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Customer Support as an Instrument of Marketing: From Technical Documentation to Virtual Support Services

Doctoral Thesis

to be awarded the degree of

Doctor of Engineering Sciences (Dr. techn.)

at the Graz University of Technology, Austria

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Graz, May 2014

Deutsche Fassung:
Beschluss der Curricula-Kommission für Bachelor-, Master- und Diplomstudien vom 10.11.2008
Genehmigung des Senates am 1.12.2008

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List of Abbreviations

AIDA	Attentation Interest Desire Action
ASP	Application Service Provider
BC	Before Christ
CECIIS	Central European Conference on Information and Intelligent Systems
CX	Customer Experience
e.g.	example given
EBES	Eurasia Business and Economics Society
EDUCON	Engineering Education Conference
FAQ	Frequently Asked Questions
HICSS	Hawaii International Conference on System Sciences
IARIA	International Academy, Research, and Industry Association
IEEE	Institute of Electrical and Electronics Engineers
IJACSA	International Journal of Advanced Computer and Applications
IoT	Internet of Things
IS	Information Systems
IT	Information Technology
M2M	Machine to Machine
NFC	Near Field Communication
no	number
SaaS	Software-as-a-Service
SAI	Science and Information Organization
TAM	Technology Acceptance Model
TV	Television
UE	Usability Engineering
Univ.	University
UX	User Experience
VCE	Virtual Customer Environment
vol	volume

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„The importance of physical products lies not so much in owning them as obtaining the services they render.“

Philip Kotler 1977

„The focus is not on products, but on the consumers' value -creating processes, where value emerges for consumers, and is perceived by them...the focus of marketing is value creation rather than value distribution.“

Christian Gronroos 2000

1 Introduction

The society we are living in encounters a large amount of technologies in our daily routines. The outcome of technological development is a controversial discussed topic. Technology just builds a framework for applications, but acceptancy of these applications decides wheter a development is rather usefull than useless. If people widely accept an innovation, potentials for social changes are released. Last examples for changes in society were affected by the rise of the Internet and the spread of smartphones. Both built the foundation for a fast number of new usefull applications. While the Internet enables the worldwide communication between people and organisations, smarthphones allow a personalized, location-independet and context-sensitive access. Changes let to the „always on“ mentality.[1]

The topic of this doctoral thesis reacts to these developments by observing a highly effected subject area. Private as well as corporate communication is in transition[2]. Long lasting communication and marketing strategies become outdated and do not show effective any more. On the other hand, new technological facts open new potentials for marketing actions. Technical documentation refers to the transportation of various forms of product information from manufacturer to user. The ongoing change in customer communication and businesses' demand for differentiation from competitors build an area of tension for product and service improvements. Technical documents represent the product and therefore the business behind. Besides the actual product, these documents formed a communicational bridge between business and customer. Technological change influences this position. As the following sections will show, businesses gain new potentials for marketing communication, customer loyalty and engagement, product improvements and service offerings. This thesis demonstrates potentials and gives answers on how to respond to changes and benefit from potentials.

The doctoral thesis addresses two research areas. First, technical documentation is form of corporate communication having its roots in marketing research. The impact of technical documentation on customer experience and therefore buying behavior will be highlighted. Second, the implementation and application of modern information technologies belongs to the area of information systems research. Information systems have to be utilized to adapt to change communication behavior and facilitate future service implementations.

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[1] Cf. Von Birgit Van Eimeren, „ Always on “ – Smartphone , Tablet & Co . Als Neue Taktgeber Im Netz,” *Media Perspektiven*, 7-8 (2013), 386–390.

2 Cf. Petricia A. Carlson, “Information Technology and Organizational Change,” *Journal of Technical Writing and Communication*, 31 (2001).

1.1 Background

Technological changes and new established innovations implicate risks as well as chances for businesses. New business models with greater benefits for customers replace formerly reliable business models. Especially the permanent availability of online resources showed enormous impact on formerly steady markets such as the media industry. Demand for offline media in form of printed newspapers, magazines or non-interactive television is decreasing for years, while the importance of online media is increasing. Nevertheless, it is much more than just bring physical goods into the virtual world. Virtual environments employ the instant connectivity if individuals and enrich former service offerings. Customers automatically generate huge amounts of usage data while consuming services. Businesses capitalize collected data for optimizations of offerings and services. A cycle of generating data by users and utilizing data by businesses emerges.

Technical documents like user guides or instruction manuals are produced for explaining functionalities of physical goods. Businesses react to the ongoing change in customer communication by producing digital forms of technical documents and distributing them via the Internet. Though, many more factors than a virtualization of former physical offerings have to be considered. Digital services represent new interaction potentials and impacts on customer support experiences. Physical and virtual offerings are merging, resulting in physical products with virtual occurrences. The automotive industry acts as an example, as modern cars are already equipped with Internet connectivity. Does this simply bring the Internet into the car or is the car becoming part of the Internet?[3] This question can be asked for many industries and products. Machine-to-machine (M2M) communication[4] and the Internet-of-things[5] (IoT) are catchphrases to describe the convergence of physical and virtual offerings. Some technologies are already established to bridge these two, but it is less a technical question but more the question of user acceptance.

The digital revolution also showed deep impacts on marketing communication. The relevance of word-of-mouth marketing was already respected before the Internet, but social media allowed customer to communicate in many different ways. Social networks such as Facebook or private virtual communities foster information exchange without boundaries. From the perspective of businesses, a loss of communication control is the result. Before social media, marketing communication took mainly place between business and customer.

[3] Cf. “Vernetzte Fahrzeuge: Rollender Datensammler,” *Hamburger Zeit Online*, 2014 <http://www.zeit.de/mobilitaet/2014-03/auto-ueberwachung-autoindustrie-vernetzung> [accessed 21 April 2014].

[4] Cf. David Boswarthick, Omar Elloumi and Olivier Hersent, “M2M Communications,” *IEEE Transactions on Information Theory*, 50 (2012), 3062–3080.

[5] Cf. Mahbubul Alam, Rasmus H. Nielsen and Neeli R. Prasad, “The Evolution of M2M into IoT,” *2013 First International Black Sea Conference on Communications and Networking (BlackSeaCom)*, 2013, 112–115.

Online networks omit businesses, leading to intensified exchange between customers solely. Platforms for the comparison of products or services are emerging. Customers exchange their experiences, evaluate products and give direct recommendations for future purchases. Customers are gaining new power due to this direct information exchange. They get well informed, compare prices and gain instant expertise to solve problems on their own. The Internet initiated a power shift to consumers.[6]

Businesses on the other hand need do to adapt to these new facts. They have to gain an understanding of how customers think and act, how their needs and demands changed. Marketing strategies that integrate customer support activities have to be developed. As an instrument of marketing right between customer and business, technical documentation has direct impact on customer experiences, as the following sections will demonstrate.

1.2 Research question and aims

This doctoral thesis deals with the fact of a changed communication behavior. Impacts for the field of technical documentation are defined and emerging marketing potentials are highlighted. The applied approach addresses businesses dealing with technical documentation and customer support, as well as researchers within the scientific community of industrial marketing and information systems research.

The overall research question relates to the challenges businesses are currently facing in customer support:

How does customer support have to be designed to meet customers' changed communication behavior?

This central question accompanied the entire research undertaking. To answer this question, two research aims had to be achieved. First, impacts of communication changes on technical documentation had be identified and analyzed. Second, recommendations of business actions for the design and implementation of virtual support environments are issued. Each of these aims raised further sub-questions to answer.

First research aim: Identification and analysis of impacts of communication changes on technical documentation

As the overall research question addresses the implications for businesses to meet the changed communication behavior, *the change in communication itself has to be analyzed in detail*. Various studies and empirical data concerning communication issues already exist but

[6] Cf. Leyland F. Pitt and others, "The Internet and the Birth of Real Consumer Power," *Business Horizons*, 45 (2002), 7–14.

the influence on corporate communication has to be stated. Information technology led to increased customer-to-customer information exchange, fostering the availability of public customer feedback and critique. Answers to this question build the foundation for all further research and gives insights into marketing potentials.

After determining general issues of corporate communication, *the concrete impact for technical documentation has to be deducted*. Customers may not utilize technical documentation in the same way they just did a couple of years ago. New needs and demands emerged, effecting the technical writing industry as well as product manufactures. It is to determine how customers actually receive support and how various forms of offerings may cover customer needs. Finally, customer attitudes according to product package enclosures will give insights in acceptance of printed documents.

Second research aim: Recommendations of business actions for the design and implementation of virtual support environments

While the first research aim identifies communication changes, the second research aim addresses concrete implications businesses can apply to meet depicted customer expectations. The experience of support offerings will play a major role for businesses, as it shows direct influence on future buying behaviors. Therefore, the second aim concentrates on achieving high customer experience, which will be ensured by putting the customer into focus within research.

The first question raised relates to the actual situation customers are facing when requesting support. From the perspective of customers, not marketing actions are relevant but efficient solutions to gain knowledge to overcome a situation. This leads to the question *which learning theories and approaches can be applied to support consumer learning.* Regardless the form of support, customers desire to solve a problem with a minimum of effort.

Next, the design of customer-orientated support environments requires attention. Information systems research concentrates on designing application with high customer acceptance. Data determined in the first research aim leads to *implications on how modern support environments meet customer expectations*. To answer this question special focus must be set on the customer's perspective to ensure acceptance as well as usefulness for customers and businesses.

One issue already stated in a section above relates to the bridging of physical goods, like consumer electronics, with virtual support offerings. Media discontinuity bears the risk that customers may utilize offerings different from manufacturers. The embedding of learning and support environments into physical products eliminates this risk by initiating the support process by the product itself. Two research questions come into mind. First, by integrating support into the product new potentials for customer learning emerge. So, *how can these*

systems directly support the customer while actually using the product? And second, *what impact will this have on product engineers, as they will become responsible for customer support*?

