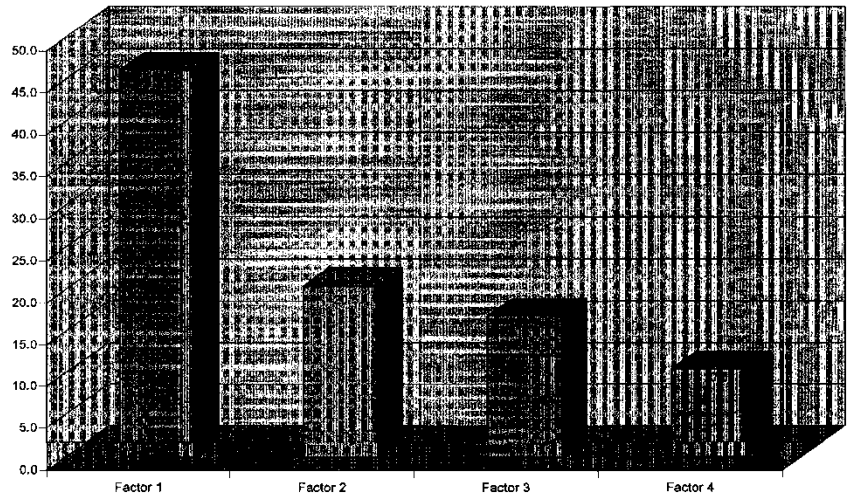

Figure 5: Average component score: all firms

The Mann-Whitney non-parametric test for comparing the means of variables from independent samples indicates that with the exception of factors 2 to 3 there is a statistically significant difference (2-tailed asymptotic sigma value = 0.000) between the means of all four components. (Reinard, 2006).Descriptive statistics are shown in Table 12.

Table 12: Descriptive Statistics of the average factor ratings for all firms

	N	Minimum	Maximum	Mean	Std. Deviation
Factor #1 – all firms	286	0.13	374.69	46.11	48.61
Factor #2 – all firms	286	0.00	136.25	20.52	21.98
Factor #3 - all firms	286	0.00	147.26	16.91	17.67
Factor #4 – all firms	286	0.00	81.82	10.55	11.86
Valid N (listwise)	286				

The relative scores of the different types of organizations were also examined for further insights into the adoption rates of the value co-creation components. Since 37% of the sample was comprised of Open Source Software companies it was easy to compare the average scores for each of the four components for the OSS firms with the scores of the rest of the sample as shown
in Figure 6.

Component 1 (Community forum) was found to be significantly more important than the other 3 components for the OSS firms with an average score of 55 versus 44 for the non-OSS firms.

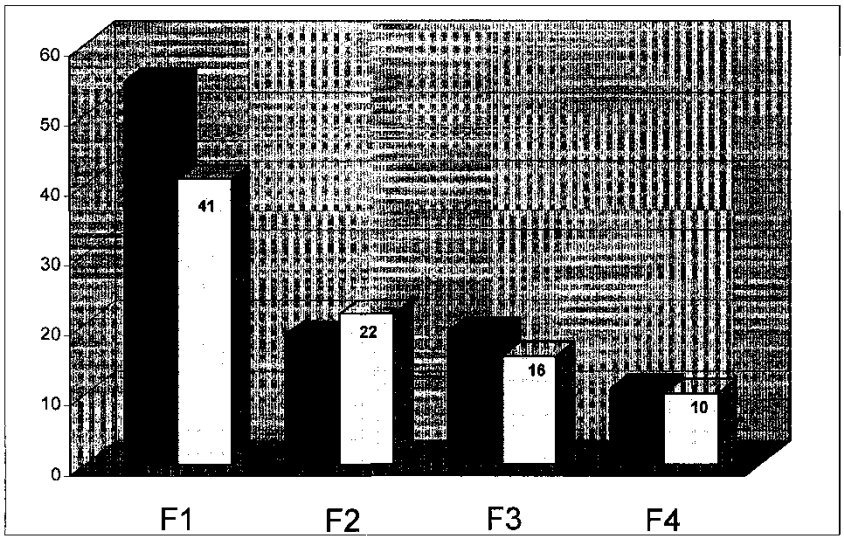

Figure 6: Averaged component scores: OSS firms compared with remainder

The Mann-Whitney non-parametric test for comparing the means of variables from independent samples indicates that factor 1 shows the only statistically significant difference (2-tailed asymptotic sigma value < 0.05) between the OSS and non-OSS firms (Reinard, 2006). Descriptive statistics are shown in Table 13 and Table 14.

Table 13: Descriptive Statistics of the average factor ratings for OSS firms

	N	Minimum	Maximum	Mean	Std. Deviation
Factor #1 – OSS firms	106	0.19	374.69	54.90	56.94
Factor #2 – OSS firms	106	0.00	87.36	18.66	19.69
Factor #3 – OSS firms	106	0.00	112.16	19.12	18.97
Factor #4 – OSS firms	106	0.00	69.21	10.97	12.38
Valid N (listwise)	106				

Table 14: Descriptive Statistics of the average factor ratings for non OSS firms

	N	Minimum	Maximum	Mean	Std. Deviation
Factor #1 – Non–OSS firms	180	0.13	363.67	40.93	42.27
Factor #2 – Non–OSS firms	180	0.00	136.25	21.62	23.21
Factor #3 – Non–OSS firms	180	0.04	147.26	15.60	16.77
Factor #4 – Non–OSS firms	180	0.00	81.82	10.29	11.56
Valid N (listwise)	180				

Comparing the average scores of the Eclipse foundation members (49% of the total) with the rest of the sample demonstrated that for these firms component 2 was the dominant metric as shown in Figure 7.

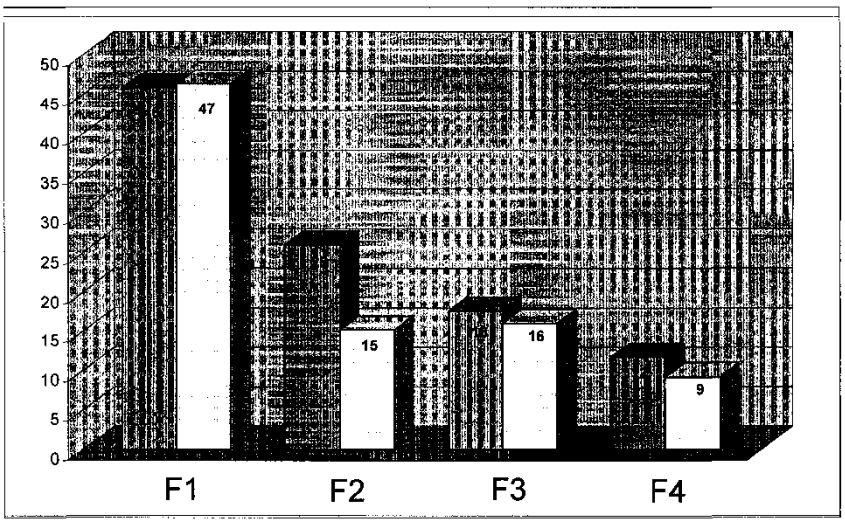

Figure 7: Averaged component scores: Eclipse firms compared with remainder

The Mann-Whitney non-parametric test for comparing the means of variables from independent samples indicates that the dominant statistically significant differences (2- tailed asymptotic sigma value = 0.000) between the Eclipse and non-Eclipse firms can be found in factors 2 and 4. There is also a statistically significant difference in factor 3 but the level of significance is lower (2-tailed asymptotic sigma value < 0.05). Descriptive statistics are shown in Table 15 and Table 16.

Table 15: Descriptive Statistics of the average factor ratings for all Eclipse-related firms

	N	Minimum	Maximum	Mean	Std. Deviation
Factor #1 – Eclipse related firms	140	0.30	322.48	45.67	41.86
Factor #2 – Eclipse related firms	140	0.00	136.25	25.92	25.66
Factor #3 – Eclipse related firms	140	0.04	147.26	17.60	17.20
Factor #4 – Eclipse related firms	140	0.00	48.71	11.81	9.77
Valid N (listwise)	140				

Table 16: Descriptive Statistics of the average factor ratings for all non-Eclipse firms

	N	Minimum	Maximum	Mean	Std. Deviation
Factor #1 Non-Eclipse firms	146	0.13	374.69	46.53	54.44
Factor #2 Non-Eclipse firms	146	0.00	66.17	15.34	16.23
Factor #3 Non-Eclipse firms	146	0.00	112.16	16.23	18.13
Factor #4 Non-Eclipse firms	146	0.00	81.82	9.33	13.48
Valid N (listwise)	146				

4.7 Groups of Firms Manifesting High Degrees of Value Co-creation

Using the scores calculated above, the websites were ranked to identify the companies most active in the adoption of each of the four value co-creation components. The top 25% (71) scoring websites in each component were considered to be the "most active" in terms that component. For all four components, the top 25% of firms represent greater than 80% of the scores' dynamic range.

The resulting four sets (141 different websites) were analyzed to identify the groups of active firms using each of the 15 possible different combinations of value co-creation components. We propose that each different combination of value co-creation components is associated with a distinct value co-creation approach.

Each group of active firms was assigned a code indicating the composition of the components used by the group, for example, code 1234 indicates that this group of firms was among the top 25% most active in all 4 components. The list of active websites in the 1234 code group is given in Table 17. The complete list of active company websites sorted by group code is provided in Appendix C. Table 18 lists the number of active firms in each of the 15 groups.

