



Applying text-mining to personalization and customization research literature – Who, what and where?

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ARTICLE INFO

Keywords:

Personalization
Customization
Mass customization
Text-mining
Research profiling
Literature review

ABSTRACT

Personalization and customization have numerous definitions that are sometimes used interchangeably in the literature. This study combines a **text-mining approach for profiling personalization and customization research with a traditional literature review** in order to distinguish the main characteristics of these two research streams. Research profiling with search words personalization and customization is conducted using the Web of Science literature database. The elements typical to the personalization and customization research are identified. Personalization research has a strong focus on technology and the internet; in addition to which it emphasizes customers' needs and preferences as well as information collection for user modeling and recommender systems. Customization is an older research stream, and the main body of the research has focused on tangible products but has lately initiated research in service fields. Based on the insights gained from research profiling and literature review, this study suggests a new classification of concepts linked to personalization.

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1. Introduction

Personalization is a concept that is intuitively appealing. The roots of personalization are in the relationship marketing and management (Crosby, Evans, & Cowles, 1990; Dwyer, Schurr, & Oh, 1987). Just like a helpful sales clerk, the seller (or the electronic customer interface), greets the customer by name, remembers what s/he has purchased or browsed previously, and suggests products s/he might be interested in the future (Lin, Hong, Chen, & Dong, 2010). During the 21st century the wide-spread use of information and communication technologies has made personalization a more varied and affordable strategy for implementing interactive relationships with customers.

The benefits of personalization may be many for both marketers and customers. Individualized products, services, and communication may attract customer attention and foster customer loyalty and lock-in (Ansari & Mela, 2003), and serve as a protection against the commoditization of the offering (Wind & Rangaswamy, 2001). Personalization is one of the major changes that influence marketing (Goldsmith & Freiden, 2004; Kalaignanam, Kushwaha, & Varadarajan, 2008). Kalyanam and McIntyre (2002) include personalization as a significant element in the online marketing mix. Several researchers (e.g., Moon, Chadee, & Tikoo, 2008; Tam &

Ho, 2006) examine how personalization affects the attitudes and purchase intentions and behavior of consumers. Besides in marketing and in information systems, personalization has drawn increasing research attention also in various other academic fields, such as computer science, management and economics (Kwon, Cho, & Park, 2010).

Customization is another commonly used term. Furthermore, when a comparatively low price is emphasized (the same or almost the same as for a standardized product), the term mass customization is used. **Researchers have not achieved a consensus in conceptualizing personalization and customization** (Wind & Rangaswamy, 2001). According to some researchers, the concepts are different (Arora et al., 2008; Gilmore & Pine, 1997; Kumar, 2007; Montgomery & Smith, 2009), whereas other researchers use the terms interchangeably (Miceli, Ricotta, & Costabile, 2007; Peppers & Rogers, 1997). **The motivation for this paper arises from the desire to understand personalization and how it is defined and conceptualized in the literature.** This study examines personalization using two approaches: (1) traditional literature review, and (2) research profiling with text-mining tools (Porter, Kongthong, & Lu, 2002; see also Delen & Crossland, 2008).

This study presents definitions and frameworks of personalization retrieved predominantly from the marketing, information systems and computer science literature. The article continues with the description of the research profiling method, and the presentation of the results of the electronic database searches that were conducted using the Web of Science database of Thomson Reuters. The results reveal the main similarities and differences of the personalization and customization literature. The final

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section discusses the findings and concludes the paper with a framework of the contemporary usage of the concepts.

2. Definitions and frameworks of personalization

2.1. Definitions from the research literature

The idea of personalization – to offer the right products and services at the right time and in the right place to the right customers – goes by many names. Researchers use terms like individualization (Riemer & Totz, 2001), segmentation (Smith, 1956), targeting, profiling, and one-to-one marketing (Peppers & Rogers, 1997). Smith (1956) defines the original idea of tailoring the offering to better suit a certain customer group as segmentation: “Market segmentation involves viewing a heterogeneous market as a number of smaller homogeneous markets, in response to differing preferences, attributable to the desires of consumers for more precise satisfaction of their varying wants”. It is difficult to differentiate between market segmentation and a personalized offering, or individual marketing as Simonson (2005) calls it. According to him, many examples of one-to-one marketing could also be classified as usage-based segmentation. Furthermore, Kwon et al. (2010) argue that one-to-one personalization of content does not improve customer value more significantly than one-to-N personalization. According to them, market segmentation provides a good alternative if one-to-one personalization requires too much time, cost or effort.

Davis (1987) is the originator of the other concept of this study, mass customization. Pine (1993) provides the practical underpinnings to shape mass customization into a viable strategy (Kumar, 2007). Hart (1996) defines mass customization as “using flexible processes and organizational structures to produce varied and often individually customized products and services at the price of standardized mass-produced alternatives”. Gilmore and Pine (1997) use the term customization, and define four basic types of customization: adaptive, cosmetic, transparent, and collaborative customization. According to them, collaborative customizers conduct a dialog with customers to help them articulate their needs, to identify the precise offering that fulfills those needs, and to make customized products for them. Adaptive customizers offer one standard, but customizable, product that is designed so that users can alter it themselves. Cosmetic customizers present a standard product differently to diverse customers, and transparent customizers provide individual customers with unique goods or services without letting them know explicitly that those products and services have been customized for them. Wind and Rangaswamy (2001) coin the term customerization that combines mass customization with customized marketing, and aims at buyer-centric marketing. Customerization is under the control of customers and initiated by them, and it focuses on helping customers to better identify or define for themselves what they want (Wind & Rangaswamy, 2001). Table 1 presents a list of the definitions of personalization and includes also those of customization or mass customization, if presented in the same article.

As can be inferred from Table 1, the conceptualizations diverge in the research literature. The most recent conceptualizations make a distinction between personalization as a seller-initiated activity, and customization as a customer-initiated activity. Still, this is not generally agreed in the literature.

2.2. Personalization processes and frameworks

According to Peppers and Rogers (1997), one-to-one marketing is personalized marketing, where an enterprise knows its customers and treats them differently. The authors conceptualize

Table 1

Definitions of personalization and similar concepts (in chronological order).