1.3 Design Science methodology

To argue business implications, a research framework within the applied science of information systems is required. The design science methodology is an often-cited framework in information systems research as it focuses on both rigor and relevance. The results of design science research are either theories or artifacts in varies forms, which are permanently justified. Artifacts are designed in the form of constructs, models, methods or instantiations[7]. Design science and behavioral science complement each other. Behavioral science provides findings and knowledge for information systems research. It thereby ensures the truth of design science results. The artifacts developed by design science on the other hand act as an input for behavioral science to identify new truths. The design science methodology thereby ensures the usefulness for practical applications. Figure 1 pictures this complementary circuit between behavioral and design science.

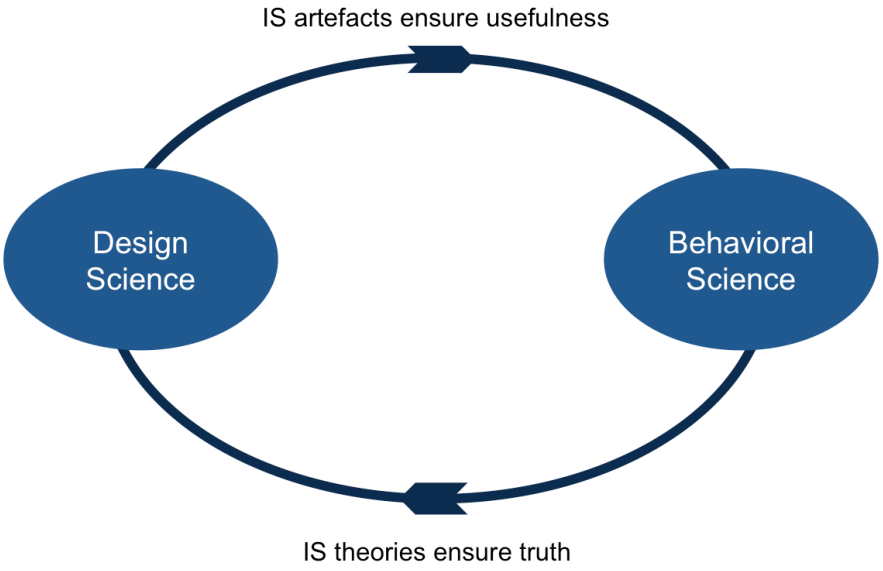

Figure 1: Complementary circuit between behavioral and design science[8]

For the purpose of this doctoral thesis, the design science approach by Hevner et. al[9] was applied. They argue that information systems research utilizes a knowledge base on the one

[7] Cf. AR Hevner, ST March and Jinsoo Park, "Design Science in Information Systems Research," *Mis Quarterly*, 28 (2004), 75–105.

[8] Cf. Robert Winter, "Interview Mit Alan R. Hevner Zum Thema „Design Science"," *Wirtschaftsinformatik*, 51 (2008), 148–151.

hand and identifies business needs on the other hand to develop useful information systems. An existing knowledge base ensures the rigor of research. Foundations as well as methodologies have to meet scientific criteria for further application. The environmental component represents real life demands and therefore ensures the relevance of research. People, technologies as well as organizations may represent the environment, respectively the relevance. Figure 2 pictures the design science approach by Hevner et al.[10]

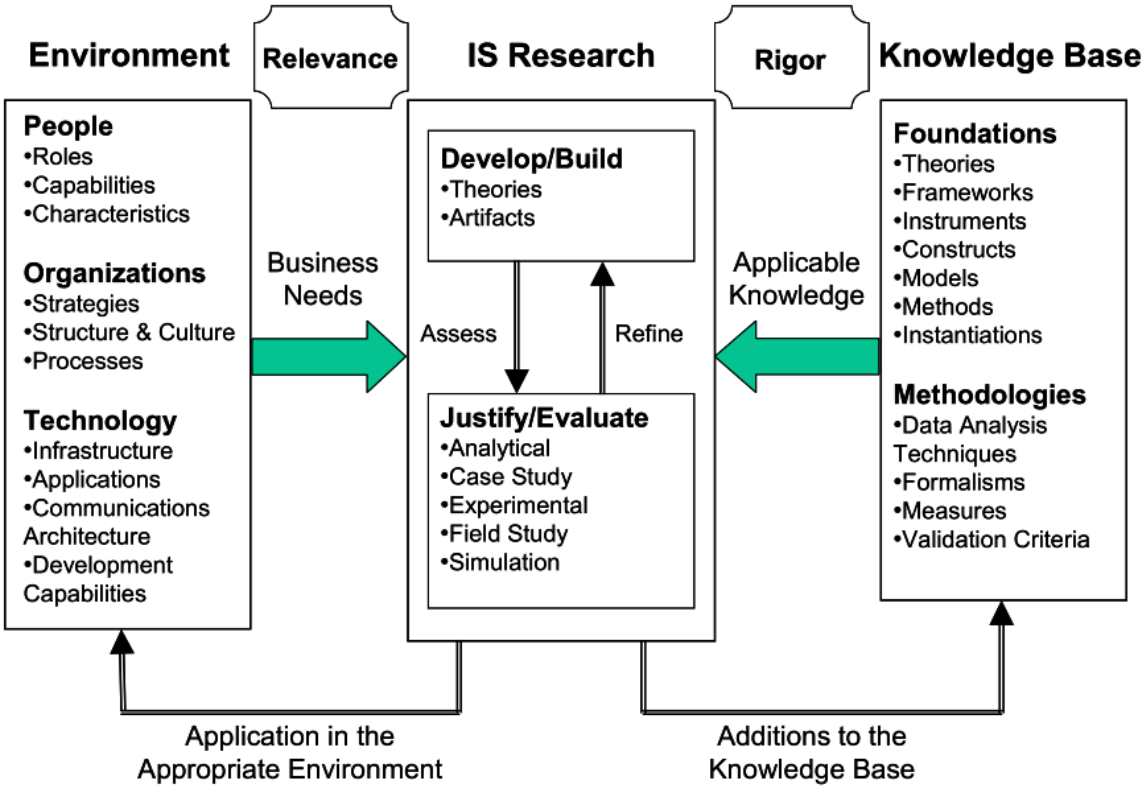

Figure 2: Design Science as research methodology[11]

Results of information systems research impact the environmental component as well as the knowledge base. The environment benefits from appropriate applications and therefore supports the research trigger. Additionally, design science artifacts bring additions to the knowledge base, which may again lead to further theoretical research.[12] [13]

[9] Cf. Hevner, March and Park, "Design Science in Information Systems Research."

[10] Cf. Hevner, March and Park, "Design Science in Information Systems Research."

[11] Cf. Hevner, March and Park, "Design Science in Information Systems Research."

[12] Cf. Martin Bichler, "Design Science in Information Systems Research," *Wirtschaftsinformatik*, 48 (2006), 133–135.

[13] Cf. Robert Winter, "Was Ist Eigentlich Grundlagenforschung in Der Wirtschaftsinformatik?," *Wirtschaftsinformatik*, 51 (2009), 223–231.

In the concrete case of research, the design science methodology was applied as an overall framework of research. Research aims raise various sub-questions, which were defined in the previous subsection. This thesis is structured as a cumulative dissertation as these sub-questions require deeper research. As every sub-question lead to it's own research methodology to get solved, applied methods are manifold and described in detail in each publication. In terms of design science, existing literature in communication change and methodology basics are utilized and represent the knowledge base, and therefore the rigor of the proceeding. Customer as well as business needs define the relevance, as both parties observe or demand changes in customer support. The developed customer journey map represents an artifact, which is justified by multiple research sources and self-conducted studies. Finally, business implications base on these results and represent new inputs for behavioral research.

1.4 Structure

The cumulative doctoral thesis consists of ten sections, whereof seven sections are separate articles in the area of technical documentation and product support. Due to the practical orientated research question, some publications were presented at high-ranked conferences to ensure both, rigor in science as well as relevance for practitioners. Two of these conferences are recognized as "A"-conferences. The publication "Model of a Personalization-based Agent System for Early Product Adoption Phases" was accepted and presented at the 46th Hawaii International Conference on System Sciences (HICSS)[14] and published in the corresponding proceedings. The publication "The Impact of Technological Development on the use of Technical Product Documentation" was accepted and presented at the 3rd International Conference on Social Eco-Informatics (SOTICS)[15] and published in the corresponding proceedings. The journal publication "Narrowing Down Learning Research: Technical Documentation in Information Systems Research" was accepted and published in the peer reviewed journal "International Journal of Advanced Computer Science and Applications (IJACSA)" which scored an impact factor of 1,324 in 2012 and is thus comparable in importance to leading information systems journal in the German-speaking research area. For more accurate viewpoint, the doctoral thesis is structured into four areas. The structure is shown in Figure 3, including all seven publications in colored boxes.

[14] „A" ranking according to:
Swinburn University Rating available at http://www.research.swinburne.edu.au/researchers/publication-collections/era/conferences/results.php?code=0806 [accessed 21 April 2014],
Uni Erlangen Ranking in Information Technology available at http://www.wi2.uni-erlangen.de/_fileuploads/research/generic/ranking/index.html [accessed 21 April 2014]

[15] „A" ranking according to:
Uni Erlangen Ranking in Information Technology available at http://www.wi2.uni-erlangen.de/_fileuploads/research/generic/ranking/index.html [accessed 21 April 2014]

Figure 3: Structure of doctoral thesis

The first area includes the introduction as wells as the theoretical foundation for the following areas. Section 1 describes the research question and the methodology applied to answer the question. Section 2 gives a detailed overview into the topic by explaining the position of technical documentation within the discipline of marketing research. A special focus is set on the ongoing change in communication behavior due to technological developments and the challenges businesses are facing thereby.

Publications within research aim one focus on communicational aspects of technical documentation. First, a profound analysis on available literature was conducted to determine corresponding research areas, publishing institutions and researchers. Quantitative as well as qualitative literature studies were performed to ensure a solid foundation for all further research. The publication is included in section 3. The communication space as an answer to communication changes is presented in section 4. Section 5 explains the impact on technical documentation by analyzing the actual usage of technical documents. To update outdated research, a study on the actual attitude and usage behavior of manuals and potential support alternatives was conducted.