Table 17: Group Code Organizations active in all value co-creation components

Group Code	Organization URL	Firm Type	
1234	http://www.latticesemi.com/		
1234	http://www.altera.com/		
1234	http://aws.amazon.com/		
1234	http://www.ddci.com/		Eclipse
1234	http://www.salesforce.com/		Eclipse
1234	http://www.curl.com/		Eclipse
1234	http://www.lynuxworks.com/		Eclipse
1234	http://www.brocade.com/	OSS	Eclipse
1234	http://www.intervoice.com/	OSS	Eclipse
1234	http://www.progress.com/	OSS	Eclipse
1234	http://www.tibco.com/		Eclipse
1234	http://www.parasoft.com/		Eclipse
1234	http://www.polarion.com/		Eclipse
1234	http://www.digium.com	OSS	
1234	http://www.db4o.com	OSS	
1234	http://www.radview.com	OSS	
1234	http://www.pentaho.com	OSS	

Table 18: Distribution of Active Organizations by Component Group Code

Code	Value Co-creation Approach	# of Top Firms	Percent
1	Community Forum for Open Dialog	12	4.2%
2	Resource Sharing	14	4.9%
3	Personalization	18	6.3%
4	Co-production	16	5.6%
12	Resource sharing communities	8	2.8%
13	Personalization through community	3	1.0%
14	Co-production through community	5	1.7%
23	Personalization through resource sharing	5	1.7%

Code	Value Co-creation Approach	# of Top Firms	Percent
24	Co-production through Resource sharing	3	1.0%
34	Personalization through co-production	8	2.8%
123	Personalization through resource sharing in communities (e.g. OSS)	9	3.1%
124	Co-production through resource sharing in communities (e.g. Ecosystems)	11	3.8%
134	Personalization through co-production by communities	7	2.4%
234	Co-production of personalized offerings through resource sharing	5	1.7%
1234	Community co-production of personalized offerings through resource sharing	17	5.9%

4.8 Data Validation

To validate the results of the research, a sample was constructed from the websites of the 2007 Fortune 1000 firms and then searched for the value co-creation keywords. Ninety six of the Fortune 1000 firms were dropped either because they no longer maintained a web presence at the listed URL or they did not meet the 50-1.55 million webpage/site criterion. The complete listing of 904 Fortune 1000 firms searched is provided in Appendix D.

When the resulting correlation table data were analyzed prior to factor extraction the determinant of the table was found to be more than 2 orders of magnitude below the recommended minimum threshold for effective factor extraction. This is indicative that even though many of the same leading firms were present in both sample sets, the business models used by the Fortune 1000 firms differed from those of the sample of co-creation firms enough to prevent a pattern of keyword use to emerge. Table 19 shows the complete results of the validity tests for the Fortune 1000 sample.

Table 19: Fortune 1000 Firms Data Validity Test Results

Metric		Actual	Limit
Correlation table determinant		3.59×10^{-8}	$>1.0 \times 10^{-5}$
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.872	>0.5
Bartlett's Test of Sphericity	**Approx. Chi-Square**	15,304.29	
	Df	378	
	Sig.	0.000	<0.05

CHAPTER V

5. Discussion of results

This chapter includes four sections. Section 5.1 provides the interpretation of the factors (i.e., the value co-creation components) found in section 4. Section 5.2 provides insights formulated from the comparison of adoption rates of the value co-creation components for the entire sample and for comparisons of the adoption rates by organization type. Section 5.3 provides a discussion of a possible rationale for the presence of the dominant sets of combinations of value co-creation components.

5.1 Component Interpretation

The Principal Component Analysis identified four distinct factors corresponding to four value cocreation components each including a set of keywords (variables) associated with specific types of co-creation activities. Using our initial knowledge about the definitions and use of the keywords derived from the value co-creation literature and the contexts of the selected keywords found in selected company websites, each factor was interpreted to produce a descriptive definition for each value co-creation component. These definitions are provided below and are summarized in Table 20.

Component 1: Community Driven Open Dialog

This component has a total loading of 1.9 and accounts for 8.6% of the variation in the data. It includes the following combinations of keywords:

a) "(customer OR user) AND (learn OR learning)" with a loading of 0.74

b) "(customer OR user) AND (communities OR community OR network OR networking OR forum)" with a loading of 0.71

c) "(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)" with a loading of 0.67

d) "(customer OR user) AND (dialog OR dialogue OR communicate OR communication OR conversation OR contact OR feedback OR call OR interact OR "information sharing" OR engage)" with a loading of 0.56.

The presence of customer learning as the most dominant variable (1a) in this factor is a key to understanding that, regardless of the channel used, the most important outcome of the dialogue that occurs within these community forums is learning. The learning takes place within the organization which uses insights gained through dialogue to deliver more personalized products and services either to narrower market segments or to individual customers (von Hippel, 2001).

Learning also takes place among customers themselves who use the learning to better participate in the value creation processes across the entire value network.

The network nature of the learning and information exchange processes is emphasized by the relatively large value of the loading of the second variable (1b). The loading of the third variable (1c) indicates that most of the dialogue is used by the organization to gather intelligence into how to better serve the customer. It also demonstrates customers' proactive role in the communication process. More advanced levels of interaction and collaboration are expected to take place at higher levels of value co-creation maturity; the maturity model of co-creation is discussed in more detail in the conclusions. The fourth variable (1d) provides the overall context for this factor and indicates that the purpose of these community forums is to enable dialogue between the organization and the customer for information exchange and sharing.

Therefore, the first factor could be identified with a value co-creation component that we have labelled "Community Driven Open Dialog." It could be interpreted as an indicator of the presence of a community forum designed to engage customers in an open dialog including networking, information sharing and learning activities with the organization, other customers or other members of the value network. Motorola is a good example from our sample of an organization active in the use of a Community Driven Open Dialog.

The interpretation of the Community Driven Open Dialog value co-creation component finds significant support in recent literature on value co-creation. For example, Prahalad and Ramaswamy (2004) point out that two of the key drivers for the emergence of the value cocreation paradigm are manifested in the increasingly active role of customers in information access and networking. In addition, they identify dialog as the first value co-creation building block together with access to

information and tools - the second building block. Kohlbacher (2008) provided a framework emphasizing the importance of knowledge co-creation and information sharing for the development of new products. Jaworski and Kohli (2006) emphasized that in the value co-creation process it is both the firm and the customer that are engaged in the learning process and the subject of learning goes across the interface between them. They also underline the need for an open dialog and provide criteria for the identification of its existence pointing out that trust is a key factor for its emergence. Interestingly, trust does not appear among the variables in this value co-creation component. This may be due to the fact that 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).

Component 2: Partnerships for Resource Sharing

This component has a total loading of 5.6 and accounts for 11.7% of the variation in the data. It includes the following combinations of keywords:

a) "internal AND (expertise OR resource)" with a loading of 0.72

b) "cost AND (reduce OR reduction OR saving)" with a loading of 0.70

c) "customer AND (partnerships OR interaction OR relationship OR participate OR participation OR activity OR action)" with a loading of 0.65

d) "(design OR process) AND (flexibility OR flexible OR adaptable)" with a loading of 0.65

e) "(customer OR user) AND (cooperate OR cooperation OR collaboration OR partnership)" with a loading of 0.55

f) "(customer OR user) AND (risk manage OR management OR control OR assess OR reduce OR reduction OR potential OR exposure)" with a loading of 0.53

g) "trust OR honesty OR integrity" with a loading 0.53

The presence of the "internal expertise and resource" variable (2a) at the highest loading indicates the relative importance of expertise and resources as the main assets shared between the firm, the customers and the other members of the value network. Expertise and resources enable the shaping of new offerings including new products and services. It also demonstrates the relative importance

that the expertise and resources be offered by all stakeholders within the value network to enable meaningful value co-creation experiences.

The relatively high loading of the "Cost reduction" variable (2b) is indicative that it is one of the principle motivations for customers and firms to enter into partnerships to co-create offerings. Most probably, cost reduction here encompasses more than just price and may entail other costs such as effort, lead time or brand investments. It should not be considered apart from the value creation process but, rather, within the context of the conscious management of the priceexperience relationship (Prahalad & Ramaswamy, 2004).

Partnerships between customers and firms (variable 2c) are what are being actively formed at this level of co-creation and include not just partnerships between individual firms and end users but also include business to business relationships that take place across the value network. Flexible designs and processes (variable 2d) are both a goal and a prerequisite to enabling customers to effect real change to the offerings provided by the value network. User involvement in the design process within the value network emerges as an issue in the next value co-creation component 3: (Personalization through options and modularity) after the information exchange and learning activities have been developed as described in component 1 (Community Forum for Open Dialog). Interestingly, risk management (variable 2f) and the need for trust (variable 2g) both appear as key issues at this level. Risk management is a prerequisite for trust to develop and trust is a crucial component for any partnership to be successful.

Therefore, the second factor could be identified with a value co-creation component that we have labelled "Partnerships for Resource Sharing". It could be used to describe the emergence of partnerships enabling user access to company expertise and resources, participation in and creation of adaptable designs and processes aiming at reducing the cost of offerings and reliant on trust, integrity and risk management. TSMC is a good example from our sample of an organization active in the use of Partnerships for Resource Sharing.

The interpretation of the Partnerships for Resource Sharing value co-creation component is supported by findings in recent literature on value co-creation. For example, Prahalad and Krishnan (2008) emphasize the changing nature of the

company-customer interactions including a transformational shift from ownership of resources to access and sharing of resources. Another important aspect for resource sharing is the complementarity of the expertise and resources shared between firms and customers (Jaworski & Kohli, 2006). This aspect was not taken into account in the development of the combination of keywords. Prahalad and Ramaswamy (2004) identified access to resources as being part of the second value cocreation building block while the importance of issues associated with risk assessment are identified as being one of the value co-creation building blocks (Prahalad & Ramaswamy, 2004). Risk disclosure (and not only articulation of particular benefits) emerges as a major bone of contention between consumers and business engaged in value co-creation activities (Prahalad & Ramaswamy, 2004).

The capability for flexible design and adaptable processes is prerequisite to the ability for customers to participate in the design processes. The design process flexibility and adaptability variable (2d) appears at the same loading level as the partnership variable (2c) which shows that the major subjects of cooperative actions (variable 2e) are product, service and process designs. This finding is in accordance with similar finding in the literature on co-designing modes of cooperation between customers and firms (Berger, Moslein, Piller & Reichwald, 2005; Sanders &Stappers, 2008).

The cost reduction variable (2b) deserves particular attention and should be considered within the context of the specific customer demands for personalized value. Empirical evidence from studies on market segmentation (von Hippel, 2006) shows that the heterogeneity of user needs is clearly combined with a willingness to pay for better products or services, i.e. customers are always trying to minimize costs but not at the expense of compromising the value - they are willing to pay more to get more if this "more" is valuable and makes sense for them. This conclusion is also supported by a cost function model for the co-production of services that was recently developed by Etgar (2006). The model suggests that to perform relevant value cocreating activities customers and firms strive to minimize the total cost of each activity by choosing the most efficient mix of participants. The model also shows how customers make strategic decisions to minimize the cost of value co-creating activities by trying to maximize the efficiency of the joint value creation process.