Author (s)	Definition (s)
Peppers and Rogers (1997)	<i>Personalization</i> is customizing some feature of a product or service so that the customer enjoys more convenience, lower cost or some other benefit. Personalization can be initiated by the customer or by the firm
Riemer and Totz (2001)	<i>Personalization</i> (or individualization which are used synonymously) in general means matching one object's nature with one subject's needs (i.e. customize products, services, content, communications to the needs of single customers or customer groups). <i>Mass customization</i> is the individualization of products (and services) at the cost of one-size fits all
Blom and Monk (2003)	<i>Personalization</i> is a process that changes the functionality, interface, information content, or distinctiveness of a system to increase its personal relevance to the individual
Chellappa and Sin (2005)	<i>Personalization</i> refers to the tailoring of products and purchase experience to the tastes of individual consumers based upon their personal and preference information. Therefore, personalization is critically dependent on vendors' ability to acquire and process consumer information, and on consumers' willingness to share information and use personalization services
Ho (2006)	In <i>customization</i> , a web site provides an array of choices for the users to modify a web site's look and feel (i.e. is a user-driven process). Relevant content based on the preferences of groups of users is provided in <i>adaptation</i> (i.e. according to the country of web users). <i>Personalization</i> is a process of providing relevant content based on individual user preferences, and personalized web sites obtain preference information implicitly by tracking customer purchases or usage habits
Tam and Ho (2006)	There are three types of personalization: <i>user-driven personalization</i> when the user specifies in advance the desired web layout and content that matches her interests and preferences with the tools and options provided. In <i>transaction-driven personalization</i> , an online merchant generates the personalized layout and content, and thus personalization is driven by previous transactions. <i>Context-driven personalization</i> employs an adaptive mechanism to personalize content and layout for each individual user based on the context and inference of users' processing objectives in real time (e.g., product inspection versus random browsing)
Arora et al. (2008)	<i>Personalization</i> is a firm's decision on the marketing mix suitable for the individual that is based on previously collected customer data. <i>Customization</i> , on the other hand, occurs when a customer proactively specifies one or more elements of her/his marketing mix
Kumar (2007)	<i>Personalization</i> is a limiting case of mass customization. <i>Mass customization</i> aims at a market segment of few, whereas <i>mass personalization</i> aims at a market segment of one. The degree of transformation from mass customization to mass personalization depends on the extent to which the product of a company is soft and produced electronically
Frias-Martinez, Chen, and Liu (2009)	There are two major approaches to <i>personalization</i> : <i>adaptability</i> that enables users to adapt the content layout and navigation support to their preferences by themselves, while <i>adaptivity</i> makes an automatic adaptation for users
Montgomery and Smith (2009)	<i>Personalization</i> is the adaptation of products and services by the producer for the consumer using information that has been inferred from the consumer's behavior or transactions. <i>Personalization</i> is automated by the marketer on behalf of the customer as opposed to <i>customization</i> that a customer requests on her own behalf

Who does it?	To whom?	What?			
		Content	User Interface	Functionality	Channel/ Info Access
Implicit (System)	Individuated				
	Categorized				
Explicit (User)	Individuated				
	Categorized				

Fig. 1. Implementation possibilities in personalization, based on Fan and Poole (2006, pp. 187–188).

personalization as a four-phase process: (i) identifying potential customers; (ii) determining their needs and their lifetime value to the company; (iii) interacting with customers in order to learn about them; and (iv) customizing products, services and communications to individual customers.

Also Adomavicius and Tuzhilin (2005) study personalization as a process. They see personalization as an iterative process that consists of (i) understanding the customer; (ii) delivering the personalized offering, and (iii) measuring the impact of personalization. Vesanen and Raulas (2006) develop the process model further and propose that personalization is a broad concept that encompasses execution, marketing outputs in the form of products and services, promotion and communication, price and delivery, and the creation of value for both customers and marketers.

The personalization framework of Miceli et al. (2007) combines multiple dimensions that capture the customer heterogeneity. They characterize personalization by four dimensions: value, knowledge, orientation and relationship quality. Value refers to customer expectations for both content and site-specific features, while the knowledge dimension pertains to the customer's expertise and familiarity with the internet and web-based interaction tools. Orientation means the customer's mindset during the navigation experience, and relationship quality depicts the strength of the customer's relationship with the firm. The analytical framework of Miceli et al. (2007) aims to prescribe the ideal personalization process, by clustering the customers based on these four dimensions, and suggesting the most appropriate form of personalization for each cluster.

Fan and Poole (2006) present a personalization framework, where personalization occurs either by the system (implicit), or by the user (explicit) (see Fig. 1). The object of personalization can be the content, user interface, functionality or channel. Furthermore, the framework makes a distinction whether personalization is directed to individuals (individuated) or to groups of individuals (categorized).

The object of personalization can also be any part of the marketing mix: product, promotion, placement or price (Arora et al., 2008; Chang, Changchien & Huang, 2006; Hong, Suh, Kim & Kim, 2009; Vesanen & Raulas, 2006). In addition, customer communication can be personalized in several ways: according to frequency, timing, or by website, newsletter or e-mail designs.

3. Comparison of personalization and customization literature with research profiling

3.1. Method of research profiling

Literature reviews are an essential part of any scientific research. They can be done in different scales: from one section to whole state-of-the-art review articles. Their purpose is to justify the research questions and to present relevant earlier research on the subject. The search process for relevant literature is iterative as in each search one learns more about the topic under investigation. Porter et al. (2002) propose enhancing the traditional

Table 2

Traditional literature reviews and research profiling. Source: Porter et al. (2002, pp. 353).

Traditional literature reviews	Research profiling
Micro focus (paper-by paper)	Macro focus (patterns in the literature as a body)
Narrow range (~20 references)	Wide range (~20–20,000 references)
Tightly restricted to the topic	Encompassing the topic + related areas
Text discussion	Text, numerical, and graphical depiction

literature review through an extensive research profiling approach utilizing text-mining, as “this broad scan of contextual literature can extend the span of science by better linking efforts across research domains. Topical relationships, research trends, and complementary capabilities can be discovered, thereby facilitating research projects”.