The second research aim deals with the design of support environments. At first, design approaches for environments with focus on learning theories are compared in section 6. Learning theories employ knowledge regarding the exchange of complex information, which lead to a mapping of adequate theories applyable in targed area of technical documentation and support. Business implications for the design of virtual support environments in the consumer electronics markets are given in section 7. Focus was set on the customer's point of view within a support process, thus a customer journey map was designed. Aspects of embedding technical documentation into products from two different perspectives follow. First, the publication "Model of a Personalization-based Agent System for Early Product Adoption Phases" in section 8 presents a model to support customers in product learning. The article highlights product adoption potentials due to the integration of usage analysis mechanism in phases of learning how to handle a product. While this is of high matter for software systems, physical products require an embedding of support facilities into the product design. Section 9 depicts potentials for embedding support systems into physical products. Implications for engieneering education are argued as these developments constitute new challenges for product designers, support specialists as well as marketers.

Finally, findings are summarized in section 10. Overall implications for businesses and researchers are addressed in section 11, finished by a short résumé.

1.5 Publications

All seven articles are summarized with their current status of publication.

1) Section three: "**Narrowing Down Learning Research: Technical Documentation in Information Systems Research"**
by Puchleitner, T.
published in the International Journal of Advanced Computer Science and Applications (IJACSA), vol. 4, no.4, pp. 23-28 (2013).

2) Section four: "**Communication Technology as Enabler for the Communication Space"**
by Puchleitner, T., Harnisch, M.
published in Proceedings of the IADIS International Conference e-Society 2012, Berlin (2012), pp. 265-272.

3) Section five: **"The Impact of Technological Development on the use of Technical Product Documentation"**
by Puchleitner, T.
published in Proceedings of SOTICS 2013: The Third International Conference on Social Eco-Informatics, Lissabon (2013), pp. 28-33.

4) Section six: **"Designing services for customer support: ensuring high customer experience for the consumer electronics market"**
by Puchleitner, T.
accepted for presentation at 13th EBES (Eurasia Business and Economics Society) Conference, full paper ***sending for review*** to EBES 2014 Anthology.

5) Section seven: "**Using New Media for Consumer Learning: Mapping practical and theoretical approaches on Information Service Design"**
by Puchleitner, T.
sent for review to the International Journal of Information and Communication Technology.

6) Section eight: **"Model of a Personalization-Based Agent System for Early Product Adoption Phases"**
by Harnisch, M., Puchleitner, T., Reinisch, M. and Uitz, I.
published in the Proceedings of the 2013 46th Hawaii International Conference on System Sciences (HICSS), Maui (2013), pp. 3457-3466.

7) Section nine: **“From manuals towards product embedded interactive learning environments”**
by Puchleitner, T., Petrovic, O.
published in the Proceedings of IEEE Global Engineering Education Conference 2014 (EDUCON), Istanbul (2014).

The current status of all publications is listed online at “UniGrazOnline / UGO” of University of Graz. Updates can be accessed via http://online.uni-graz.at.

2 Technical documentation and Marketing

Technical documentation is rarely seen as an instrument of marketing but this section will determine it's strong influence on customers' opinion building. Marketing is a widespread field of activity. The three stages buying cycle in Figure 4 demonstrates the focus of research as a framework. From the customer's perspective, technical documentation is requested after a sale was performed within the usage phase. From a marketing perspective, technical documentation represents an instrument in aftersales, affecting future purchases.

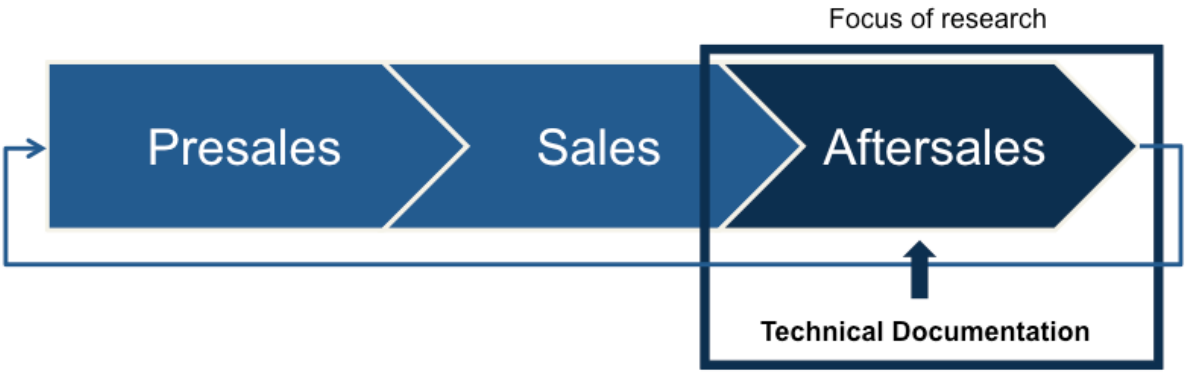

Figure 4: Technical documentation in the buying cycle

The more generic term of "customer support" also relates to aftersales activities, but is embossed by a different mindset. While common written technical documents base on the translation of product specific features and applications[16], support focuses on the assisting of customers to help overcome a problem[17] [18]. The transition from business thinking in technical product documentation to customer orientated support environments is argued in the following subsections. After giving detailed insights into the research field of technical documentation and related areas, the strong connection to the field of marketing is constituted. This is also stated by a constant increase of scientific publications, which highlights the topic's relevance for practitioners as well as researchers.

The second subsection demonstrates the ongoing change in customers' communication behaviors. New forms of social interactions allow customers to communicate directly to each other, leading to a loss of control for businesses. Perceptions in aftersales of one customer

[16] Cf. Jonathan Price and Henry Korman, *How to Communicate Technical Information: a Handbook of Software and Hardware Documentation* (Benjamin/Cummings Publishing, 1993).

[17] Cf. Levent V. Orman, "Consumer Support Systems," *Communications of the ACM*, 50 (2007), 49–54.

[18] Cf. M.F. Steehouder, "Beyond Technical Documentation: Users Helping Each Other," in *Proceedings. IEEE International Professional Communication Conference* (IEEE, 2002), pp. 489–499.

may directly impact presales of potentially new customers. Understanding and reacting in appropriate ways to these changes ensures efficient marketing actions.

Finally, subsection three focuses on business implementations of customer support systems. It is particularly surprising that companies within the same business market, offering similar products, utilize technical documents in very different ways. State-of-the-art research on implementations of customer support is discussed and potentials for bringing product and support mechanism closer together are presented.

2.1 Technical documentation in research

The term "technical documentation" is defined in many ways in research and gets often associated with "technical communication".

The Society for Technical Communication[19] gives an overview on technical communication: "*Technical communication is a broad field and includes any form of communication that exhibits one or more of the following characteristics:*

- *Communicating about technical or specialized topics, such as computer applications, medical procedures, or environmental regulations.*
- *Communicating by using technology, such as web pages, help files, or social media sites.*
- *Providing instructions about how to do something, regardless of how technical the task is or even if technology is used to create or distribute that communication.*"

Technical communicators provide information in various forms and make it accessible to those who need such information. Some typical fields of interests are[20]:

- Design and development of training programs for education people with new or improved skills
- Specification of functional aspects and proposals to support the communication between technical experts - thereby preventing misunderstandings or risks caused by miscommunication
- Designing instruction sets to help users and engineers to understand processes, products or services

[19] Cf. Society for Technical Communication, "Defining Technical Communication" <http://www.stc.org/about-stc/the-profession-all-about-technical-communication/defining-tc> [accessed 21 April 2014].

[20] Cf. Society for Technical Communication.

In contrast, definitions of technical documentation focus on the usage of products. A classic definition by Hoffmann, Hölscher and Thiele[21] describes technical documentation as "*useful informations of a product and it's usage in a structured form – in printed paper or digital form"*.

Another summarization comes from Transcom[22]: "*Technical documentation is the generic term for documentation with regard to a product. People mainly associate the term with the documents and information that are passed on to the public by the manufacture"*.

Technical documentation can therefore be seen as a sub-form of technical communication with special focus on external communication to product users. These can either be customers in the usual way, but also external product maintainer and engineers.

Juhl[23] gives a definition by specifying five areas of technical document responsibility:

- Service description
- Technical manual
- Job description
- Functionality
- Technical brochures

Technical documentation has also strong roots in the discipline of translation science. In fact, most classic literature on technical communication and documentation is listed in translation science libraries. The reason for this lies in the initial idea of technical documents. Engineering divisions manufacture products that are automatically influenced and embossed by engineering mindset, thinking and wording. All three differ from those of customers. Customers have to "learn" how to use a product, leading to the need for learning material. Technical writers create these documents with the goal to translate the product with its features and wording into a language the potential customer is expected to understand. Technical documents therefore translate the product from the perspective of an engineer to a customer-orientated thinking and wording.

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[21] Cf. Walter Hoffmann, Brigitte G. Hölscher and Ulrich Thiele, *Handbuch Für Technische Autoren Und Redakteure: Produktinformation Und Dokumentation Im Multimedia-Zeitalter* (Erlangen: Publicis Corporate Publishing, 2002).

[22] Cf. Transcom, "What Is 'Technical Documentation'?" <http://www.transcom.de/transcom/en/technische-dokumentation.htm> [accessed 21 April 2014].

[23] Cf. Dietrich Juhl, *Technische Dokumentation: Praktische Anleitungen Und Beispiele* (Heidelberg: Springer Publishing, 2005).