The fact that trust (variable 2g) appears within this particular value co-creation component needs to be further discussed. Jaworski and Kohli (2006) associate the emergence of trust with the presence of an open dialog but trust did not appear as an issue in our first value co-creation component - Community Forum for Open Dialog. The emergence of trust as an issue in the Partnerships for Resource Sharing component demonstrates that trust must be *developed* within the context of the first component focusing on open dialog. The fact that it did not emerge as an issue at the Community Forum for Open Dialog level could be associated with its emergent nature - it is not a precondition for an open dialog but is built into dialog (Ballantyne, 2004). The discussion of trust in the context of value co-creation has another aspect in its importance for the development of partnerships between members of the value co-creation chain. This aspect was recently described by Flint and Mentzer (2006) - trust among supply chain members is critical for involving customers in value co-creation.

Component 3: Personalization through options and modularity

This component has a total loading of 1.5 and accounts for 7.8% of variation in the data. It includes the following combinations of keywords:

a) "(customer OR user) AND (options OR choice OR choose)" with a loading of 0.68

b) "integrated AND online AND services" with a loading of 0.66

c) "customization OR customize OR customized OR personalize OR individualize OR "add feature" OR "added feature" with a loading of 0.58

d) "(product OR process) AND (modularity OR modular OR module)" with a loading of 0.46

e) "ecosystem OR "value network" OR "value constellation" OR "multiple partners" OR "external contributor" OR "external source"" with a loading of 0.46

In order for a firm to offer any degree of personalization, it must enable choice through a menu of options from which the customer can select (variable 3a). Integrated on-line services (variable 3b) are indicative of the need for a mature information communications technology infrastructure to allow customers to exercise choice and to contribute to the value creation process. The variable 3c (customization) indicates that at this level of value co-creation customers are able to

not only select from a menu of options but also actually influence the suite of options that the value network can provide.

A degree of product or process modularity (variable 3d) is required to enable the firm to act on the input from the customer to produce personalized offerings. Variable 3e ("ecosystem OR value network") shows the importance of the network properties of the value co-creation environment to the ability to offer customers a range of choices and to enable their creativity and innovation capacity by allowing them to add new options from external sources resulting in truly "personalized" experiences. Interestingly, personalization emerges as an issue only within the context of the network properties of the value co-creation ecosystem.

Therefore, the third factor could be identified with a value co-creation component that we have labelled "Personalization through Options and Modularity" and could be interpreted to mean the personalization of offers through partnerships across the value network to provide choices and options enabled by product and process modularity, and integrated online services. Dell Computers is a good example from our sample of a company active in personalization through options and modularity. Existing literature on value co-creation (Prahalad & Ramaswamy, 2004) clearly identifies that enabling multiple options is one of the key dimensions of choice in value co-creation. Prahalad and Krishnan (2008) point to the relationship between the efficient governance of business management processes and the capabilities of the underlying ICT infrastructure including integrated online services and analytical data management tools.

The possibility for customers to personalize existing offerings and to shape new offerings deserves special attention. Personalization emerges within the context of well developed value network relationships and within modular product/service architectures with clearly identified open business functional blocks and points of access to multiple members of the value network.Although the term personalization is predominantly used in the case of individual consumers (B2C), it can also be applied to the case of businesses (B2B). However, the emerging value cocreation paradigm presupposes the collapse of the traditional distinction between B2B and B2C since every individual who interacts with the company should be considered as a consumer (Prahalad & Ramaswamy, 2004). To address the personalization

phenomenon in this case of businesses, Zhang, Chen and Li (2007) suggest using the term 'customerization' - a term that was used earlier by Wind and Rangaswamy (2001).

Component 4: Co-production

This component has a total loading of 1.6 and accounts for 8.6% of the variation in the data. It includes the following combinations of keywords:

a) "(customer OR user) AND (disclose OR inform OR disseminate OR reveal)" with a loading of 0.58

b) "(customer OR user) AND (produce OR assemble OR manufacture)" with a loading of 0.57

c) "(customer OR user) AND (IP OR "intellectual property")" with a loading of 0.50

d) "(customer OR user) AND (test OR trial OR beta)" with a loading of 0.44

Based on the relatively low loadings (less than 0.6) we conclude that this is the weakest of the four value co-creation components found within our dataset. As such it is considered as the business activity with the lowest degree of adoption in our sample of firms most active in value co-creation and is therefore likely the most difficult to implement. Variable 4a "disclose OR inform OR disseminate OR reveal" has the highest loading indicative of the relative importance of a high degree of transparency between organizations and customers for co-production to take place. Variables 4b "produce OR assemble OR manufacture" and 4d "test OR trial OR beta" indicate that at this level, customers and users are actively engaged in the development, production and testing of offerings. Of course, in order for customers to participate in the production processthey will demand that the intellectual property rights (variable 4c) be clearly defined. It is not surprising that IP rights become an issue in situations where companies must open their manufacturing processes and reveal know-how enabling customers to engage in co-production.

Therefore, the fourth factor could be identified with a value co-creation component that we have labelled "Co-production" and used to describe the co-production of offerings by user involvement in manufacturing, assembly and beta trial activities; requiring disclosure and sharing of intellectual property. Scalix, an open source software company which provides an email and calendar application for the Linux platform was the most active firm in the co-production factor.

The variables included in the co-production factor indicate that there is a relationship between disclosing, revealing and IP issues. This relationship can be understood in light of user innovation network theory (Von Hippel, 2007), according to which innovators involved in a peer production process often freely reveal proprietary information, including existing and potential intellectual property rights to that information; and all interested parties are given access to the information - the information becomes a public good (Von Hippel, 2007).

Table 20: Interpretation of the Extracted Components: summary

Component	Title	Definition
1	Community Driven Open Dialog	Community forum designed to engage customers in an open dialog including networking, information sharing and learning activities with the organization, other customers or other members of the value network
2	Partnerships for Resource Sharing	Partnerships enabling user access to company expertise & resources to create adaptable designs & processes aiming at reducing costs and based on trust, integrity & risk management
3	Personalization through options and modularity	Personalization of offers through partnerships across the value network to provide choices/options enabled by product and process modularity, and integrated online services
4	Co-production	Co-production of offers by user involvement in manufacturing, assembly and final beta trial activities; requiring disclosure and sharing of intellectual property

5.2 Comparison of website score versus value co-creation component and company type

Since factor analysis is intended to identify distinct components that are un-correlated, we assume that the components extracted represent independent types of business strategies used by firms engaging in value co-creation. However the data might also be interpreted in a way that considers the value co-creation components as progressive maturity levels or capabilities.

Value co-creation components as stages in a maturity model - a possible interpretation

Figure 5 shows that the average of the component 1 scores for our sample of firms is significantly (> 2 times) higher than the scores of components 2 through 4. This could indicate that the deployment of community forums is much more prevalent in the sample than resource sharing, personalization or co-production. As such it seems that it could be intuitively expected that most of the firms in the sample

provide and engage in some kind of forum for open dialog through which their customers can share information, learn and obtain advice and provide feedback on the company's products and services. It could be suggested that at the community building stage firms develop various capabilities such as trust, transparency and risk management that are prerequisite for the emergence and the success of the next three components. Similarly one could suggest that the resource sharing that occurs as part of component two forces firms to develop the modular products and processes and to build the value networks that enable personalization and co-production to occur. Co-production at component four requires not only a forum, trust, risk management, modularity and a value network but also a business ecosystem consisting of a platform built on integrated on-line services on which customers and other firms can participate in co-design and coproduction of the products and services offered through the ecosystem. It also demands that the intellectual property rights and rules of engagement between participants are well defined before customers and partners will invest their time, resources and creativity in helping to produce products or services that the firms can monetize.

This sequence of prevalence of the components of value co-creation implies that the capabilities represented by component one may be easier to implement than those of component two etc. It may also be that in certain cases the capabilities of the lower components are prerequisites of higher component capabilities. This may be interpreted to imply that the components could be considered as distinct stages of a value co-creation maturity model with component one: Community Driven

Open Dialog at the lowest level (stage 1) through component four: Co-production at the highest level of maturity (stage 4). It must be pointed out, however, that this potential implication is not directly supported by our research and needs to be further studied.

To gain further insights into the way that the value co-creation components operate within a specific business and market environment, the sample set was sorted by organization type (OSS, Eclipse) and the average score of each component calculated for the different types of organization as shown in Table 21 and Table 22. We observed that relative to the rest of the sample the Open Source Software organization sub-sample were highly active in component one (Community Driven

Open Dialog). We believe that this indicates that the OSS companies must nurture their communities more actively than other co-creation based firms in order to be effective in the marketplace. This finding is well supported in the academic literature (Lombardi, 2009).

Table 21: Average Scores of Open Source Software Organizations

Company type	Component 1	Component 2	Component 3	Component 4
OS Firm Average	55	19	19	11
Non-OS Firm Average	41	22	16	10

The results show that the firms of the Eclipse sub-sample are more active in component two (Resource Sharing) relative to the rest of the sample. Again this finding corresponds with earlier studies from the academic literature which found that access to resources and complementary assets is a fundamental motivation for firms entering into business ecosystems like Eclipse (Lombardi, 2009).

These findings show how the process can be used to gain insights into existing market ecosystems and to find underserved niches. They also help to reinforce the validity of our process by showing that the progression of prevalence of the components for these sub-samples is consistent with the overall data sample.

Table 22: Average Scores of Eclipse Foundation Member Organizations

Company type	Component 1	Component 2	Component 3	Component 4
Eclipse Firm Average	46	26	18	12
Non-Eclipse Firm Average	47	15	16	9

5.3 Analysis of Firms Active in Value Co-creation

Using the component scores to rank each organization by how "active" they are in terms of value cocreation enabled us to examine the combinations of value co-creation components dominant in the markets served by our sample. Figure 8 shows the distribution of companies most active in each of the 15 groups representing the various combinations of components. The six most dominant groupings are highlighted in the figure and are broken out in Table 23.