Research profiling is made possible through sophisticated text-mining tools combined with modern search engines and science databases (Porter et al., 2002). Text-mining enables deriving novel information, such as associations, hypotheses and trends, which are not explicitly present in the research abstracts analyzed (Delen & Crossland, 2008). Text-mining allows automated or partially automated processing of text, and technically, it numericizes text documents, and uses common data mining techniques to extract patterns from them (Delen & Crossland, 2008). There exist several alternative text-mining tools (see Yang, Akers, Klose, & Barcelon Yang, 2008 for a comprehensive review) that could be employed for research profiling. Especially tools that have been designed for structured (i.e. fielded) research or patent abstracts are more useful than those tools that mine free-form (unstructured) text. Besides offering pattern extraction and advanced reporting functions, text-mining tools allow the researcher to interact with the literature data in unprecedented ways. The tools can be regarded as Decision Support Systems for researchers (Bragge, Relander, Sunikka, & Mannonen, 2007).

Research profiling should answer such questions as who, what, where, and when (Porter et al., 2002). For example, who are the prolific authors in a research field? What are their specific research subjects? Which institutions conduct research in the field? When has the research been conducted? How has it evolved over time? The answers are provided using simple frequency lists and trend figures. In addition, text-mining tools make it possible to conduct correlation and factor analyses with textual data, and also to visualize the results using multi-dimensional scaling maps. Such visual analyses show, for example, which researcher networks are contributing to the subjects included in a literature review. Table 2 summarizes the key differences between traditional literature reviews and research profiling. The largest difference is based on the amount of literature included, and, consequently, on the type and scope of discussion it allows.

3.2. Results of research profiling

In this study the research profiling method is applied on personalization and customization literature utilizing one of the most well-known scientific databases, the Web of Science (WoS) provided by Thomson Reuters (previously known as the Institute for Scientific Information, ISI). This database has a wide coverage on information systems and computer science journals, and is thus a suitable database. The searches on personalization/personalisation and customization/mass customization articles were conducted in April, 2009, and they resulted in 883 (personalization) and 1544 (customization) articles for 1986–2009. The data (including bibliographic details and abstracts) were imported to a text-mining tool called VantagePoint (www.thevantagepoint.com). The data was

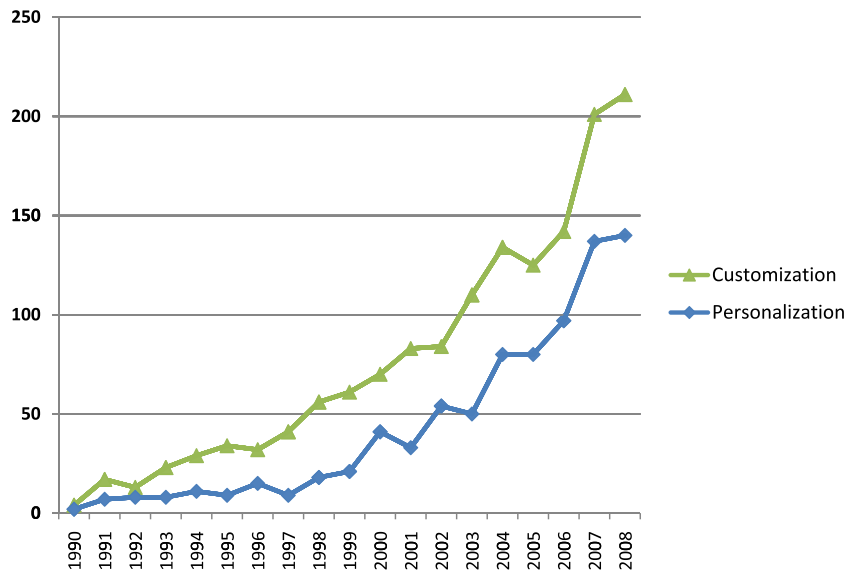


Fig. 2. Number of personalization and customization research articles in 1990–2008.

cleaned to improve the validity of the results (e.g. author and affiliation names and author-defined keywords need to be cleaned due to their multiple occurrences). Only journal articles were included in our analysis. After the clean-up the actual data analysis started.

The yearly divisions of articles returned with the literature searches are presented in Fig. 2. Articles from years 1986 to 1989 (only few articles) and 2009 (not a full year) are omitted from the figure. The figure shows that research on these topics has increased constantly.

Almost 2900 and 4000 different authors have contributed to personalization or customization research, respectively. Table 3 lists the 10 most prolific authors of personalization and customization, and the number of authored articles (due to ties there are 11–12 author names in the table). There are no common authors in the top-10 lists. The research activity of these top researchers amounts to approximately 3% and 5% of all the articles published in personalization or customization research streams, respectively. The low percentages indicate that the fields are relatively “scattered”, probably due to their multidisciplinary nature. In comparison, in such fields as pricing in marketing and simulation & gaming, the top-10 researchers have been found to account for around 13% of the whole research activity (Bragge, Thavikulwat, & Töyli, 2010; Leone, Robinson, Bragge, & Somervuori, 2011).

Appendix A depicts an auto-correlation map of the top-53 personalization researchers having contributed at least three articles in the field. The x- and y-axes of the map have no specific meaning. The multi-dimensional scaling algorithm proprietary to Vantage-Point simply tries to reduce an N-dimensional representation to two dimensions, seeking to maintain authors with a high degree of similarity (correlation) in close proximity to each other. Generally speaking, authors who are close to each other are more similar than those that are farther away. However, the presence or absence of a line (and the thickness of the line, depicting Pearson’s r correlation varying from 0 to 1 as seen in the legend) between any two authors are more appropriate measures of proximity, since it implies whether the authors have or do not have co-authored articles in the sample. Information boxes listing the author’s four most common keywords are attached to the author nodes (to preserve readability, only selected boxes are shown). It can be seen from the map that the top-10 authors (except Tuzhilin, listed in Table 3) are highly networked, forming two strong co-author clusters: around Fernandez-Vilas in the upper part of the map and around Frias-Martinez in the middle right of the map.

Table 3

The 10 most prolific authors (with ties) of personalization and customization research.

Personalization		Customization	
Author	#	Author	#
Fernandez-Vilas, Ana	7	Jiao, Jianxin (Roger)	24
Frias-Martinez, Enrique	7	Tseng, Mitchell M.	16
Garcia-Duque, Jorge	7	Simpson, Timothy W.	11
Pazos-Arias, Jose J.	7	Kumar, Ashok	9
Chen, Sherry Y.	6	Piller, Frank T.	9
Diaz-Redondo, Rebeca P.	6	Salvador, Fabrizio	9
Gil-Solla, Alberto	6	Huang, George Q.	8
Liu, Xiaohui	6	Tu, Y. L.	8
Lopez-Nores, Martin	6	Forza, Cipriano	7
Ramos-Cabrer, Manuel	6	Li, Li	7
Smyth, Barry	6	Zhang, Yiang	7
Tuzhilin, Alexander	6		

Appendix B depicts a corresponding map of the customization researchers. Those authors that have contributed at least four customization articles are included in the map (top-41), as lowering the threshold to three articles would have resulted in an unreadable map with over 110 author nodes. Only one strong cluster from the top-10 authors can be found from the map. It is centered around the most prolific author, Jiao (at the lower part of the map).