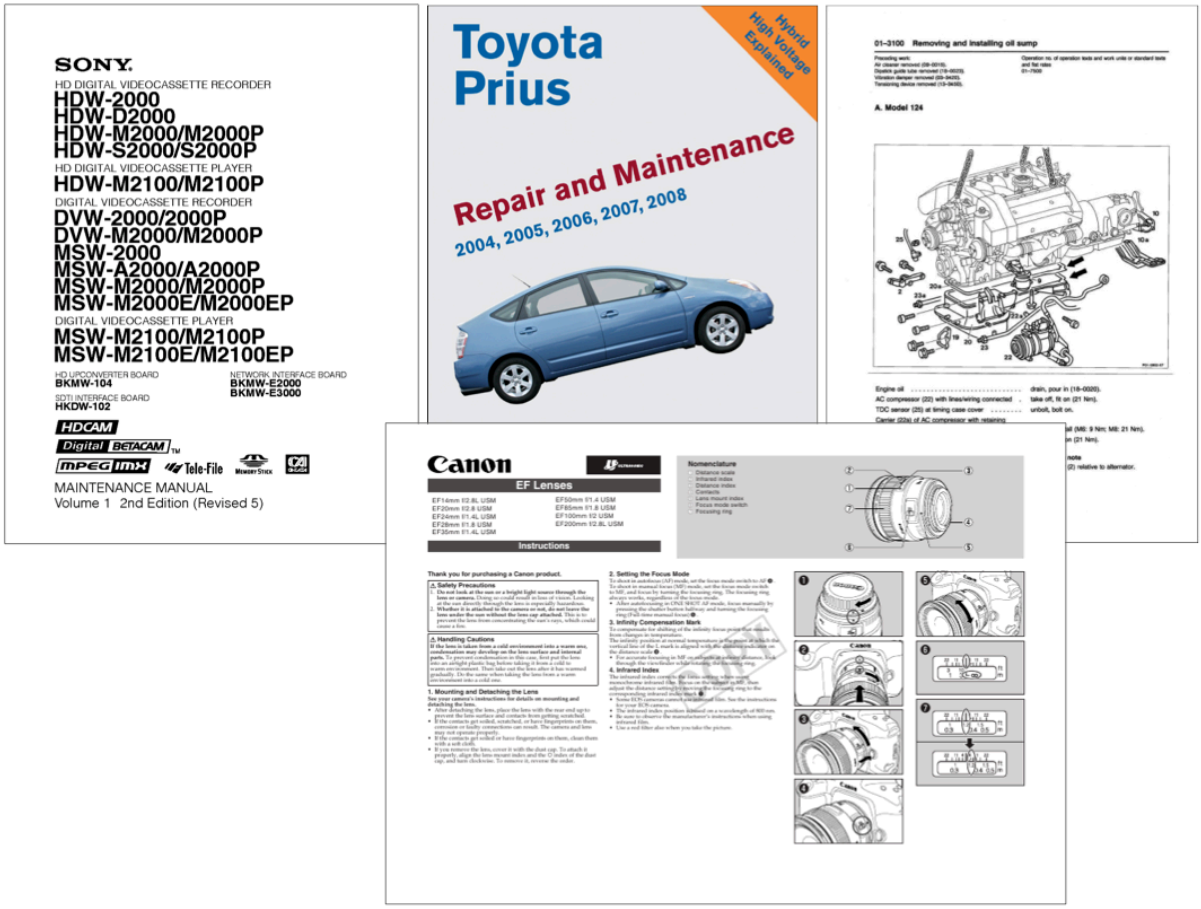

Figure 5: Various forms of technical documents[24]

External documentation, as part of technical communication, is intended to support the customer in different problematic situations. A study by Gebert[25] gives insights into the use of instruction manuals. Based on the study, 37 percent of the participating users would instantly utilize the product before seeing manuals. As about another third of the participants mentioned that they only partially read manuals, only the last third actually requires the manual for initial usage. A later study by Wiese, Sauer and Ratzinger[26] analyzed the usage of written product information for electronic consumer products. They observed a test-group

[24] Sources from left to right to bottom: http://elektrotanya.com/PREVIEWS/78967544/23432455/sony/sony_dvw_msw_hdw-2000_d2000_m2000_s2000_m2100_p_ep_maintenance_manual.pdf_1.png, http://www.bentleypublishers.com/images/bentley_tp08_cv_large.jpg, http://crazyaboutmercedes.com/35-thickbox_default/mercedes-benz-service-manual-v-8-engine-m119.jpg, http://www.rubrication.net/images/PDF-Preview-Canon-Camera-Lens-User-Manual-for-Canon-EF-20mm-f2.8-USM-Camera-Lens.png

[25] Cf. Dörte Gebert, "Gebrauchsansweisungen Als Marketinginstrument" (Wiesbaden: Forkel-Verlag, 1988).

[26] Bettina S Wiese, Jürgen Sauer and Bruno Rüttinger, "Consumers' Use of Written Product Information.," *Ergonomics*, 47 (2004), 1180–94.

regarding their triggers for usages of manuals and categorized potential triggers into personality variables, socio-demographic variables, product features and situational influences. Especially situational influences show an increased demand for manuals as whenever participants received cues, a higher demand for further instructions was evoked.

According to these findings two main triggers for the demand of technical documentation can be depicted:

- Product learning in early product adoption phases
- Problem solving and maintenance support

While the former is naturally requested at first usages of the product or the usage of new product features, support and problem solving offerings are requested at all times.

2.1.1 Marketing and information systems research

Although usefulness of products plays a major role in these definitions, most of them ignore the high importance of technical documents in terms of marketing. About two thirds of customers still read or at least notice product accompanied documents before they put the product into operation.[27] [28] For these customers, the technical document represents the first contact of a new product.

Marketing research defines such points of contact between customer and business as touchpoints.[29] Bruhn and Ahlers[30] describe touchpoints as "*communicative contacts between business and customer where customers receive an impression of brand, employees and/or services*".

Another definition by Spengler, Sigrist and Sopp[31] extends the focus of touchpoints: "*The term 'touchpoints' refers to all the contact points of a brand with potential or actual clients and other stakeholders"*.

[27] Cf. Thomas Puchleitner, "The Impact of Technological Development on the Use of Technical Product Documentation.," in *Proceedings of the 3rd International Conference on Social Eco-Informatics* (Lissabon, 2013), pp. 28–33.

[28] Cf. Gebert, "Gebrauchsansweisungen Als Marketinginstrument."

[29] Cf. Christopher Meyer and André Schwager, "Understanding Customer Experience," *Harvard business review*, 85 (2007).

[30] Cf. Manfred Bruhn and Grit Mareike Ahlers, "Customer Touch Points - Aufgaben Und Vorgehensweise Einer Multi-Channel Communication," in *Handbuch Multi-Channel-Marketing* (Wiesbaden: Gabler, 2007), pp. 393–425.

[31] Cf. Christoph Spengler, Renzo Sigrist and Peter Sopp, "Exploit Innovation Potential to the Maximum," *Swiss Innovation Guide*, 2011, 1–4.

This leads to a more marketing-orientated focus of technical documents due to their position as a marketing touchpoint. Researchers with background in marketing already connect both ideologies and define technical documents as an instrument with influence on customer satisfaction. Nickl[32] sees technical documents even as a classic marketing instrument: "*Technical documentation is part of the product and has to match the product's performance. At the same time, documentation represents an output of communication, which transports the brand's image. Therefore, technical documentation is related to classical instruments of marketing such as product flyer or advertisements*".

Customer experience

Figure 4 already highlighted where technical documentation takes place within the buying lifecycle. Therefore, corresponding touchpoints relate to offerings in aftersales, leading to the question which marketing field includes actions after a purchase was already processed. Experience research, in particular user and customer experience research, opens a wider view regarding influencing factors of customer satisfaction. User and customer experience is often equally used in literature. Shawn, Dibeehi and Walden[33] define customer experience as follows: "*A customer experience is an interaction between an organization and a customer as perceived through a customer's conscious and subconscious mind. It is a blend of an organization's rational performance, the senses stimulated and emotions evoked, and intuitively measured against customer expectations across all moments of contact*". They separate between the terms of usability, user experience and customer experience (see Figure 6).

[32] Cf. Markus Nickl, *Marken – Herausforderung Für Die Technische Dokumentation*, *Marke und Gesellschaft* (VS Verlag für Sozialwissenschaften, 2009).

[33] Cf. C Shaw, Q Dibeehi and S Walden, *Customer Experience: Future Trends and Insights* (Palgrave Macmillan, 2010).

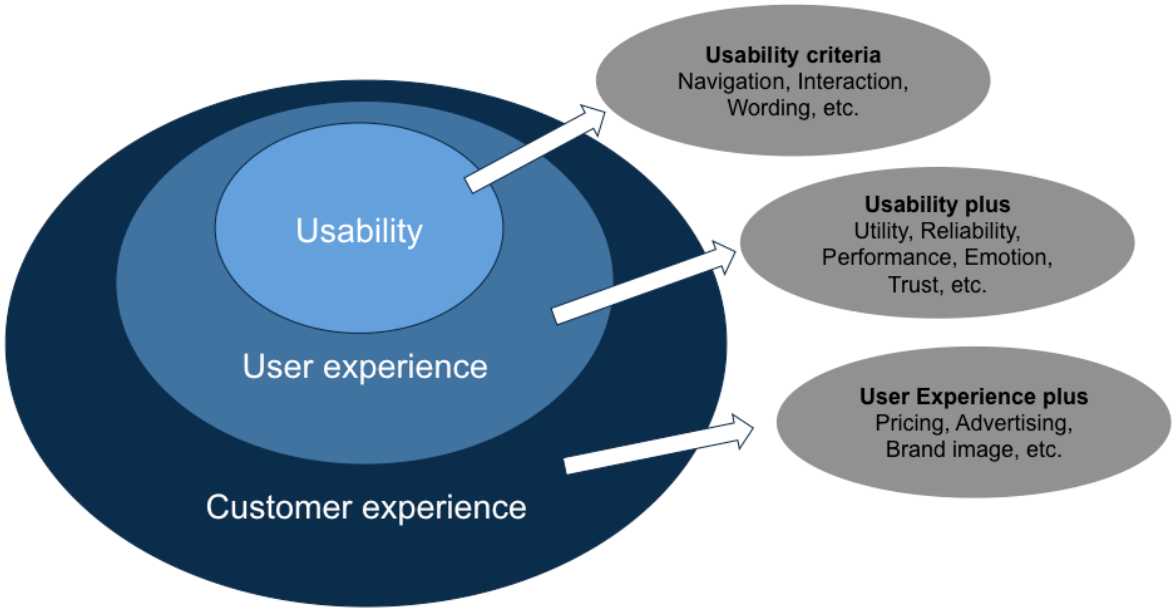

Figure 6: Usability vs. User experience vs. Customer experience[34]

Usability research focuses on various aspects of product design[35], while technical communication and documentation relates to usage-related aspects off the product's current scope[36]. Usability describes aspects that affect users while using the product and thereby represent form-factors of a product like the navigation or wording. Research within the area of user experience includes factors that describe the product, like utility or reliability, but also take personal impressions into consideration. The most holistic approach refers to the customer experience, where all potential influencing factors are considered. The pricing model, the brand's image, advertising campaigns as well as the reputation of quality are part of the customer's experience.