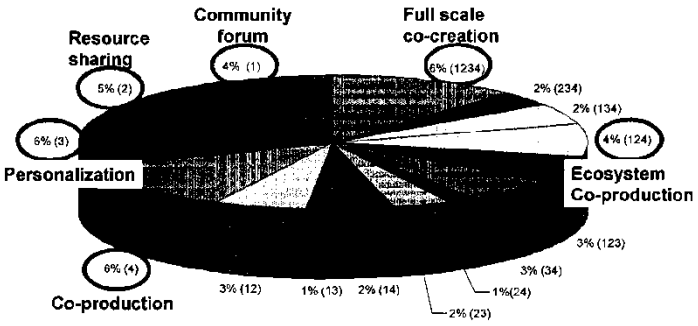

Figure 8: Strategies of organizations active in value co-creation (% is in relation to the total sample of firms)

Table 23: Dominant Component Combinations

Co-creation strategy	% of active companies	% of total sample	Group
Full scale co-creation	12.1%	5.9%	1234
Personalization	12.8%	6.3%	3
Co-production	11.3%	5.6%	4
Resource sharing	9.9%	4.9%	2
Community Forum	8.5%	4.2%	1
Ecosystem driven co-production	7.8%	3.8%	124

The high proportion of companies in the 1-2-3-4 (Full scale co-creation) grouping indicates that many of the most active firms use all four components in building their business strategies. This finding is not surprising given that many of the sampled firms were selected based on being exemplary cases of value co-creation.

The 1-2-4 grouping (Ecosystem based co-production) is indicative of organizations reliant on business eco-systems to design, manufacture and distribute whole product offerings and to a degree may be representative of business-to-business transactions. The fact that a high proportion of the sampled organizations (49%) are members of the Eclipse ecosystem may account for the presence of this grouping in the set of dominant component combinations. From the list of firms in Appendix C we see that 8 out of the 11 group 1-2-4 firms are Eclipse members (73%).

The relative dominance of firms using only single value co-creation components is indicative of firms that have adopted particular co-creation activities

without fully formulating or articulating a value cocreation business approach. This is not surprising since the different value co-creation activities may be part of the operation of many firms that have nothing to do with an intentionally developed co-creation strategy. For example, many firms may have a forum to support their businesses. Component two alone (Resource Sharing) may be indicative of firms active in a traditional type of value network relationship without using a community forum to build dialogue with end users. Firms active in component three (Personalization through Modularity) alone may be typical of the firms like Dell that offer the ability for customers to make simple selections from menus of items but do not engage in more advanced methods of collaboration with customers. Activities in component four alone may be indicative of a traditional business to business relationship where two firms each perform independent tasks in offering a whole product but collaboration and interchange are kept to a minimum and tightly controlled with the rules of engagement as laid down in contractual agreements.

Like the averaged website scoring analysis in section 5.2 Comparison of website score versus value co-creation component and company typeabove, these results could potentially be interpreted as reinforcing the view of the value co-creation components as part of a maturity model where components one and two are prerequisite to component four or components three and four. This interpretation, however, needs to be studied further.

CHAPTER VI

6 Conclusions, limitations and suggestions for future research

This chapter is organized into three sections. Section 6.1 presents the conclusions of the research. Section 6.2 identifies limitations of the research. Section 6.3 provides suggested opportunities for future research.

6.1 Conclusions

Previous research into value co-creation has relied on qualitative studies into a handful of firms well known for engaging customers in the process of value co-creation. As described in the literature review, these early studies present a number of different models describing the key components of value co-creation approaches and offerings. This research offers an empirically derived description of the components of value co-creation extracted from data gathered from a sample 287 organizations chosen from a diverse range of industries and markets.

• The analysis of the data suggests that there are four distinct types of value co-creation components:
(1): community driven open dialog
(2): partnerships for resource sharing
(3): personalization through options and modularity
(4): co-production
• There are two emerging approaches used by firms to engage customers and partners in value co-creation:
• full scale co-creation involving all four value co-creation components - this approach may be indicative of a combination of company-centric and customer-centric perspectives of the emerging value co-creation business paradigm
• ecosystem-driven co-production involving components one, two and four- this approach may be indicative of a company-centric perspective of value co-creation.
• Interestingly, all four value co-creation components occur on an individual basis. We would not necessarily interpret the use of a given value co-creation component as a single component cocreation approach but suggest instead that it is indicative of

latent value co-creation capability. It is expected that firms that are intentionally engaging in value co-creation would use a combination of components.

I suggest that the four value co-creation components may be considered in two ways:

• as components of two distinct value co-creation business approaches:

i) full scale value co-creation; and

ii) ecosystem driven co-production

• as stages of a value co-creation maturity model based on the gradual development of the resources and capabilities that enables firms to sequentially engage in the value cocreation activities described in components one, two, three and four (the maturity model view is only indirectly supported by the results and needs to be studied further).

• Considering the four types as components of different co-creation approaches indicates that:

• a high proportion (~12%) of our active firm sub-sample employ all four of the components of value co-creation

• companies employing the ecosystem-driven co-production strategy could enhance their co-creation activities by developing mechanisms for the personalization and customization of offers through options enabled by product or process modularity and integrated on-line services

• Each of the four value co-creation components could be implemented independently of the others but not necessarily within the context of a value co-creation strategy. For example, component three (personalization) was found to be the most common component with ~13% of the active firm sub-sample. Companies employing single components may strongly enhance their value co-creation capability by developing some of the tools and mechanisms of the other components.

• If the four components are interpreted as stages of a maturity model:

• the averaged component scores in the overall sample as well as the Eclipse and OSS sub-samples implies a progression in the level of implementation difficulty of components one through four

• the presence of only combinations 1-2-3-4 and 1-2-4 in the "active firm" sub-sample implies that components 1-2 may be prerequisite to both combinations - 1-2-3-4 and 1-2-4

• trust, honesty, integrity and risk management across the community appear to be critical aspects of the second maturity level, i.e. companies must develop the proper enabling mechanisms at the Community Driven Open Dialog stage before the sharing of resources will take place at more advanced stages
• customization and personalization of offers becomes possible at the third maturity stage when a value co-creation ecosystem has already emerged around a modular product/service architecture and a value network that enables contributions from external sources and contributors
• co-production could be the most difficult to implement stage of value co-creation and is reliant on the preliminary development of: i) participatory platforms enabling collaboration and resource sharing; ii) a modular value chain and product/service development structure; and iii) integrated online services for coordinating cooperative activities
• management of IP rights becomes critical at the last (Co-production) stage, i.e. companies must develop the proper IP rights management mechanisms at the three lower stages.

While it may be an intuitively compelling proposition, the entirety of the research results does not directly support the existence of the value co-creation maturity model. To support the hypothesis that the components represent a progression in level of difficulty would require a series of ethnographic case studies to gather the evolutionary logic and the level of difficulty metrics. It could be that many businesses employ only component one because it presents a higher return on investment. The available data are also unable to confirm the hypothesis that some components are prerequisites of others to emerge. A longitudinal study of firms active in the "full-scale" value co-creation approach could be helpful in examining how value co-creation capabilities evolve over time.

• Companies that rely on Open Source Software overwhelmingly focus on type one (Community Forum) co-creation. This could be explained by the critical importance OSS firms place on governing and sustaining a community of independent contributors.
• Members of the Eclipse Foundation focus primarily on type 2 activities as resource sharing is one of the primary motivations for firms to enter into a set of business ecosystem relationships.

6.2 Limitations

This research has a number of limitations: First, the web content mining approach is dependent on the assumption that the way companies use the keywords on their websites is analogous to how they conduct their business. While this approach quickly produces a large amount of data, it is done without detailed analysis of the context in which the keywords are actually used - such an analysis of context of the millions of web pages involved would simply not be feasible within the scope of a master's thesis. However, future research could analyze the smaller groups of firms engaged in a specific value co-creation strategy.

Second, as discussed by authors of most statistics texts covering common factor analysis, interpretation of the variables to develop definitions of the factors can be subjective. As such it can be influenced by the theoretical bias of the researchers. (Reinard, 2006; Field, 2005; Darlington, 2008).

Third, as discussed in the research method and results sections, the results show some degree of sensitivity to the set of keywords used and websites sampled; different inputs may cause the data to become less correlated, influence the validity tests or cause variation in the extracted factor loadings.

Fourth, as a snap-shot in time, the data are inadequate for the derivation of a value co-creation maturity model. Maturity models require a longitudinal study that observes the emergence of the various capabilities over time to validate whether certain capabilities are prerequisite to the development of other higher level capabilities.

Fifth, the initial set of keywords seem to be product development oriented and do not take into account value co-creation associated with the development of new distributions channels and new niche creation (Bryce & Dyer, 2007).

6.3 Future Research Opportunities

Opportunities for future research include:

• Enrich and refine keywords to take into account other aspects of co-creation such as new distribution channel development and niche creation.

• Develop case studies of the emerging groups of firms (most active in co-creation) to verify that the companies' business strategies are accurately represented by the

proposed group description, validate the interpretations of the components and examine the ICT infrastructures that enable particular value co-creation components.

• Develop a research methodology based on a longitudinal study of a large sample of companies by periodically replicating the methodology used here to examine the temporal evolution of corporate co-creation strategies. Such a study could be complemented by parallel studies using new and refined sets of keywords to test the emergence of new industry trends and business models. This approach could be used to validate whether the components of value co-creation can be used to construct a maturity model for how best to introduce the capabilities of value cocreation over time.

• Develop a similar research methodology to examine the relationship between the degrees of value co-creation and innovation. Such methodology would require the development of a second set of keywords focusing on innovation measures and on using regression analysis to examine the relationship between value co-creation and innovation components in the way they emerge from the factor analysis.