Table 4 depicts the top-10 affiliations (and ties). The total number of different affiliations for personalization is around 750, and around 1200 for customization. The top affiliations represent approximately 11.6% of the personalization and 15.2% of the customization research activity. Three affiliations appear in both top lists: Georgia Institute of Technology, Hong Kong University of Science & Technology, and University of Michigan (marked in italics).

Both personalization and customization research are published in a large variety of journals. Table 5 lists the top-11 journals based on the frequency of published articles. Only *Expert Systems with Applications* appears in both top lists (marked in italics). As much as 457 different journal titles have published research on personalization, and the top-11 journals represent 17.5% of the 883 personalization articles. With customization research the number of different journal titles is 664. The top-11 journals represent 17.0% of the 1544 customization articles. The focus of personalization research on computing sciences; and customization’s interest

Table 4

Top-10 affiliations of personalization and customization research.

Personalization		Customization	
Author affiliations	#	Author affiliations	#
Brunel Univ., UK	11	Nanyang Technological Univ.	38
IBM Corp., USA	10	Hong Kong Univ. of Science & Technology, Peoples R. China	26
New York Univ. (NYU), USA	9	National Univ. of Singapore, Singapore	22
Univ. of Minnesota, USA	9	Stanford Univ., USA	21
Univ. of Toronto, Canada	9	Georgia Institute of Technology, USA	17
Harvard Univ., USA	8	MIT, USA	17
Univ. of Illinois, USA	8	Penn State Univ., USA	17
Georgia Institute of Technology, USA	7	Univ. of North Carolina, USA	17
Hong Kong Univ. of Science & Technology, Peoples R. of China	7	Univ., of Texas at Austin, USA	17
National Technology Univ. of Athens, Greece	7	Univ., of Michigan, USA	16
Univ. of Melbourne, Australia	7	Shanghai Jiao Tong Univ., China	14
Univ. of Michigan, USA	7	Univ., of Calgary, Canada	14
Univ. of Turin, Italy	7	Univ., of California Berkeley	14
Univ. of Washington	7	Univ., of Maryland	14

Table 5

Top 11-journals of personalization and customization research.

Personalization		Customization	
Journal	#	Journal	#
<i>Expert Systems with Applications</i>	36	International Journal of Production Research	49
User Modeling and User-Adapted Interaction	21	International Journal of Advanced Manufacturing Technology	28
Communications of the ACM	15	Production Planning & Control	24
Computers in Human Behavior	12	Computers in Industry	23
Interacting with Computers	12	Concurrent Engineering – Research and Applications	23
Multimedia Tools and Applications	12	IEEE Transactions on Engineering Management	21
Decision Support System	10	International Journal of Production Economics	20
IEEE Transactions on Consumer Electronics	10	Journal of Intelligent Manufacturing	20
Wirtschaftsinformatik	10	International Journal of Operations & Production Management	19
IEEE Transactions of Knowledge and Data Engineering	9	International Journal of Computer Integrated Manufacturing	18
Educational Technology & Society	8	<i>Expert Systems with Applications</i>	17

in production and operations management are clearly distinguishable in the journal lists.

The Web of Science categorizes each journal into 1–6 subject areas. For example, *Expert Systems with Applications*, is categorized under three areas: Computer Science – Artificial Intelligence; Engineering – Electrical & Electronic, and Operations Research & Management Science. There are altogether 122 different subject categories in the personalization research sample and 164 categories in customization. Table 6 presents the top-10 subject categories for both areas. Five categories appear on both top-10 lists (the four largest categories of personalization research as well as Operations Research & Management Science). By far the largest (meta) subject category of personalization research is Computer Science with its various subcategories (it is attached to 47% of the journals publishing personalization research), followed by the Engineering meta-category (18%). The same meta categories, but

Table 6

Top-10 subject categories of personalization and customization research.

Personalization		Customization	
WoS subject category	#	WoS subject category	#
Computer Science, Information Systems	200	Operations Research & Management Science	276
Engineering, Electrical & Electronic	125	Engineering, Manufacturing	269
Computer Science, Artificial Intelligence	117	Management	222
Computer Science, Software Engineering	98	Engineering, Industrial	193
Telecommunications	78	Computer Science, Interdisciplinary Applications	175
Computer Science, Theory & Methods	66	Engineering, Electrical & Electronic	167
Operations Research & Management Science	66	Computer Science, Information Systems	161
Information Science & Library Science	55	Business	135
Education & Educational Research	51	Computer Science, Software Engineering	112
Computer Science, Cybernetics	50	Computer Science, Artificial Intelligence	102

in different order dominate the customization research (40% is attached to Engineering and 33% to Computer Science meta category).

Keywords offer an indication of what is being studied within the research streams. Analyzing the top 16 keywords² defined by the authors (Table 7) reveals that personalization research is conducted mainly in the online environment, focusing on personalization technologies and techniques such as recommender systems, user models, collaborative filtering, web usage mining, and user profiles. Because personalization depends on the gathering and usage of user information, privacy issues are a major concern. Customization keywords refer more to tangible products (e.g., product family, supply chain management, platform product, modularity, product configurator, product development). Four keywords occur in both top lists: personalization, e-commerce, customization, and internet (in italics). During the latest 4 years, service has emerged as a top keyword in customization research indicating the widening of the research interest.

For visualizing how the top keywords overlap and appear in the same abstracts (remembering that typically 5–6 keywords are attached to each article), we have produced multidimensional Aduna cluster maps (see Appendices C and D). Each keyword is represented with a differently colored spider form, where the dots at the limbs depict the number of articles where a particular keyword appears. Note that some limbs with a large amount of non-overlapping dots are attached to articles that have other, less frequently used, keywords in them.

The personalization Aduna map (Appendix C) illustrates, for example, that recommender systems and collaborative filtering appear together in 13 personalization articles. These types of visualized connections enable researchers to quickly get the “big picture” of a field. The customization map (Appendix D) offers a useful overview on what other keywords are linked to customization and to mass customization research, respectively. Also the large limbs with the non-overlapping dots of these two keywords illustrate that they are used in different clusters of research.