Product adoption

Besides marketing literature, also information systems research engages in usability and experience research. While marketing research concentrates on impacts on buying behavior, information systems research intends to design services according to users' requirements. Both mindsets endorse acceptance research to allow implications for the adoption and usage of products and services. For technical products, the technology acceptance model by

[34] Cf. Shaw, Dibeehi and Walden, *Customer Experience: Future Trends and Insights*.

[35] Cf. Jakob Nielsen, *Usability Engineering (Interactive Technologies)* (San Francisco: Morgan Kaufmann, 1993), p. 362.

[36] Cf. Janice Redish, "Technical Communication and Usability : Intertwined Strands and Mutual Influences Commentary," *IEEE Transactions on Professional Communication*, 53 (2010), 191–201.

Davis[37] is an often-cited construct to explain which factors influence the adoption of products. Also usability research claims to identify relevant aspects for further usage[38]. Davis as well as Nielsen name factors with high impact on positive product adoption (see Figure 7 and Figure 8). Both agree, that the easiness to learn how to handle a service or product highly influences product adoption rates.

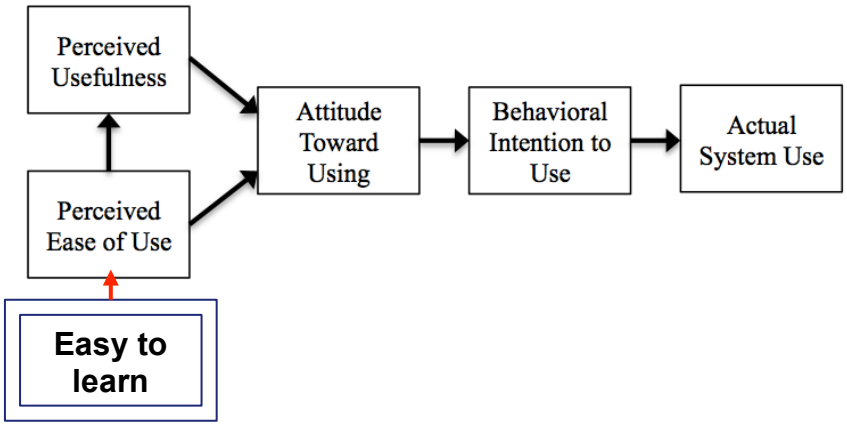

Figure 7: Technology Acceptance Model (TAM) by Davis[39]

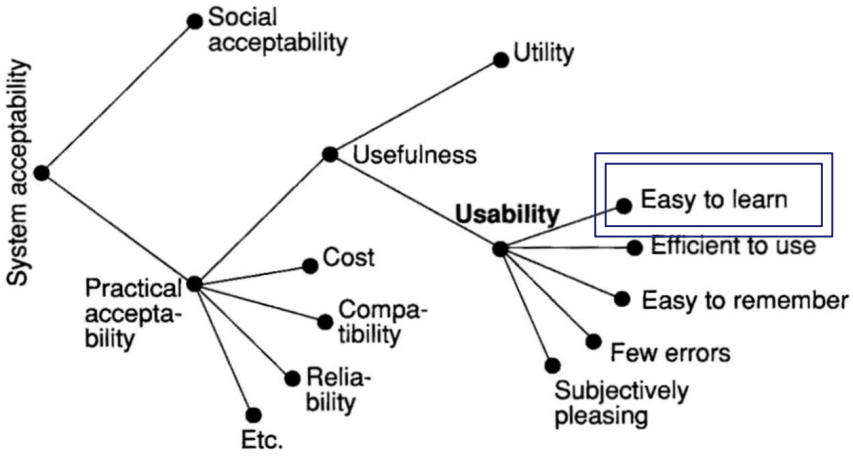

Figure 8: System acceptability by Nielsen[40]

[37] Cf. Fred D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13 (1989), 319–340.

[38] Cf. Nielsen.

[39] Cf. Davis.

[40] Cf. Nielsen.

By concluding all these aspects, the framework of research in Figure 9 can be drawn. As customer support actions represent activities in aftersales, they influence the customers overall experience.

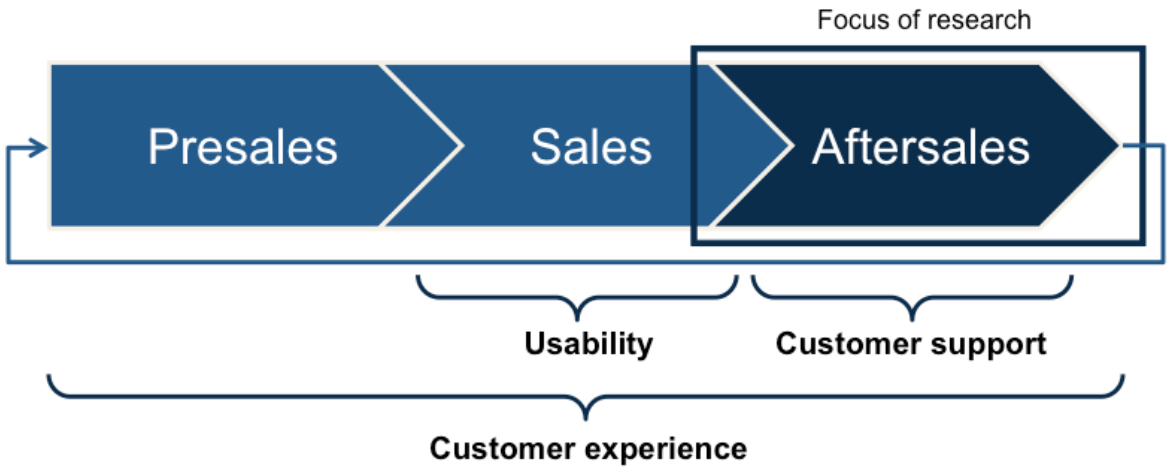

Figure 9: Framework of research

An optimization of customer support actions to improve customer experience support was retained across all publications.

2.1.2 Relevance in literature

Besides the qualitative research regarding corresponding literature, also a quantitative methodology was applied. Scientometric analyses allow the screening of topics to gain knowledge about the addressed research areas as well as to depict the most referred terms and keywords for further research.[41]

Usability as well as experience research gained vast importance in the last years. A scientometric literature analysis was conducted in April 2014. Based on the scientific database Scopus[42], the keywords “usability”, “user experience” and “customer experience” show an overall of 2.719 publications within the area of social sciences for the year 2000. Numbers constantly increased to more than 16.000 new publications per year starting in 2012. As the selected database shows a continuous increase in publications within various topics, a comparison between publication increase of all three terms and overall publications was performed. Figure 10 shows this comparison in form of percentages of publications addressing these three aspects and overall publications within the social sciences. While in

[41] Cf. Alan Porter, Alisa Kongthon and Jye-Chyi Lu, “Research Profiling: Improving the Literature Review,” *Scientometrics*, 53 (2002), 351–370.

[42] Elsevier: Scopus, available at http://www.scopus.com [accessed 21 April 2014]

2001 about 0,25 percent of all published articles relate to usability research, the number continuously grows to more than 0,57 percent in 2013. Experience research shows similar developments with an increase from 1,32 percent to 2,74 percent for 'user experience' and 0,39 percent to 1,17 percent for "customer experience" between 2001 and 2013.

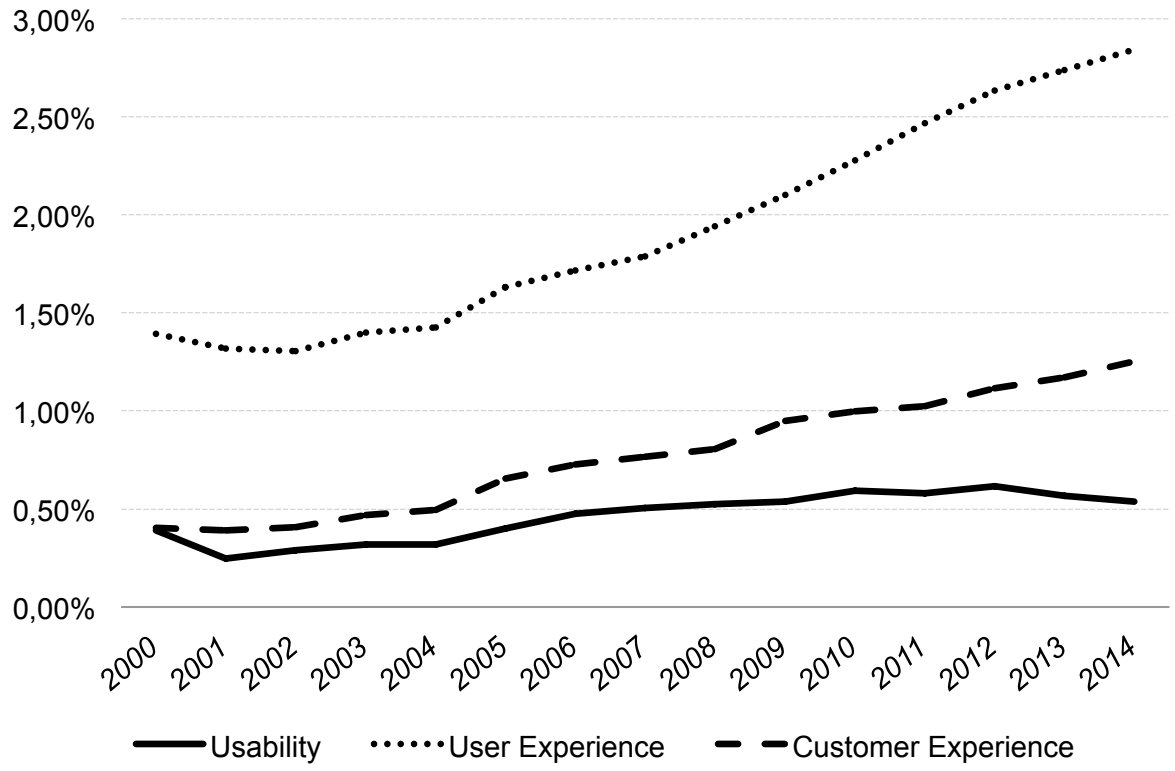

Figure 10: Grow in publications for usability and experience research[43]

This increased relevance of usability and experience research is triggered by uprising demand in practice. Topics like "usability engineering"[44] or "human-centered design"[45] and process models like the "service design process"[46] shift the focus from the product with its functionalities and limitations, to the actual user. Changing the viewpoint from an internal

[43] Percentage of term-related publications per year within life sciences on Scopus.com, performed April 2014.