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Appendix A: Research Sample

Organization URL	Organization Type (OSS, Eclipse or other)	
http://2bits.com	OSS	
http://apatar.com	OSS	
http://aws.amazon.com/		
http://aws.typepad.com/		
http://bpocanada.com	OSS	
http://code.google.com/android/	OSS	
http://craigslistfoundation.org/		
http://developer.amd.com/		Eclipse
http://developer.apple.com/		
http://eracks.com	OSS	
http://extjs.com	OSS	
http://ez.no	OSS	
http://factory.lego.com/		
http://fedoraproject.org/	OSS	
http://forum.developers.facebook.com/	OSS	
http://groups.google.com/group/android-developers?pli=1	OSS	
http://ifs.hsr.ch/		Eclipse
http://kiva.org/		
http://liblime.com	OSS	
http://namethis.com/		
http://nikeplus.nike.com/nikeplus/?locale=en_us		
http://openmethods.com/	OSS	Eclipse
http://osuosl.org/	OSS	Eclipse
http://queue.acm.org/		Eclipse
http://rcp-company.com/	OSS	Eclipse
http://redmondmediagroup.com/		Eclipse
http://secondlife.com/		
http://secondlifegrid.net/	OSS	
http://software-support.biz/		Eclipse
http://trolltech.com	OSS	
http://us.etrade.com/		
http://wso2.com	OSS	
http://www.access-company.com/	OSS	Eclipse
http://www.accurev.com/		Eclipse
http://www.adacore.com/		Eclipse
http://www.adidas.com/		
http://www.adobe.com/		Eclipse
http://www.akazaresearch.com	OSS	
http://www.aldon.com/		Eclipse
http://www.alfresco.com	OSS	
http://www.alkacon.com	OSS	

Organization URL	Organization Type (OSS, Eclipse or other)	
http://www.altera.com/		
http://www.ancitconsulting.com/		Eclipse
http://www.anddev.org/	OSS	
http://www.andrena.de/	OSS	Eclipse
http://www.android.com/	OSS	
http://www.anyware-tech.com/	OSS	Eclipse
http://www.apache.org/	OSS	
http://www.aptana.com/		Eclipse
http://www.aras.com	OSS	
http://www.archipelago.com/		
http://www.arm.com/		Eclipse
http://www.astaro.com	OSS	
http://www.atmel.com/		
http://www.avantsoft.com/		Eclipse
http://www.bandxi.com/	OSS	Eclipse
http://www.basecamphq.com/		
http://www.birt-exchange.com/		Eclipse
http://www.blackducksoftware.com/		Eclipse
http://www.biuage.com/		Eclipse
http://www.biuenog.com/		Eclipse
http://www.borland.com/		Eclipse
http://www.bredex.de/en/		Eclipse
http://www.brocade.com/	OSS	Eclipse
http://www.buildabear.com/		
http://www.bzmedia.com/		Eclipse
http://www.ca.com/		Eclipse
http://www.cardinal.com/		
http://www.cemexusa.com/		
http://www.cenit.de/		Eclipse
http://www.cignex.com	OSS	
http://www.cisco.com/		
http://www.cieversafe.com	OSS	
http://www.cloudsmith.com/		Eclipse
http://www.coach.com/		
http://www.coliab.net/		Eclipse
http://www.compeople.de/		Eclipse
http://www.compiere.com	OSS	
http://www.compuware.com/		Eclipse
http://www.convergys.com/		
http://www.crowdspring.com/		
http://www.curi.com/		Eclipse
http://www.cypress.com/		
http://www.db4o.com	OSS	
http://www.ddci.com/		Eclipse
http://www.deere.com/		
http://www.deli.com/		
http://www.dfki.de/web/		Eclipse

Organization URL	Organization Type (OSS, Eclipse or other)	
http://www.digium.com	OSS	
http://www.diyhappy.com/		
http://www.doityourself.com/did-it-myself		
http://www.dsdm.org/		Eclipse
http://www.eads.com/		Eclipse
http://www.earthweb.com/		
http://www.eclipse.org/		Eclipse
http://www.embarcadero.com/		Eclipse
http://www.empolis.com/		Eclipse
http://www.emusoftware.com	OSS	
http://www.enea.com/		Eclipse
http://www.enfoldsystems.com	OSS	
http://www.enterprisedb.com	OSS	
http://www.ericsson.com/		Eclipse
http://www.eteration.com/		Eclipse
http://www.etsy.com/storque/	OSS	
http://www.excelsior-usa.com/		Eclipse
http://www.exist.com/	OSS	Eclipse
http://www.fokus.fraunhofer.de/		Eclipse
http://www.freescale.com/		Eclipse
http://www.froglogic.com/		Eclipse
http://www.fujitsu.com/		Eclipse
http://www.funambol.com	OSS	
http://www.gehealthcare.com/usen/		
http://www.gepower.com/		
http://www.gigaspaces.com	OSS	
http://www.greenplum.com	OSS	
http://www.groundworkopensource.com	OSS	
http://www.guardiandigital.com	OSS	
http://www.harley-davidson.com/		
http://www.healthnet.com/		
http://www.hitachi.com/		Eclipse
http://www.hp.com/		Eclipse
http://www.ibm.com/		Eclipse
http://www.ibs.net/		Eclipse
http://www.icesoft.com	OSS	
http://www.ideo.com/		
http://www.ikea.com/		
http://www.ikea.com/ms/en_US/		
http://www.ilog.com/		Eclipse
http://www.ingres.com/	OSS	Eclipse
http://www.innocentive.com/		
http://www.innoopract.com/		Eclipse
http://www.innovations-software.com/		Eclipse
http://www.instantiations.com/		Eclipse
http://www.instinctools.com/		Eclipse
http://www.instructables.com/		

Organization URL	Organization Type (OSS, Eclipse or other)	
http://www.intalio.com/		Eclipse
http://www.intel.com/		Eclipse
http://www.intervoice.com/	OSS	Eclipse
http://www.iona.com/		Eclipse
http://www.itemis.com/		Eclipse
http://www.iwaysoftware.com/		Eclipse
http://www.jitterbit.com	OSS	
http://www.jumpbox.com	OSS	
http://www.kestral.com.au/		Eclipse
http://www.klocwork.com/		Eclipse
http://www.knithappens.com/		
http://www.knowledgetree.com	OSS	
http://www.kpitcummins.com/		Eclipse
http://www.krugle.com/		Eclipse
http://www.landsend.com/		
http://www.laszlosystems.com/	OSS	Eclipse
http://www.latticesemi.com/		
http://www.leapfrog.com/		
http://www.lego.com/		
http://www.lifung.com/		
http://www.linux.org/	OSS	
http://www.linux.org/groups/usa/	OSS	
http://www.linuxit.com	OSS	
http://www.lombardisoftware.com/		Eclipse
http://www.lsi.com/		Eclipse
http://www.lulu.com/		
http://www.lynuxworks.com/		Eclipse
http://www.macraigor.com/		Eclipse
http://www.makezine.com/		
http://www.making-greeting-cards.com/		
http://www.mbproject.org/		Eclipse
http://www.mdstec.com/		Eclipse
http://www.medsphere.com	OSS	
http://www.medtronic.com/		
http://www.mentor.com/		Eclipse
http://www.microdoc.com/		Eclipse
http://www.microfocus.com/		Eclipse
http://www.mirant.com/		
http://www.misysbanking.com/	OSS	Eclipse
http://www.mks.com/		Eclipse
http://www.motorola.com/		Eclipse
http://www.mozilla.com/en-US/	OSS	
http://www.mulesource.com	OSS	
http://www.mvista.com/	OSS	Eclipse
http://www.mysql.com/	OSS	Eclipse
http://www.nec.com/		Eclipse
http://www.netapp.com/		Eclipse

Organization URL	Organization Type (OSS, Eclipse or other)	
http://www.netapp.com/us/		
http://www.netfiix.com/		
http://www.nexaweb.com/	OSS	Eclipse
http://www.ninesigma.com/		
http://www.nokiausa.com/		
http://www.noveli.com/		Eclipse
http://www.nuxeo.com	OSS	
http://www.obeo.fr/		Eclipse
http://www.objectweb.org/	OSS	Eclipse
http://www.ocsystems.com/		Eclipse
http://www.ocwconsortium.org/		
http://www.omg.org/		Eclipse
http://www.onstar.com/		
http://www.openbravo.com	OSS	
http://www.openhandsetalliance.com/	OSS	
http://www.openlogic.com	OSS	
http://www.openmakesoftware.com/	OSS	Eclipse
http://www.opensociai.org/	OSS	
http://www.opensystems-pubiishing.com/		Eclipse
http://www.open-xchange.com	OSS	
http://www.oracle.com/		Eclipse
http://www.orangehrm.com	OSS	
http://www.osgi.org/		Eclipse
http://www.palamida.com/	OSS	Eclipse
http://www.paragent.com	OSS	
http://www.parasoft.com/		Eclipse
http://www.pentaho.com	OSS	
http://www.perforce.com/		Eclipse
http://www.poiarion.com/		Eclipse
http://www.ponoko.com/		
http://www.progress.com/	OSS	Eclipse
http://www.project-open.com	OSS	
http://www.prosyst.com/	OSS	Eclipse
http://www.protecode.com/		Eclipse
http://www.qnx.com/	OSS	Eclipse
http://www.quest.com/		Eclipse
http://www.radview.com	OSS	
http://www.reardencommerce.com/		
http://www.redhat.com/	OSS	
http://www.rei.com/		
http://www.remain.nl/		Eclipse
http://www.replaysolutions.com/		Eclipse
http://www.rim.com/		Eclipse
http://www.rpath.com	OSS	
http://www.rsmart.com	OSS	
http://www.rtcgroup.com/		Eclipse
http://www.safe.com	OSS	

Organization URL	Organization Type (OSS, Eclipse or other)	
http://www.salesforce.com/		Eclipse
http://www.sap.com/		Eclipse
http://www.sas.com/		Eclipse
http://www.scalix.com	OSS	
http://www.serena.com/		Eclipse
http://www.sigs-datacom.de/		Eclipse
http://www.sixapart.com	OSS	
http://www.skywaysoftware.com/	OSS	Eclipse
http://www.slickedit.com/		Eclipse
http://www.snaplogic.com	OSS	
http://www.softwareag.com/		Eclipse
http://www.sonyericsson.com/		Eclipse
http://www.soyatec.com/	OSS	Eclipse
http://www.spikesource.com/	OSS	Eclipse
http://www.spotrunner.com/		
http://www.springsource.com/	OSS	Eclipse
http://www.st.com/		Eclipse
http://www.starstandard.org/		Eclipse
http://www.sugarcrm.com	OSS	
http://www.sumerset.com/		
http://www.sybase.com/		Eclipse
http://www.symbian.com/	OSS	
http://www.talend.com	OSS	
http://www.teamprise.com/		Eclipse
http://www.tensilica.com/		Eclipse
http://www.tesco.com/		
http://www.thalesgroup.com/		Eclipse
http://www.thinkquest.org/library/		
http://www.threadless.com/		
http://www.threadless.com/news		
http://www.ti.com/		Eclipse
http://www.tibco.com/		Eclipse
http://www.tietoenator.com/		Eclipse
http://www.timesys.com/	OSS	Eclipse
http://www.toshiba.com/		Eclipse
http://www.travelocity.com/		
http://www.trixbox.com	OSS	
http://www.tsmc.com		
http://www.tutorvista.com/		
http://www.ubuntu.com/	OSS	
http://www.umc.com/		
http://www.varien.com	OSS	
http://www.virtualiron.com	OSS	
http://www.virtuallogix.com/		Eclipse
http://www.virtutech.com/		Eclipse
http://www.vmware.com/		
http://www.vyatta.com	OSS	