In summary, personalization and customization research are still clearly distinguishable research streams, even though

² Note that keywords have been indexed by WoS only after year 1990, and thus, the keyword analyses are based on a partial sample (around 65–68%) of the articles from the last two decades.

Table 7

Top-16 keywords defined by authors.

Personalization		Customization	
Keywords (authors')	#	Keywords (authors')	#
Personalization	248	Mass customization	188
Recommender system	41	Customization	122
User model	38	Product family	33
Electronic commerce	37	Electronic commerce	32
Collaborative filtering	33	Supply chain management	32
Data mining	18	Platform product	23
Web usage mining	17	Genetic algorithm	18
User profile	15	Modularity	18
Customization	13	Product configurator	18
Ontology	13		
Adaptive	12	Personalization	16
Information retrieval	12	Product development	16
Privacy	12	Flexibility	14
		Postponement	14
Clustering	11	Service	14
Context aware	11		
		Case study	13
		Design	13
		Internet	13
Internet	10		
Machine learning	10		

customization research has approached personalization research due to the increased utilization of ICT. Three affiliations are represented in both top-10 lists. Although the WoS subject categories of journals publishing personalization and customization research are very similar, only one journal, *Expert Systems with Applications*, recurs on both top-11 journal lists.

4. Discussion and conclusions

Both personalization and customization research are on the rise, and several disciplines, such as computer science, information systems science, marketing, management and economics, study these topics (Kwon et al., 2010). Since the research interest is comparatively recent, the definitions are still unfolding. For some researchers, the difference between personalization and customization is not important, whereas some researchers emphasize their difference. Among researchers who define personalization and customization as separate concepts, the consensus seems to be that the term personalization is used in three instances: (i) in company-driven processes; (ii) when marketing, especially personalized communication, is studied; and (iii) in the internet environment. Customization is perceived as an activity controlled by users, for example, configuring the content of a website, whereas mass customization focuses mainly on tailor-making of products emphasizing affordable prices.

Lately, customization research has started to explore services. The salience of service for the GDP of the developed nations, and the service focus in the traditional manufacturing companies has contributed to the change. Furthermore, the dissemination of ideas of the service-dominant logic (Vargo & Lusch, 2004) has underlined the importance of service: service is seen as the common denominator in exchange, not some special form of exchange – what goods are not. Central to the service-dominant logic is co-creation that consists of customers' active involvement and interaction with their supplier, from product design to product consumption. In addition, a new multi-disciplinary service science explores various aspects of service design and management (Spohrer, Maglio, Srinivasan, & Kreulen, 2006). Faced with so many initiatives it is not surprising that also customization research has turned to studying services.

The research profiling and literature analyses of this study bring forth a personalization framework where the current concepts of

PERSONALIZATION			
	Intangibles (web context, service)		Tangibles (products)
	Individual	Group	Individual and group
System initiated	One-to-one personalization	Mass personalization	Mass customization
User initiated	(Web) customization	Collaborative customization	

Fig. 3. Framework for personalization, customization and mass customization research.

personalization, customization and mass customization research are clarified (Fig. 3).

The framework is based on the user involvement in the personalization process, following the earlier models of Wu, Im, Tremaine, Instone, and Turoff (2003) and Fan and Poole (2006). The potential to personalize the offering from one person to more recipients has been depicted as the personalization continuum. One-to-one personalization is personalization directed to an individual and initiated by a system (also expressed as implicit, transaction-driven or adaptability), whereas personalization directed to several people is called mass-personalization. Customer-initiated personalization for configuring websites is typically called web-customization (also explicit personalization or adaptability). A new concept, collaborative customization, refers to a situation in which consumers collectively personalize a website or service to fit their common preferences. This is already done to some extent with folksonomies, which means collaborative keyword-indexing that makes collective classification of information possible (Mathes, 2004). The users of a service are thus turned from consumers to prosumers (Stock, 2007). For example, collaborative personalized search (Xue, Han, Yu, & Yang, 2009) is an example of collaborative personalization.

The framework is a starting point for analysis and subject to future change because both research fields are in constant flux. For example, information gathering on customers' preferences, needs and previous behavior usually combines both customer and company initiatives, thus the division to personalization and customization based on who takes the initiative blurs in reality. In addition, customization research that has traditionally focused on tangible products has started to move into the service domain making the distinction between research into tangibles and non-tangibles less relevant. Personalization should be used as the higher level construct since it is more open and it encompasses several different forms of matching of individual preferences and offerings (Poulin, Montreuil, & Martel, 2006). Mass customization is a more limited concept and a special case of personalization.