[44] Cf. Nielsen.

[45] Cf. Susan Gasson, "Human-Centered Vs. User-Centered Approaches to Information System Design," *Journal of Information Technology Theory and Application*, 5 (2003), 29–46.

[46] Cf. Arthur V. Hill and others, "Research Opportunities in Service Process Design," *Journal of Operations Management*, 20 (2002), 189–202.

perspective to the thinking in customer problems allows the design of competitive products and services[47].

Scientometric literature analyses are powerful tools to overview a research landscape and gain deep insights into a very specific topic. Identifying researchers or institutions within the research area ensures state-of-the-art knowledge and builds the basis for further knowledge exchange. The publication “Narrowing Down Learning Research – Technical Documentation in Information Systems Research” in section 3 marks an important step within the research project. Starting with the problem situation the customer is facing when requesting technical documents, the scientific community was screened and further analyzed by applying database technologies. By combining quantitative with qualitative analysis, a solid literature foundation was built.

2.2 Marketing communication and technical documentation

The Internet opened new potentials in various fields. Especially the way people are communicating changed tremendously due to new technological developments. To follow the research aim, a detailed view on this ongoing change in communication has to be given. First, the question on what actually changed has to be answered, to identify which forms of communication still addresses customers. Second, customers understanding of technical documentation and customer support has to be analyzed. By considering both views, the environmental factors of modern communication as well as specific components of technical documentation, conclusions for support service offerings can be drawn.

2.2.1 Changes in communication behavior

Internet usage is rapidly growing in the last decades. Numbers by TNS Infratest[48] show the distribution of Internet connectivity in German households (see Figure 11). While in 2001 about 37 percent of all Germans had access to the Internet, numbers increased to more than 76 percent. Keeping in mind that elderly people and young children are not addressed here, large parts of the consuming society is online and likely uilitzing new communication possibilities.

[47] Cf. Christian Kraft, *User Experience Innovation: User Centered Design That Works* (Apress, 2012).

[48] TNS Infratest: percentages of inhabitants (14 years of age and older) online in Germany 2013 via Statista.

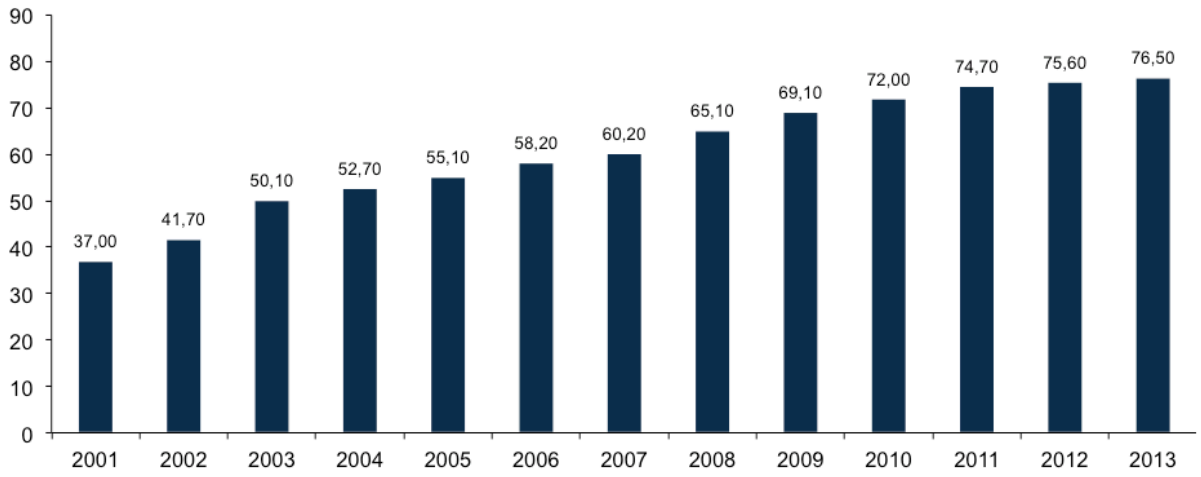

Figure 11: Percentages of inhabitants online in Germany[49]

This development had tremendous impact on media channels and media consumptions. While the transition from analog to digital video and audio already took place, a similar process is currently affecting printed media. Distribution numbers of classical printed newspapers and magazines are decreasing, while digital subscriptions are increasing. The ARD/ZDF longterm study in Figure 12 observes this media development. Numbers are given for the years 1970, 1980, 1990, 2000 and 2010. Of particular interest are the separated numbers of 2000 and 2010. For both years, the youth (14 to 29 years of age) is separated from the overall audience. While a general switch from television and newspaper to Internet channels can be depicted, these separated numbers outline the relevance of habits in the usage of media channels. In 2010, 32 percent utilized television to gather news, about 11 percent read newspapers. For the same year, numbers are significantly lower for the youth with only 16 and 1 percent. While overall only 33 percent are using Internet channels to obtain information, people between 14 and 29 years of age primarily surf the Internet (about 70 percent). People keep their habits, which is an important fact for the implementation of new information systems.

[49] TNS Infratest: percentages of inhabitants (14 years of age and older) online in Germany 2013 via Statista.

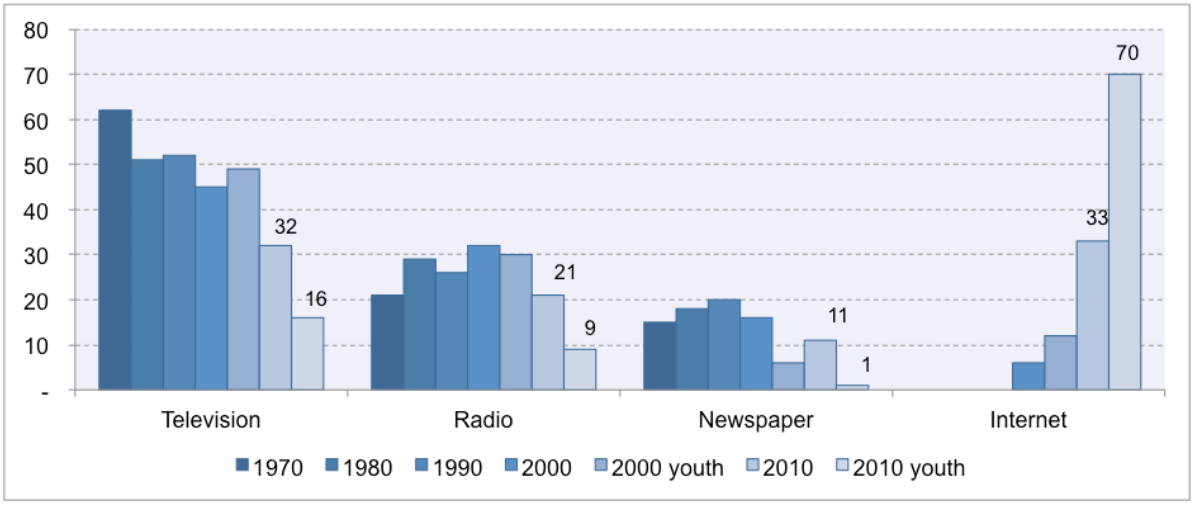

Figure 12: Survey results on primary sources for information gathering[50]

After determining the development in overall Internet usage and depicting the relevance of age for media channels, actual applications come into mind. Again, the ARD/ZDF longtime study gives detailed insights into the usage behavior when surfing the web. As Figure 13 shows, information research like Wikipedia[51] still plays a mayor part in web usage scenarios. Entertainment follows with video portals such as YouTube[52]. Various forms of communities build the third part of essential tools that are utilized. Especially private communities and social media services are gaining importance.

[50] ARD/ZDF Longtime Study on mass-communication, Germany 1970-2010. Participants in total (age 14 and older) vs. youth (age 14 to 29 only).

[51] Wikipedia available at http://www.wikipedia.org [accessed 21 April 2014].

[52] Youtube available at http://www.youtube.com [accessed 21 April 2014].

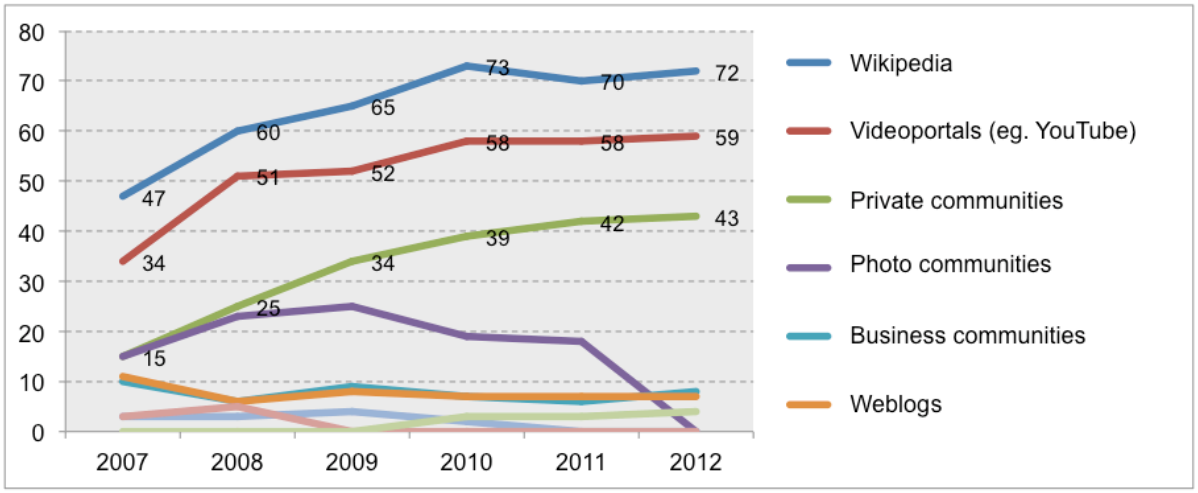

Figure 13: Survey on usage of online services in Germany[53]

Figure 14 shows concrete numbers regarding current developments in social media. About two billion people are currently connected online by social media networks. This number is predicted to grow to more than 2,5 billion within the next three years. Social media networks not only refer to private networks such as Facebook, but also business networks where specialists and opinion leaders come together belong to this group.