Organization URL	Organization Type (OSS, Eclipse or other)	
http://www.wavemaker.com	OSS	
http://www.weiglewilczek.com/		Eclipse
http://www.windriver.com/		Eclipse
http://www.xilinx.com/		
http://www.xwiki.com	OSS	
http://www.zend.com/en/	OSS	Eclipse
http://www.zenoss.com	OSS	
http://www.zensar.com/		Eclipse
http://www.zeroc.com	OSS	
http://www.zimbra.com	OSS	
http://www.zmanda.com	OSS	

Appendix B: Search Keywords

Keywords
lease OR rent OR license OR "self serve" OR "self service"
(customer OR user) AND experience
simulation OR simulate OR model OR modeling OR "virtual world" OR "reference design "OR "reference flow" OR "demo application "OR toolkit OR tutorial OR SDK OR "software development kit"
(product OR process OR service) AND (evolution OR evolve)
(customer OR user) AND (negotiate OR negotiation)
(customer OR user) AND language AND translation
(customer OR user) AND address AND concern
(customer OR user) AND (dashboard OR statistics)
(customer OR user) AND (IP OR "intellectual property")
(customer OR user) AND (test OR trial OR beta)
ecosystem OR "value network" OR "value constellation" OR "multiple partners" OR "external contributor" OR "external source"
trust OR honesty OR integrity
(customer OR user) AND risk AND (manage OR management OR control OR assess OR reduce OR reduction OR potential OR exposure)
customization OR customize OR customized OR personalize OR individualize OR "add feature" OR "added feature "
(customer OR user) AND (disclose OR inform OR disseminate OR reveal)
(customer OR user) AND (cooperate OR cooperation OR collaboration OR partnership)
(customer OR user) AND (produce OR assemble OR manufacture)
(product OR process) AND (modularity OR modular OR module)
(customer OR user) AND (dialog OR dialogue OR communicate OR communication OR conversation OR contact OR feedback OR call OR interact OR "information exchange" OR "information sharing" OR connect OR access OR engage)
(customer OR user) AND (suggest OR suggestion OR input OR request OR demand)
(customer OR user) AND (survey OR review OR voting OR vote OR rate OR rating)
integrated AND online AND services
customer AND (partnerships OR interaction OR relationship OR participate OR participation OR activity OR action)
design OR process AND (flexibility OR flexible OR adaptable)
(customer OR user) AND (options OR choice OR choose)
internal AND (expertise OR resource)
(customer OR user) AND (learn OR learning)
cost AND (reduce OR reduction OR saving)
(customer OR user) AND (communities OR community OR network OR networking OR forum)

Appendix C: Active Organizations Listed by Component Group Code

Group Code	Organization	Organization Type	
1	http://www.makezine.com/		
1	http://www.symbian.com/	OSS	
1	http://www.ubuntu.com/	OSS	
1	http://www.anddev.org/	OSS	
1	http://www.nokiausa.com/		
1	http://www.rei.com/		
1	http://www.leapfrog.com/		
1	http://www.motorola.com/		Eclipse
1	http://www.qnx.com/	OSS	Eclipse
1	http://www.sybase.com/		Eclipse
1	http://www.ca.com/		Eclipse
1	http://www.greenplum.com	OSS	
2	http://www.tsmc.com		
2	http://www.mirant.com/		
2	http://www.mbproject.org/		Eclipse
2	http://www.fujitsu.com/		Eclipse
2	http://www.thalesgroup.com/		Eclipse
2	http://www.palamida.com/	OSS	Eclipse
2	http://www.misysbanking.com/	OSS	Eclipse
2	http://www.mdstec.com/		Eclipse
2	http://www.cenit.de/		Eclipse
2	http://www.bluenog.com/		Eclipse
2	http://www.compuware.com/		Eclipse
2	http://www.zensar.com/		Eclipse
2	http://www.softwareag.com/		Eclipse
2	http://www.kpitcummins.com/		Eclipse
3	http://www.tesco.com/		
3	http://factory.lego.com/		
3	http://www.ikea.com/		
3	http://www.dell.com/		
3	http://www.spotrunner.com/		
3	http://www.rtcgroup.com/		Eclipse
3	http://software-support.biz/		Eclipse
3	http://www.mvista.com/	OSS	Eclipse
3	http://www.prosyst.com/	OSS	Eclipse
3	http://www.bluage.com/		Eclipse
3	http://www.instinctools.com/		Eclipse
3	http://www.innoopract.com/		Eclipse
3	http://www.avantsoft.com/		Eclipse
3	http://www.mulesource.com	OSS	
3	http://www.emusoftware.com	OSS	
3	http://www.compiere.com	OSS	
3	http://www.openbravo.com	OSS	

3	http://ez.no	OSS	
4	http://aws.typepad.com/		
4	http://www.atmel.com/		
4	http://www.ocwconsortium.org/		
4	http://www.bredex.de/en/		Eclipse
4	http://queue.acm.org/		Eclipse
4	http://www.st.com/		Eclipse
4	http://www.soyatec.com/	OSS	Eclipse
4	http://www.fokus.fraunhofer.de/		Eclipse
4	http://www.birt-exchange.com/		Eclipse
4	http://www.protecode.com/		Eclipse
4	http://www.slickedit.com/		Eclipse
4	http://www.macraigor.com/		Eclipse
4	http://www.iona.com/		Eclipse
4	http://www.froglogic.com/		Eclipse
4	http://www.paragent.com	OSS	
4	http://www.scalix.com	OSS	
12	http://www.convergys.com/		
12	http://www.itemis.com/		Eclipse
12	http://www.ingres.com/	OSS	Eclipse
12	http://www.sas.com/		Eclipse
12	http://www.lombardisoftware.com/		Eclipse
12	http://www.aldon.com/		Eclipse
12	http://www.iwaysoftware.com/		Eclipse
12	http://www.cignex.com	OSS	
13	http://redmondmediagroup.com/		Eclipse
13	http://www.mysql.com/	OSS	Eclipse
13	http://apatar.com	OSS	
14	http://www.etsy.com/storque/	OSS	
14	http://www.adobe.com/		Eclipse
14	http://www.replaysolutions.com/		Eclipse
14	http://eracks.com	OSS	
14	http://www.cleversafe.com	OSS	
23	http://www.archipelago.com/		
23	http://www.sap.com/		Eclipse
23	http://www.oracle.com/		Eclipse
23	http://www.tensilica.com/		Eclipse
23	http://www.rim.com/		Eclipse
24	http://www.umc.com/		
24	http://www.toshiba.com/		Eclipse
24	http://www.accurev.com/		Eclipse

34	http://www.xilinx.com/		
34	http://www.cisco.com/		
34	http://www.opensystems-publishing.com/		Eclipse
34	http://www.access-company.com/	OSS	Eclipse
34	http://www.perforce.com/		Eclipse
34	http://www.embarcadero.com/		Eclipse
34	http://www.virtuallogix.com/		Eclipse
34	http://www.alkacon.com	OSS	
123	http://www.reardencommerce.com/		
123	http://www.nexaweb.com/	OSS	Eclipse
123	http://www.rsmart.com	OSS	
123	http://www.wavemaker.com	OSS	
123	http://www.project-open.com	OSS	
123	http://www.nuxeo.com	OSS	
123	http://www.medsphere.com	OSS	
123	http://www.varien.com	OSS	
123	http://www.guardiandigital.com	OSS	
124	http://www.vmware.com/		
124	http://www.innovations-software.com/		Eclipse
124	http://www.ericsson.com/		Eclipse
124	http://www.spikesource.com/	OSS	Eclipse
124	http://www.microfocus.com/		Eclipse
124	http://www.mks.com/		Eclipse
124	http://www.klocwork.com/		Eclipse
124	http://www.blackducksoftware.com/		Eclipse
124	http://www.intalio.com/		Eclipse
124	http://www.zimbra.com	OSS	
124	http://www.virtualiron.com	OSS	
134	http://www.mozilla.com/en-US/	OSS	
134	http://www.kestral.com.au/		Eclipse
134	http://www.enfoldsystems.com	OSS	
134	http://www.knowledgetree.com	OSS	
134	http://www.trixbox.com	OSS	
134	http://www.jumpbox.com	OSS	
134	http://www.safe.com	OSS	
234	http://www.gepower.com/		
234	http://www.windriver.com/		Eclipse
234	http://www.lsi.com/		Eclipse
234	http://www.anyware-tech.com/	OSS	Eclipse
234	http://www.andrena.de/	OSS	Eclipse
1234	http://www.latticesemi.com/		
1234	http://www.altera.com/		
1234	http://aws.amazon.com/		

1234	http://www.ddci.com/		Eclipse
1234	http://www.salesforce.com/		Eclipse
1234	http://www.curl.com/		Eclipse
1234	http://www.lynuxworks.com/		Eclipse
1234	http://www.brocade.com/	OSS	Eclipse
1234	http://www.intervoice.com/	OSS	Eclipse
1234	http://www.progress.com/	OSS	Eclipse
1234	http://www.tibco.com/		Eclipse
1234	http://www.parasoft.com/		Eclipse
1234	http://www.polarion.com/		Eclipse
1234	http://www.digium.com	OSS	
1234	http://www.db4o.com	OSS	
1234	http://www.radview.com	OSS	
1234	http://www.pentaho.com	OSS	