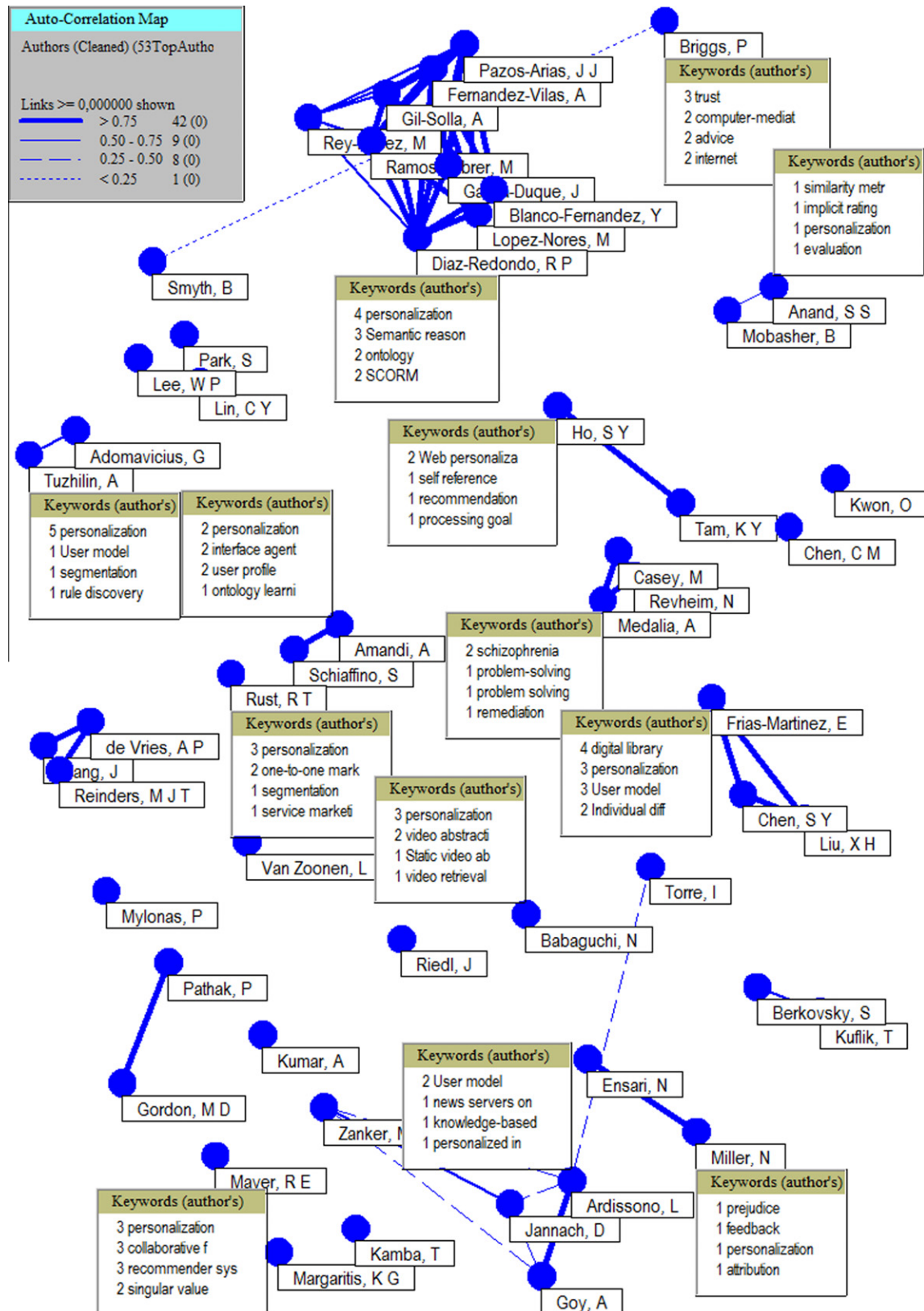
This study increases understanding of how personalization is perceived by scholars. The multiplicity of definitions and terms may slow down the development of the field and thus a unified framework is helpful. It would also be beneficial for the practitioners if the concepts were more lucid and understandable.

This research has the following limitation. Although the Web of Science is a high-quality database, and very representative regarding technical and technological journals, it is not all-inclusive. Several business journals (e.g., in advertising and communication) are not included in the database biasing the search results toward the technical point of view of personalization and customization research streams.

Acknowledgements

The authors appreciate the help of James Collins for checking the language of the manuscript. The first author is grateful for the financial support offered by the Foundation for Economic Education.

Appendix A. Autocorrelation map of personalization authors with selected keywords



Auto-Correlation Map
Authors (Cleaned) (Top41 Author)

Top links shown

- > 0.75 5 (0)
- 0.50 - 0.75 7 (0)
- 0.25 - 0.50 3 (0)
- < 0.25 6 (0)

Keywords (author's)

- 2 fixture design
- 2 setup planning
- 1 integrated manu
- 1 process plannin

Keywords (author's)

- 2 ultrasound
- 2 estimated fetal
- 2 fetal weight ga
- 2 growth standard

Keywords (author's)

- 2 3D viewing
- 2 CAD
- 1 STL
- 1 product life cy

Keywords (author's)

- 2 conformal radio
- 2 optimizing
- 1 treatment plann
- 1 beam weight

Keywords (author's)

- 3 platform produc
- 2 Mass customizat
- 2 product family
- 1 mass customizat

Keywords (author's)

- 1 Supply chain ma
- 1 Postponement
- 1 Mass customizat
- 1 questionnaire s

Keywords (author's)

- 4 Mass customizat
- 2 data mining
- 2 Clustering
- 1 product strateg

Keywords (author's)

- 6 customization
- 2 communication p
- 2 real time
- 2 distributed sys

Keywords (author's)

- 6 Mass customizat
- 4 product variety
- 3 product configu
- 2 Supply chain ma

Keywords (author's)

- 6 Mass customizat
- 4 platform produc
- 2 web service
- 2 product family

Keywords (author's)

- 4 Mass customizat
- 2 one-of-a-kind p
- 2 one-of-a-kind p
- 2 electronic comm

Keywords (author's)