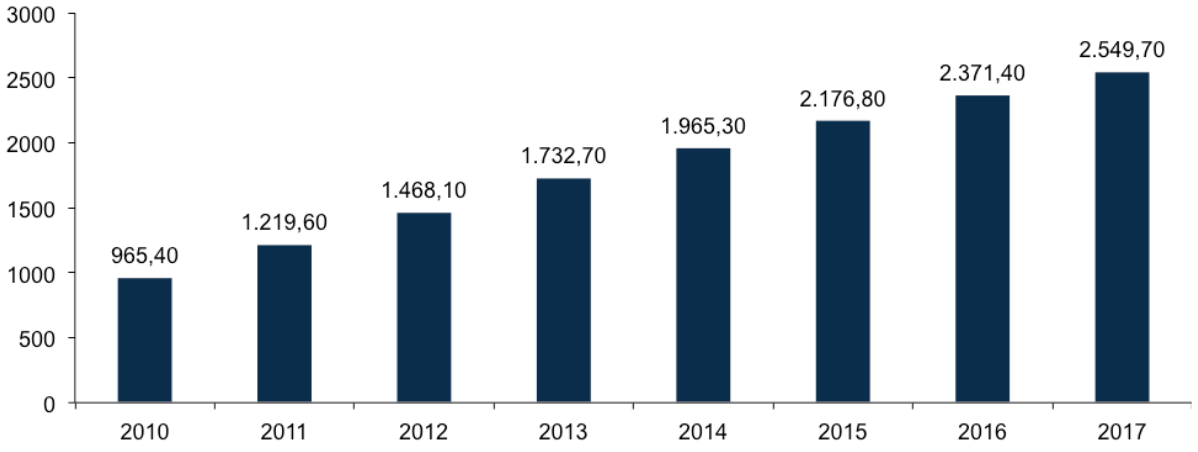

Figure 14: Worldwide development of social media usage[54]

The predicted progress of social media networking and the thereby released communication potentials highlights upcoming changes in business communication. Communication is in steady progress. Starting with the age of orality, to the age of literacy to the age of electronic

[53] ARD/ZDF Longtime Study on mass-communication, Germany 1970-2010. Usage of online services (age 14 and older).

[54] eMarketer: Worldwide social media users, June 2013 via Statista.

mass media, the age of new media evolved.[55] While earlier developments required centuries to spread, recent decades and years showed an enormous increase in technological development and thus, new communication possibilities[56]. Especially the permantent Internet availability due to smartphones allows people to stay in contact via different channels whenever and wherever required.[57]

Communication theory research focused on the transfer of information and knowledge between individuals. Aristotle (384 BC – 322 BC) already concentrated parts of his research on information transmission processing. He defined an early form of the sender-receiver model including the sender (lat. “ethos”), the receiver (lat. “pathos”) and the actual content (lat. “logos”).[58] Until today several theories are built on this model, starting from more technical aspects of signal transmission[59] to more marketing-orientated models.

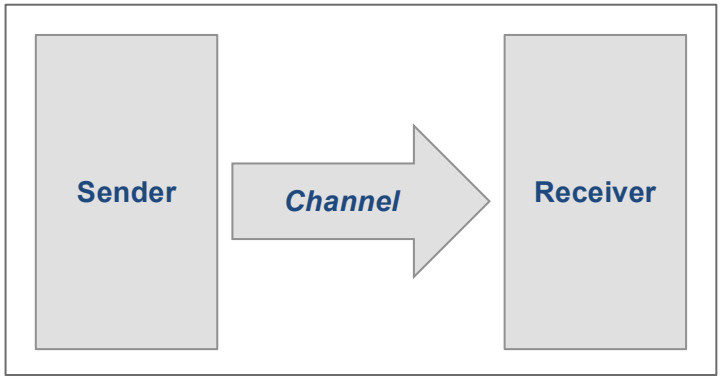

Figure 15: Basic sender-receiver model used in communication theory[60]

Late literature often refers to spaces of information exchange, which are more compatible with modern thinking in business communication.[61] [62] The communication space model

[55] Cf. Michael Harnisch and Thomas Puchleitner, “Patronizing Information Units,” in *Proceedings of the 23rd International Central European Conference on Information and Intelligent Systems* (Varazdin: Hunjak, T./Lovrencic, S./Tomicic, I., 2012), pp. 279–285.

[56] Cf. P. A. Argenti, “How Technology Has Influenced the Field of Corporate Communication,” *Journal of Business and Technical Communication*, 2006, 357–370.

[57] Cf. Juuso Karikoski and Sakari Luukkainen, “Substitution in Smartphone Communication Services,” *2011 15th International Conference on Intelligence in Next Generation Networks*, 2011, 313–318.

[58] Cf. Moisés Mayordomo-Marín, *Argumentiert Paulus Logisch?* (Tübingen: Mohr Siebeck, 2005).

[59] Cf. C E Shannon and W Weaver, *The Mathematical Theory of Communication*, *The mathematical theory of communication* (University of Illinois Press, 1949), xxvii.

[60] Cf. Harry Pross, *Medienforschung: Film, Funk, Presse, Fernsehen* (Darmstadt: Habel, 1972).

[61] Cf. Stefan Katzenberger, *Komplementäre Kommunikation Lokaler Medien: Hörfunk Und Presse: Intermediale Profile, Programmliche Pools, Publizistische Performanz* (Münster: LIT Verlag Münster, 1999).

[62] Cf. Thomas Wilking, *Strukturen Lokaler Nachrichten: Eine Empirische Untersuchung von Text- Und Bildberichterstattung* (München/New York/London/Paris: Saur, 1990).

allows business-oriented thinking in marketing communication. Every customer creates it's own space and utilizes various information systems for communication purposes. While some might access social networks, others prefer traditional ways of communication. Persons, as well as businesses, can participate in a conversation whenever their spaces utilize the same information systems. Businesses are able to decide which systems they may participate in and which are left out. Nevertheless, businesses get aware of the fact that not all potential systems are addressed and thus, customers may communicate directly (without the business) to each other. Keeping that in mind, businesses have to acknowledge this loss of control within the traditional communication chain, implementing more adequate forms of marketing communication.

The publication "Communication Technology as Enabler for the Communication Space" in section 4 describes the communication space model in detail. A special focus is set on the relevant components and the impacts for corporate communication. Interdependent factors of communication systems build the basis to fulfill customers' communication needs.

2.2.2 Role of technical documentation in marketing

Customer support, including various forms of manuals, instruction sets or frequently asked questions (FAQs) plays an uprising role for businesses to distinguish their products from competitors. Especially technical products are often developed and produced in standardized processes and outsourced to countries with low labor costs, reducing potential differentiations in terms of technology or functionality. While these alignments reduce product costs, customers quest for new recognition values and ways to connect with brands. Customer support shows one chance to form a competitive advantage by developing support as a key competence for positive customer experience.

Table 1 lists major trends, which lead to a rising importance of user-centered technical documentation and support.

Table 1: Trends fostering technical documentation as instrument of marketing

Increasing amount of technical products	Not only the amount of products possessed and used is rising in total, but also a growing technologization of products can be spotted.[63]
Shortened product	Studies show that the lifecycles of products decreas,

[63] 10000 produkte

lifecycle	leading to an increased effort for product learning. Exemplary, in 2006 the average German kept a car for more than 8 years, while in 2012 numbers dropped to about 5 years.[64] Similar studies can be found for consumer electronics like mobile phones.[65]
Changed usage behavior in case of support	Technical products used to come with various forms of enclosed manuals and instructions. Due to legal issues these enclosures are still required for many products but do not match customers' usage and learning behaviors any more. In times of permanent Internet connectivity, users directly request information the time they need it and in their preferred form.[66]
Social interaction between customers	Social media allows customers to share their experiences regarding products and support. Existing users therefore influence other potential customers. Businesses have to adapt their communication processes to handle this exchange by implementing a patronizing mindset in terms of customer.[67]
Convergence in product features	Many markets, like the smartphone market, vest into standardized processes and furthermore products, which are hard to distinguish for potential customers. Factors apart direct product features like the brand's image or support offerings differentiate brands and products and gain importance in the decision making process.[68] [69]

[64] Cf. puls Marktforschung GmbH, *Autokaeufer Puls 2012* (Germany, 2012).

[65] Cf. Andreas Manhart and Jens Gröger, "PROSA Smartphones Entwicklung Der Vergabekriterien Für Ein Klimaschutzbezogenes Umweltzeichen," 49 (2012), 30–40.

[66] Cf. Puchleitner, "The Impact of Technological Development on the Use of Technical Product Documentation."

[67] Cf. Harnisch and Puchleitner.

[68] Cf. Morris A. Cohen, N Agrawal and V Agrawal, "Winning in the Aftermarket," *Harvard Business Review*, 84 (2006), 129–138.

[69] Cf. Frank Jacob and Wolfgang Ulaga, "The Transition from Product to Service in Business Markets: An Agenda for Academic Inquiry," *Industrial Marketing Management*, 37 (2008), 247–253.

Businesses have to react to these trends and adopt their support strategy to obtain high customer experience. Personalized offers for product learning and customer support as well as the ability to directly respond to customer problems by providing automated suggestions for potential solutions combine both parties' interests. While users consume support services, businesses get the chance to get deeper insights into their customers' product usages. Data analysis on provided support services allows the detection of often appearing problems or gaining awareness regarding product features that are difficult to understand for customers.

Trends from Table 1 represent environmental factors for businesses as well as customers. These trends act as a perspective for future developments, but cannot describe actual attitudes or usage scenarios of technical documentation in real life environments.