Appendix D: 2007 Fortune 1000 Firms

Organization URL	Organization URL	Organization URL
www.3m.com	www.alcatel-lucent.com	www.anheuser-busch.com
www.53.com	www.alcoa.com	www.anico.com
www.aam.com	www.alexanderbaldwin.com	www.anixter.com
www.abbott.com	www.alleghenyenergy.com	www.anntaylor.com
www.abercrombie.com	www.alleghenytechnologies.com	www.aon.com
www.abm.com	www.allergan.com	www.aosmith.com
www.aboutschwab.com	www.alliancedata.com	www.apachecorp.com
www.acs-inc.com	www.alliantenergy.com	www.apple.com
www.acuitybrands.com	www.allstate.com	www.applera.com
www.adamsresources.com	www.alltel.com	www.applied.com
www.admworld.com	www.alphanr.com	www.appliedmaterials.com
www.adobe.com	www.altria.com	www.aquila.com
www.adp.com	www.ambac.com	www.aramark.com
www.advanceautoparts.com	www.amctheatres.com	www.archcoal.com
www.ae.com	www.amd.com	www.arkbest.com
www.aep.com	www.amerco.com	www.armorholdings.com
www.aetna.com	www.ameren.com	www.armstrong.com
www.affiniagroup.com	www.americanexpress.com	www.arrow.com
www.afginc.com	www.americangreetings.com	www.arvinmeritor.com
www.aflac.com	www.americredit.com	www.asburyauto.com
www.agcocorp.com	www.amerigroupcorp.com	www.aschulman.com
www.agedwards.com	www.ameriprise.com	www.ashland.com
www.agilent.com	www.amerisourcebergen.com	www.associatedbank.com
www.agilysys.com	www.ametek.com	www.assurant.com
www.aglresources.com	www.amfam.com	www.atk.com
www.aimco.com	www.amgen.com	www.atmosenergy.com
www.airgas.com	www.amica.com	www.att.com
www.airproducts.com	www.amkor.com	www.autoliv.com
www.airtran.com	www.amphenol.com	www.autonation.com
www.aksteel.com	www.amrcorp.com	www.auto-owners.com
www.alaskaair.com	www.amtd.com	www.autozone.com
www.albemarle.com	www.anadarko.com	www.avaya.com

Organization URL	Organization URL	Organization URL
www.alberto.com	www.analog.com	www.aventinerei.com
www.averydennison.com	www.bobevans.com	www.cbre.com
www.avisbudgetgroup.com	www.boeing.com	www.cbrlgroup.com
www.avoncompany.com	www.bonton.com	www.cbscorporation.com
www.bakerhughes.com	www.bordersgroupinc.com	www.cdw.com
www.ball.com	www.borgwarner.com	www.celanese.com
www.bankofamerica.com	www.bostonscientific.com	www.centene.com
www.bankofny.com	www.bowater.com	www.centerpointenergy.com
www.barnesandnobleinc.com	www.boydgaming.com	www.centex.com
www.baxter.com	www.briggsandstratton.com	www.centurytel.com
www.bbt.com	www.brightpoint.com	www.cephalon.com
www.bc.com	www.brinker.com	www.cfindustries.com
www.bd.com	www.brinkscompany.com	www.ch2m.com
www.bdk.com	www.broadcom.com	www.charmingshoppes.com
www.bearstearns.com	www.brown-forman.com	www.charter.com
www.beazer.com	www.brownshoe.com	www.chemtura.com
www.beckmancoulter.com	www.brunswick.com	www.chevron.com
www.bedbathandbeyond.com	www.burlingtoncoatfactory.com	www.chicos.com
www.belk.com	www.ca.com	www.childrensplace.com
www.belo.com	www.cabelas.com	www.chiquita.com
www.bemis.com	www.cablevision.com	www.chrobinson.com
www.bench.com	www.cabot-corp.com	www.chs.net
www.berkshirehathaway.com	www.caci.com	www.chsinc.com
www.biglots.com	www.calpine.com	www.chubb.com
www.biogenidec.com	www.calumetspecialty.com	www.cigna.com
www.biomet.com	www.c-a-m.com	www.cinfin.com
www.bjs.com	www.campbellsoupcompany.com	www.cintas.com
www.bjservices.com	www.capitalone.com	www.circuitcity.com
www.bk.com	www.cardinal.com	www.cisco.com
www.blackrock.com	www.careered.com	www.cit.com
www.bldr.com	www.carlisle.com	www.citigroup.com
www.blockbuster.com	www.carmax.com	www.ckr.com
www.bluelinxco.com	www.caseys.com	www.clearchannel.com
www.bms.com	www.cat.com	www.cmc.com

Organization URL	Organization URL	Organization URL
www.bnsf.com	www.cbrands.com	www.cmsenergy.com
www.coach.com	www.cunamutual.com	www.dteenergy.com
www.cokecce.com	www.cvscaremark.com	www.duanereade.com
www.colgate.com	www.cvty.com	www.duke-energy.com
www.colonialbank.com	www.cytec.com	www.dupont.com
www.comcast.com	www.czn.net	www.duraauto.com
www.comerica.com	www.dadebehring.com	www.dynegy.com
www.commerceinsurance.com	www.dana.com	www.dyn-intl.com
www.commerceonline.com	www.danaher.com	www.ea.com
www.commscope.com	www.darden.com	www.eastman.com
www.compassbank.com	www.davita.com	www.eaton.com
www.conagrafoods.com	www.deanfoods.com	www.ebay.com
www.conedison.com	www.deere.com	www.echostar.com
www.conocophillips.com	www.dell.com	www.ecolab.com
www.conseco.com	www.delmonte.com	www.edison.com
www.consolenergy.com	www.delta.com	www.eds.com
www.constellation.com	www.deluxe.com	www.elcompanies.com
www.continental.com	www.dentsply.com	www.elpaso.com
www.convergys.com	www.devonenergy.com	www.emc.com
www.con-way.com	www.dickssportinggoods.com	www.emcorgroup.com
www.cooperstandard.com	www.diebold.com	www.enbridgepartners.com
www.coopertire.com	www.dillards.com	www.energizer.com
www.coremark.com	www.directv.com	www.energytransfer.com
www.corning.com	www.dole.com	www.enscous.com
www.cornproducts.com	www.dollargeneral.com	www.entergy.com
www.costco.com	www.dollartree.com	www.eogresources.com
www.countryfinancial.com	www.dom.com	www.equityoffice.com
www.countrywide.com	www.donaldson.com	www.equityresidential.com
www.craneco.com	www.dovercorporation.com	www.erieinsurance.com
www.crbard.com	www.dow.com	www.exeloncorp.com
www.crosstexenergy.com	www.dowjones.com	www.exide.com
www.crowncork.com	www.drhorton.com	www.expeditors.com
www.csc.com	www.drs.com	www.express-scripts.com
www.csx.com	www.dstsystems.com	www.exxonmobil.com

Organization URL	Organization URL	Organization URL
www.cummins.com	www.dtag.com	www.fairchildsemi.com
www.familydollar.com	www.ge.com	www.harrahs.com
www.fastenal.com	www.generalcable.com	www.harris.com
www.fcx.com	www.generalmills.com	www.harsco.com
www.fds.com	www.genesishcc.com	www.hasbro.com
www.federal-mogul.com	www.genpt.com	www.hayes-lemmerz.com
www.fedex.com	www.genworth.com	www.hcahealthcare.com
www.ferrellgas.com	www.genzyme.com	www.hcc.com
www.ferro.com	www.ggc.com	www.hcr-manorcare.com
www.fhnc.com	www.ggp.com	www.hcsbonline.com
www.firstam.com	www.giant.com	www.healthnet.com
www.firstenergycorp.com	www.gilead.com	www.healthsouth.com
www.fiserv.com	www.globalp.com	www.heinz.com
www.flowersfoods.com	www.gm.com	www.henryschein.com
www.flowserve.com	www.goldkist.com	www.herc.com
www.fluor.com	www.goodmanmfg.com	www.hermanmiller.com
www.fmc.com	www.goodrich.com	www.hersheys.com
www.fmctechnologies.com	www.goodyear.com	www.hertz.com
www.fmglobal.com	www.grace.com	www.hess.com
www.footlocker-inc.com	www.grainger.com	www.hewitt.com
www.ford.com	www.graniteconstruction.com	www.hexion.com
www.fortunebrands.com	www.grantprideco.com	www.hillenbrand.com
www.fplgroup.com	www.graphicpkg.com	www.hiltonworldwide.com
www.franklintempleton.com	www.graybar.com	www.hnicorp.com
www.freddiemac.com	www.greatplainsenergy.com	www.hollycorp.com
www.fredsinc.com	www.greif.com	www.homedepot.com
www.frontieroil.com	www.griffoncorp.com	www.honeywell.com
www.frx.com	www.group1auto.com	www.hormel.com
www.furniturebrands.com	www.gs.com	www.hospira.com
www.gamestop.com	www.guardianlife.com	www.hosthotels.com
www.gannett.com	www.guitarcenter.com	www.hp.com
www.gapinc.com	www.halliburton.com	www.hrblock.com
www.gardnerdenver.com	www.hanover.com	www.hubbell.com
www.gateway.com	www.harley-davidson.com	www.hubgroup.com

Organization URL	Organization URL	Organization URL
www.huntington.com	www.harman.com	www.humana.com
www.huntsman.com	www.joyglobal.com	www.level3.com
www.iac.com	www.jpmorganchase.com	www.levistrauss.com
www.ibm.com	www.juniper.net	www.lexmark.com
www.idt.net	www.kbhome.com	www.lfg.com
www.iff.com	www.kcsouthern.com	www.lgi.com
www.igt.com	www.kelloggcompany.com	www.libertymedia.com
www.ikon.com	www.kellwood.com	www.libertymutual.com
www.imation.com	www.kellyservices.com	www.lifepointhospitals.com
www.imshealth.com	www.kennametal.com	www.lilly.com
www.indymacbank.com	www.key.com	www.limitedbrands.com
www.ingles-markets.com	www.khov.com	www.lincolnelectric.com
www.ingrammicro.com	www.kiewit.com	www.lithia.com
www.insight.com	www.kimberly-clark.com	www.livenation.com
www.integrysgroup.com	www.kindermorgan.com	www.lizclaiborne.com
www.intel.com	www.kindredhealthcare.com	www.lnt.com
www.internationalpaper.com	www.kingpharm.com	www.lockheedmartin.com
www.interpublic.com	www.kla-tencor.com	www.lpcorp.com
www.intuit.com	www.kodak.com	www.lsi.com
www.ironmountain.com	www.kofc.org	www.lubrizol.com
www.itt.com	www.kohls.com	www.lyondell.com
www.itw.com	www.kroger.com	www.magellanhealth.com
www.jackinthebox.com	www.l-3com.com	www.mandtbank.com
www.jacobs.com	www.labcorp.com	www.manitowoc.com
www.jarden.com	www.laidlaw.com	www.manpower.com
www.jbhunt.com	www.lamrc.com	www.marathon.com
www.jcpenney.net	www.landam.com	www.markelcorp.com
www.jefferies.com	www.landolakesinc.com	www.marriott.com
www.jetblue.com	www.landstar.com	www.marsh.net
www.jnj.com	www.la-z-boy.com	www.martinmarietta.com
www.jny.com	www.lear.com	www.masco.com
www.joann.com	www.leggett.com	www.masseyenergyco.com
www.johnsoncontrols.com	www.leggmason.com	www.massmutual.com
www.johnsondiversey.com	www.lennar.com	www.mastercard.com