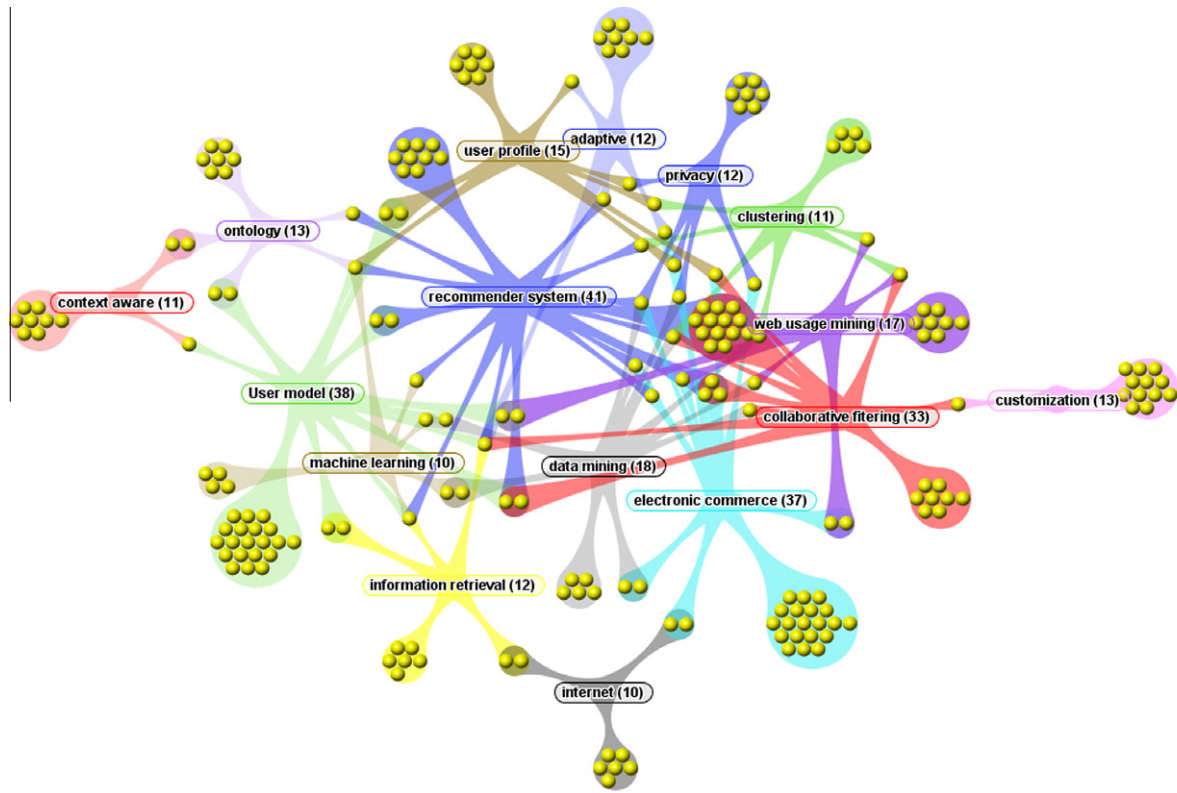
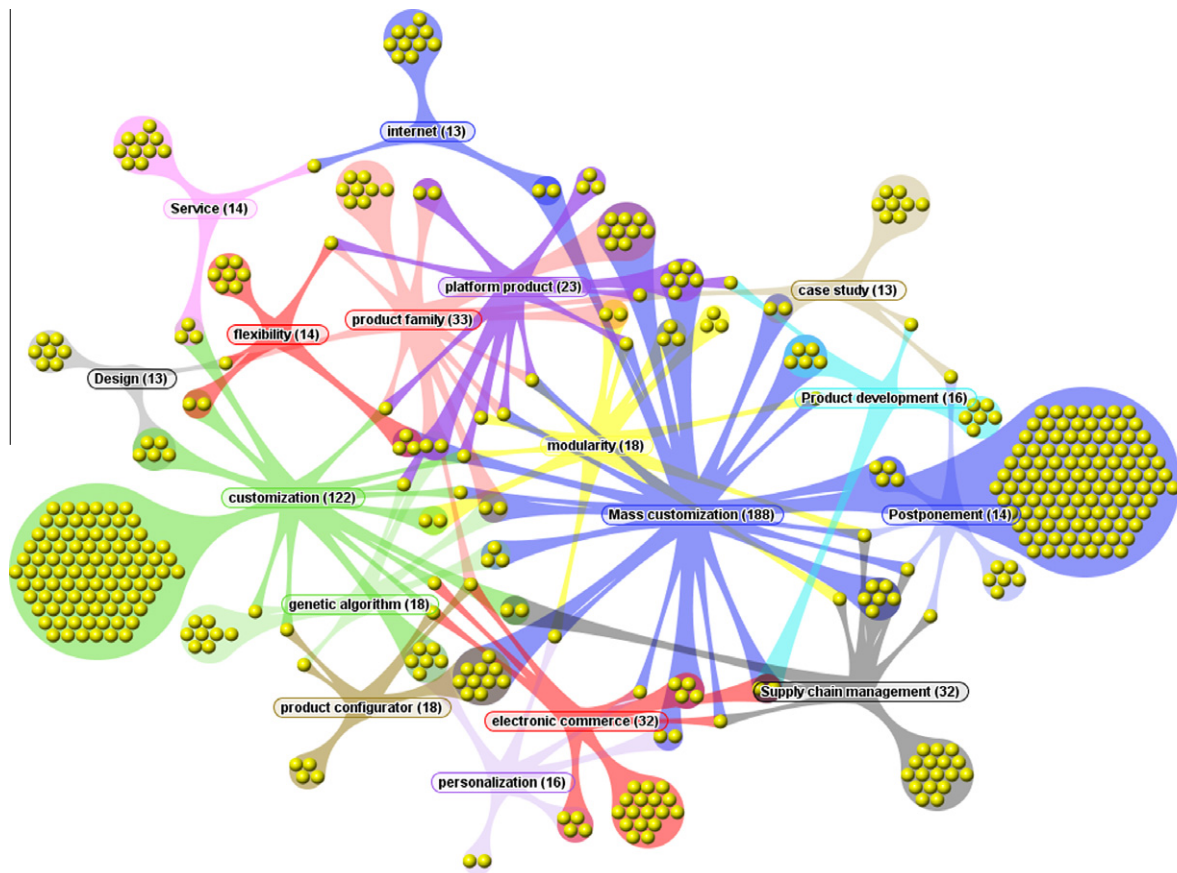
- 5 Mass customizat
- 2 meta review
- 2 modularity
- 2 personalization

Keywords (author's)

- 4 Mass customizat
- 3 product family
- 2 variety managem
- 2 routing

Keywords (author's)

- 5 severity of ill
- 4 Outcome
- 2 customization
- 2 uniformity off

Appendix C. Aduna cluster map of keywords used in personalization research (the search word personalization is excluded)**Appendix D. Aduna cluster map of keywords used in customization research**