Organization URL	Organization URL	Organization URL
www.joneslanglasalle.com	www.lennoxinternational.com	www.mattel.com
www.maxim-ic.com	www.mosaicco.com	www.nikebiz.com
www.mbia.com	www.motorola.com	www.nisource.com
www.mcclatchy.com	www.moviegallery.com	www.njresources.com
www.mccormick.com	www.mpsgroup.com	www.nobleenergyinc.com
www.mcdonalds.com	www.mt.com	www.nordstrom.com
www.mcgraw-hill.com	www.mtim.com	www.nortek-inc.com
www.mckesson.com	www.muellerindustries.com	www.northerntrust.com
www.mdu.com	www.murphyoilcorp.com	www.northropgrumman.com
www.meadwestvaco.com	www.mutualofamerica.com	www.nov.com
www.medco.com	www.mutualofomaha.com	www.novellus.com
www.medmutual.com	www.mytscstore.com	www.nrgenergy.com
www.medtronic.com	www.nacco.com	www.nscorp.com
www.mellon.com	www.nalco.com	www.nstaronline.com
www.merck.com	www.nasdaqtrader.com	www.nu.com
www.mercuryinsurance.com	www.nashfinch.com	www.nucor.com
www.meredith.com	www.natfuel.com	www.nvidia.com
www.meritagehomes.com	www.national.com	www.nvrinc.com
www.metalsusa.com	www.nationalcity.com	www.nwa.com
www.metlife.com	www.nationallife.com	www.nyse.com
www.mgmmirage.com	www.nationwide.com	www.nytco.com
www.michaels.com	www.nbty.com	www.officedepot.com
www.micorp.com	www.nctlp.com	www.officemax.com
www.micron.com	www.ncr.com	www.oge.com
www.mirant.com	www.neimanmarcus.com	www.o-i.com
www.ml.com	www.nelnet.net	www.oilstatesintl.com
www.mmc.com	www.netapp.com	www.omnicare.com
www.modine.com	www.newellrubbermaid.com	www.omnicomgroup.com
www.mohawkind.com	www.newfield.com	www.oneok.com
www.molex.com	www.newmont.com	www.oracle.com
www.molinahealthcare.com	www.newpagecorp.com	www.oreillyauto.com
www.molsoncoors.com	www.newscorp.com	www.osirestaurantpartners.com
www.monsanto.com	www.newyorklife.com	www.owenscorning.com
www.moodys.com	www.nicor.com	www.owens-minor.com

Organization URL	Organization URL	Organization URL
www.morganstanley.com	www.nii.com	www.oxy.com
www.paalp.com	www.pnmresources.com	www.regiscorp.com
www.paccar.com	www.polarisindustries.com	www.reliant.com
www.pacificlife.com	www.polyone.com	www.republicservices.com
www.packagingcorp.com	www.poolcorp.com	www.retailventuresinc.com
www.pactiv.com	www.popular.com	www.reynoldsamerican.com
www.pall.com	www.potlatchcorp.com	www.rhd.com
www.palm.com	www.pplweb.com	www.rhi.com
www.parker.com	www.praxair.com	www.richmondamerican.com
www.pathmark.com	www.precast.com	www.riteaid.com
www.pattersoncompanies.com	www.prideinternational.com	www.rjf.com
www.paychex.com	www.principal.com	www.rockwellautomation.com
www.payless.com	www.progress-energy.com	www.rockwellcollins.com
www.pb.com	www.progressive.com	www.rohmhaas.com
www.pbg.com	www.prologis.com	www.roperind.com
www.pcconnection.com	www.protective.com	www.rpminc.com
www.peabodyenergy.com	www.prudential.com	www.rrdonnelley.com
www.pentair.com	www.pseg.com	www.rsac.com
www.pepboys.com	www.publix.com	www.ruddickcorp.com
www.pepcoholdings.com	www.pugetenergy.com	www.ryder.com
www.pepsiamericas.com	www.pulte.com	www.ryerson.com
www.pepsico.com	www.pvh.com	www.ryland.com
www.perini.com	www.qualcomm.com	www.sabre-holdings.com
www.perotsystems.com	www.quanex.com	www.safeco.com
www.petrotruckstops.com	www.quantaservices.com	www.safeway.com
www.pfgc.com	www.questar.com	www.saic.com
www.pfizer.com	www.questdiagnostics.com	www.saksincorporated.com
www.pg.com	www.quiksilverinc.com	www.salliemae.com
www.pgecorp.com	www.qwest.com	www.sandisk.com
www.piedmontng.com	www.radioshackcorporation.com	www.sanmina-sci.com
www.pier1.com	www.raytheon.com	www.saralee.com
www.pilgrimspride.com	www.rd.com	www.sauer-danfoss.com
www.pinnaclewest.com	www.realogy.com	www.scana.com
www.plumcreek.com	www.regalbeloit.com	www.scansource.com

Organization URL	Organization URL	Organization URL
www.pngaming.com	www.regions.com	www.schering-plough.com
www.schnitzersteel.com	www.sovereignbank.com	www.techdata.com
www.scholastic.com	www.spansion.com	www.tecoenergy.com
www.sci-corp.com	www.spartanstores.com	www.tecumseh.com
www.scotts.com	www.spectrumbrands.com	www.teldta.com
www.scripps.com	www.spherion.com	www.tellabs.com
www.seaboardcorp.com	www.sprint.com	www.templeinland.com
www.sealedair.com	www.spx.com	www.tenethealth.com
www.sealy.com	www.standardpacifichomes.com	www.tenneco.com
www.searsholdings.com	www.stanleyworks.com	www.teppco.com
www.securian.com	www.staples.com	www.terex.com
www.selective.com	www.starbucks.com	www.terraindustries.com
www.selectmedicalcorp.com	www.starwoodhotels.com	www.textron.com
www.sempra.com	www.statefarm.com	www.thecloroxcompany.com
www.sentry.com	www.staterbros.com	www.thehartford.com
www.shawgrp.com	www.statestreet.com	www.thepantry.com
www.sherwin.com	www.steelcase.com	www.thermofisher.com
www.sigmaaldrich.com	www.steeldynamics.com	www.thetorocompany.com
www.simon.com	www.stewart.com	www.thorindustries.com
www.sirva.com	www.stryker.com	www.thornburgmortgage.com
www.sjm.com	www.suburbanpropane.com	www.thrivent.com
www.skywest.com	www.sun.com	www.ti.com
www.smith.com	www.sungard.com	www.tiaa-cref.org
www.smithfieldfoods.com	www.Sunocolnc.com	www.tiffany.com
www.smucker.com	www.suntrust.com	www.timewarner.com
www.smurfit-stone.com	www.superioressex.com	www.timken.com
www.snapon.com	www.supervalu.com	www.tjx.com
www.solectron.com	www.susser.com	www.tnb.com
www.solocup.com	www.swgas.com	www.tollbrothers.com
www.solutia.com	www.swifttrans.com	www.torchmarkcorp.com
www.sonicautomotive.com	www.symantec.com	www.towerautomotive.com
www.sonoco.com	www.synnex.com	www.travelers.com
www.sourceinterlink.com	www.synovus.com	www.tribune.com
www.southernco mpany.com	www.sysco.com	www.trin.net

Organization URL	Organization URL	Organization URL
www.southwest.com	www.systemax.com	www.troweprice.com
www.trwauto.com	www.viacom.com	www.williams-sonomainc.com
www.tsocorp.com	www.viewsonic.com	www.winn-dixie.com
www.tupperwarebrands.com	www.virginmedia.com	www.wisconsinenergy.com
www.txucorp.com	www.vishay.com	www.wm.com
www.uap.com	www.visteon.com	www.wmg.com
www.ufpi.com	www.vnc.com	www.wnr.com
www.uhsinc.com	www.volt.com	www.worthingtonindustries.com
www.unfi.com	www.vulcanmaterials.com	www.wpsc.com
www.unisys.com	www.wachovia.com	www.wrbc.com
www.united.com	www.walgreens.com	www.wrigley.com
www.unitedhealthgroup.com	www.walmart.com	www.wyeth.com
www.unitedrentals.com	www.walterind.com	www.wyndhamworldwide.com
www.unitedstationers.com	www.wamu.com	www.xcelenergy.com
www.unitrin.com	www.warnaco.com	www.xerox.com
www.universalcorp.com	www.washpostco.com	www.xilinx.com
www.univision.net	www.wcicommunities.com	www.xtoenergy.com
www.unum.com	www.weismarkets.com	www.yahoo.com
www.up.com	www.wellcare.com	www.yrcw.com
www.ups.com	www.wellsfargo.com	www.yum.com
www.usaa.com	www.werner.com	www.zalecorp.com
www.usairways.com	www.wesco.com	www.zimmer.com
www.usbank.com	www.west.com	www.zionsbancorporation.com
www.usec.com	www.westarenergy.com	www.vfc.com
www.usg.com	www.westerndigital.com	www.williams.com
www.usoncology.com	www.westernsouthern.com	
www.ussteel.com	www.westernunion.com	
www.ustinc.com	www.westlakechemical.com	
www.uwgrocers.com	www.weyerhaeuser.com	
www.valero.com	www.wfscorp.com	
www.valspar.com	www.wgint.com	
www.varian.com	www.wglholdings.com	
www.vectren.com	www.whirlpoolcorp.com	
www.verizon.com	www.wholefoodsmarket.com	