References

- Adomavicius, G., & Tuzhilin, A. (2005). Personalization technologies: A process-oriented perspective. *Communications of the ACM*, 48(10), 83–90.
- Ansari, A., & Mela, C. F. (2003). E-customization. *Journal of Marketing Research*, XL, 131–145.
- Arora, N., Dreze, X., Ghose, A., Hess, J. D., Iyengar, R., Jing, B., et al. (2008). Putting one-to-one marketing to work: Personalization, customization, and choice. *Marketing Letters*, 19(3–4), 305–321.
- Blom, J., & Monk, A. (2003). Theory of personalisation of appearance: Why people personalise their mobile phones and PCs. *Human–Computer Interaction*, 18, 193–228.
- Bragge, J., Relander, S., Sunikka, A., Mannonen, P. (2007). Enriching literature reviews with computer-assisted research mining. Case: Profiling group support systems research. In *Proceed 40th HICSS*, pp. 1–10.
- Bragge, J., Thavikulwat, P., & Töyli, J. (2010). Profiling 40 years of research in simulation & gaming. *Simulation & Gaming*, 41(6), 869–897.
- Chang, S. E., Changchien, S. W., & Huang, R.-H. (2006). Assessing users' product-specific knowledge for personalization in electronic commerce. *Expert Systems with Applications*, 30(4), 682–693.
- Crosby, L. A., Evans, K. R., & Cowles, D. (1990). Relationship quality in services selling: an interpersonal influence perspective. *The Journal of Marketing*, 54(3), 68–81.
- Chellappa, R. K., & Sin, R. (2005). Personalization versus privacy: An empirical examination of the online consumer's dilemma. *Information Technology and Management*, 6(2–3), 181–202.
- Davis, S. M. (1987). *Future perfect*. Reading, MA: Addison-Wesley.
- Delen, D., & Crossland, M. D. (2008). Seeding the survey and analysis of research literature with text mining. *Expert Systems with Applications*, 34(3), 1707–1720.
- Dwyer, F. R., Schurr, P. H., & Oh, S. (1987). Developing buyer–seller relationships. *The Journal of Marketing*, 51(2), 11–27.
- Fan, H., & Poole, M. S. (2006). What is personalization? Perspectives on the design and implementation of personalization in information systems. *The Journal of Organizational Computing and Electronic Commerce*, 16(3&4), 179–202.
- Frias-Martinez, E., Chen, S., & Liu, X. (2009). Evaluation of a personalized digital library based on cognitive styles: Adaptivity vs. adaptability. *The International Journal of Information Management*, 29(1), 48–56.
- Gilmore, J. H., & Pine, J. (1997). The four faces of mass customization. *Harvard Business Review*, 75, 91–101.
- Goldsmith, R. E., & Freiden, J. B. (2004). Have it your way: Consumer attitudes toward personalized marketing. *Marketing Intelligence & Planning*, 22(2), 228–239.
- Hart, C. W. (1996). Made to Order. *Marketing Management*, 5(2), 12–22.
- Ho, S. Y. (2006). The attraction of internet personalization to web users. *Electronic markets*, 16(1), 41–50.
- Hong, J., Suh, E.-H., Kim, J., & Kim, S. Y. (2009). Context-aware system for proactive personalized service based on context history. *Expert Systems with Applications*, 36(4), 7448–7457.
- Kalaigianam, K., Kushwaha, T., & Varadarajan, P. (2008). Marketing operations efficiency and the Internet: An organizing framework. *The Journal of Business Research*, 61, 300–308.
- Kalyanam, K., & McIntyre, S. (2002). The e-marketing mix: A contribution of the e-tailing wars. *Journal of the Academy of Marketing Science*, 30(4), 487–499.
- Kumar, A. (2007). From mass customization to mass personalization: A strategic transformation. *International Journal of Flexible Manufacturing System*, 19(4), 533–547.
- Kwon, K., Cho, J., & Park, Y. (2010). How to best characterize the personalization construct for e-services. *Expert Systems With Applications*, 37(3), 2232–2240.
- Leone, R., Robinson, L., Bragge, J., Somervuori, O. (in press). A citation and profiling analysis of pricing research from 1980 to 2010. *The Journal of Business Research*, doi:10.1016/j.jbusres.2011.04.007.
- Lin, C.-T., Hong, W.-C., Chen, Y.-F., & Dong, Y. (2010). Application of salesman-like recommendation system in 3G mobile phone online shopping decision support. *Expert Systems with Applications*, 37(12), 8065–8078.
- Mathes, A. (2004). Folksonomies – Cooperative classification and communication through shared metadata, <<http://www.adammathes.com/academic/computer-mediated-communication/folksonomies.html>>. Accessed 11.11.10.
- Miceli, G. N., Ricotta, F., & Costabile, M. (2007). Customizing customization: A conceptual framework for interactive personalization. *Journal of Interactive Marketing*, 21(2), 6–25.
- Montgomery, A. M., & Smith, M. D. (2009). Prospects for personalization on the internet. *Journal of Interactive Marketing*, 23(2), 130–137.
- Moon, J., Chadee, D., & Tikoo, S. (2008). Culture, product type, and price influences on consumer purchase intention to buy personalized products online. *The Journal of Business Research*, 61(1), 31–39.
- Peppers, D., & Rogers, M. (1997). *The one-to-one future*. New York: Double Day Publications.
- Pine, J. B. (1993). *Mass customization*. Boston, MA: Harvard Business School Press.
- Porter, A. L., Kongthon, A., & Lu, J. C. (2002). Research profiling: Improving the literature review. *Scientometrics*, 53(3), 351–370.
- Poulin, M., Montreuil, B., & Martel, A. (2006). Implications of personalization offers on demand and supply network design: A case from the golf industry. *European Journal of Operational Research*, 169(3), 996–1009.
- Riener, K., Totz, C. (2001). The many faces of personalization. In *Proceed MCPC, Hong Kong*.
- Simonson, I. (2005). Determinants of customers' responses to customized offers. Conceptual framework and research propositions. *The Journal of Marketing*, 69(1), 32–45.
- Smith, W. (1956). Product differentiation and market segmentation as alternative marketing strategies. *The Journal of Marketing*, 21(1), 3–8.
- Spohrer, J., Maglio, P., Srinivasan, S., & Kreulen, J. (2006). Service systems, service scientists, SSME and innovation. *Communications of the ACM*, 49(7), 81–85.
- Stock, W. G. (2007). Folksonomies and science communication. *Information Services and Use*, 27(3), 97–103.
- Tam, K. Y., & Ho, S. Y. (2006). Understanding the impact of web personalization on user information processing and decision outcomes. *MIS Quarterly*, 30(4), 865–890.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *The Journal of Marketing*, 68(1), 1–17.
- Vesonen, J., & Raulas, M. (2006). Building bridges for personalization: A process model for marketing. *Journal of Interactive Marketing*, 20(1), 5–20.
- Wind, J., & Rangaswamy, A. (2001). Customerization: The next revolution in mass customization. *Journal of Interactive Marketing*, 15(1), 13–32.
- Wu, D., Im, I., Tremaine, M., Instone, K., Turoff, M. A. (2003). framework for classifying personalization scheme used on e-commerce websites. In *Proceed 36th HICSS*.
- Xue, G. R., Han, J., Yu, Y., & Yang, Q. (2009). User language model for collaborative personalized search. *ACM Transactions on Information Systems*, 27(2), 1–28.
- Yang, Y., Akers, L., Klose, T., & Barcelon Yang, C. (2008). Text mining and visualization tools – Impressions of emerging capabilities. *World Patent Information*, 30(4), 280–293.