To extend available literature, a study on the actual usage of support instruments was conducted. The study not only concentrated on customer opinions, but also included observations and results of expert interviews. The multi-source and multi-method approach was performed in the publication "The Impact of Technological Development on the use of Technical Product Documentation".

2.3 Business applications

Facing these trends in communication change, it is particularly surprising that many companies still define technical documents in a very traditional way. Marketing potentials are left out, omitting chances for developing positive first touchpoints.

A simple case demonstrates different approaches on technical documents. Nokia was the global market leader for mobile phones for many years. Apple, a former computer manufacturer, entered the mobile phone market in 2007. While Nokia's worldwide market share dropped from 36,4 percent to 13,9 percent between 2009 and 2013, Apple's market share increased from 2,1 percent to 8,3 percent.[70] Apple's marketing-based view on technical devices changed the phone market in tremendous ways. This can also be observed by looking at their different thinking of technical documentation.

The comparison took place in autumn 2013 with products of their actual product range – the Apple iPhone 5 and the Nokia Lumia 620. The package's enclosed documents were

[70] Cf. Gartner: Marketshares of leading mobile phone manufacturer worldwide between 2009 to 2013 via Statista.

compared based on the dimensions of weight, pages and illustrations. The iPhone comes with warranty information, their typical Apple stickers (also a marketing instrument) and their brochure named „Hello.“. For German packages, Nokia still enclosures classic user manuals in at least two languages. Besides the warranty information, two user manuals are delivered with a total of more then 120 grams weight. Table 2 shows the comparison of both package enclosures. First, attention is set on the scope of both documents. The iPhone document only holds 14 pages containing 14 figures while the document from Nokia is a full manual with 50 pages and 15 figures. The document is therefore more than three times more extensive in weight and pages.

Table 2: Comparison of product package enclosure between Nokia and Apple[71]

	Nokia Lumia 620	**Apple iPhone 5**	**Factor**
Weight	60g	18g	~ 3,3
Pages	50	14	~ 3,5
Figures	15	14	~ 1
Naming	User Guide	Hello.	

While Nokia still interprets technical documentation in the very traditional form of printed manuals enclosed in the product package, Apple seems aware of the fact that customers only overlook these printings before usage. Customers seek for support in context-sensitive ways, utilizing generic search engines or other virtual support offerings instead of reading instruction manuals[72].

[71] Comparison is based on German document versions.

[72] Cf. Puchleitner, “The Impact of Technological Development on the Use of Technical Product Documentation.”

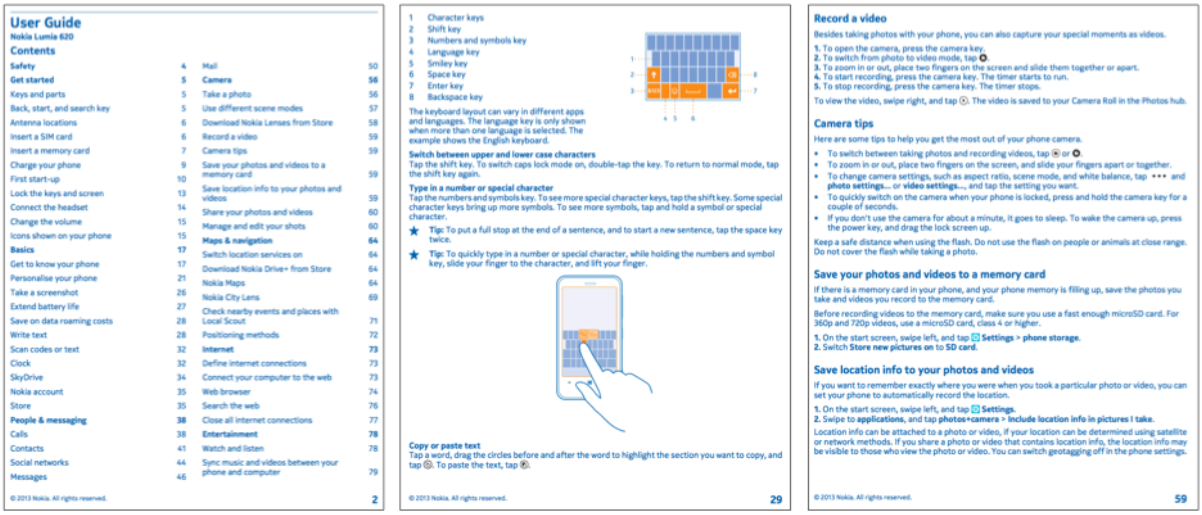

Figure 16: Product enclosed documentation for Nokia Lumia 620

In terms of marketing, the design, structure and layout differs the most between both variants. Apple uses the document as a first touchpoint to lead the customer into using the product. No technical details are explained, only solutions to fulfill customer needs are presented. Additionally, the representation itself is simple and inviting. The traditional manual from Nokia on the other hand sticks to an instructive form, starting with the list of content. Figures are rare and are only used to describe particularly difficult explanations. Nokia's manual also represents a touchpoint but lacks of taking a marketing advantage.

Figure 17: Product enclosed documentation for Apple iPhone 5

Besides the already discussed aspects regarding printed documents, also the product naming plays an important role when discussing customer support. A conducted survey shows that customers are not always aware of the exact product model or type they are

operating[73]. Naming devices in simple ways and printing the name somewhere on the product reduces the risk of customers to search for wrong support information. By simply numbering their smartphones starting with the initial iPhone to the current “5s” is easier to remember than longer identifiers such as the Lumia model „620“.

2.3.1 Virtual customer environments

The paradigm shift from printed product documentations on the one hand and direct one-to-one customer support on the other hand to an integrated customer environment is fostered by recent technological developments and the potentials of online communications. Online communities spread to fulfill very different needs, from private information exchange to knowledge transfer for business purposes. Late examples for the opening of company processes to employees and customers are open innovation approaches and value co-creation activities. In literature, customers take up to five roles in the value creation process: resource, co-creator, buyer, user and the product itself.[74] [75] Online communities, where customers fulfill some or all of these roles, are entitled as virtual customer environments (VCEs).

VCEs are intended to bond businesses with their customers by providing various benefits. While VCEs in general are utilized for product testing or prototype evaluations, this thesis covers aspects of product support. VCEs fulfill the customers’ need for information exchange in many ways. First, customers gather new knowledge out of these environments as the provided information is intended to support them. Online instruction manuals, learning materials, FAQs or other company-produced and product-related documents can be integrated. Second, customers may directly get help in case of a problem. Depending on the provided services, live-help systems via online chats or online webcasts show beneficial. Written manuals deliver support in a predefined structured way. Customers have to adopt their thinking according to this structure to find potential solutions. VCEs allow customers to ask questions by querying for them in a yielded database. Thus, customers are not required to convert their problem situation into a predefined searchable form like in static manuals. Instead, a user-centered approach is applied by allowing customers to gather information directly in the way of their context. Third, customers may not only query for solutions they may also ask questions from a user’s perspective to a forum, where other customers may participate too. In this third case, customers not only act as a consumer of the support environment but also actively participate on discussions to solve problems.

[73] Cf. Puchleitner, “The Impact of Technological Development on the Use of Technical Product Documentation.”

[74] Cf. Satish Nambisan and RA Baron, “Virtual Customer Environments: Testing a Model of Voluntary Participation in Value Co-creation Activities,” *Journal of Product Innovation Management*, 2009, 388–406.

[75] Cf. Satish Nambisan, “Designing Virtual Customer Environments for New Product Development: Toward a Theory,” *Academy of Management Review*, 27 (2002), 392–413.

Four operational scenarios can be depicted: for product ideation, product design and development, product testing and for actions in product support services[76]. These four scenarios are described in Figure 18.

	PRODUCT IDEATION	PRODUCT DESIGN & DEVELOPMENT	PRODUCT TESTING	PRODUCT SUPPORT SERVICES
Primary Customer Role	*As Resource*	As *Co-creator* and *Co-producer*	As product *Tester*	As product *User*
Desired Outcome(s)	• Product improvement ideas and suggestions • New product ideas	• Inputs on product features and design tradeoffs • Production and delivery of products/services	• Identification of product design flaws • Inputs on product (prototype) performance	• Delivery of product support services to peer customers • Diffusion of new product information • Product improvement suggestions
Typical Interaction Facilities	• Discussion forums • Messaging tools • Product knowledge base	• Discussion forums • User design tool kits • Virtual prototyping tools and interactive games	• Discussion forums • Virtual concept testing tools • Virtual product simulations	• Discussion forums • Messaging tools • Product knowledge base

Figure 18: Operational scenarios of virtual customer environments[77]

Nambisan and Nambisan[78] already define the most important role of customers within VCEs: *"Perhaps the most common role for customers is supporting other customers as product support specialists. This allows them to leverage their product-related knowledge and expertise to extend support to peers."*

Finally, state-of-the-art in virtual customer environments research already defined generic implications for the design of support systems[79]:

- Design to encourage customer innovation:
  Special features, such as content rating systems, customer recognition programs, and exclusive customer forums, provide richer innovation environments.
- Link the external to the internal:
  Companies can adapt organizational roles, communications mechanisms, and product development processes to connect VCE participants with internal product teams.

[76] Cf. Satish Nambisan and Robert a. Baron, "Interactions in Virtual Customer Environments: Implications for Product Support and Customer Relationship Management," *Journal of Interactive Marketing*, 21 (2007), 42–62.

[77] Cf. Nambisan and Robert a. Baron.

[78] Cf. S Nambisan and P Nambisan, "How to Profit From a Better Virtual Customer Environment," *MIT Sloan Management Review*, 2008.

[79] Cf. Satish Nambisan, "Inside Rensselaer , June 6 , 2008 : Enhancing Virtual Customer Environments," 2 (2008), 2008.

- Embed the VCE in customer relationship management activities:
  By involving VCE participants in existing, offline marketing and customer relations activities, companies can demonstrate their appreciation and cement customer relationships.
- Manage customer expectations:
  Companies can reduce the potential for misunderstanding and negative outcomes by managing customer expectations about their roles in the innovation process and how their input will be used.

Particularly surprising is the fact, that VCEs represent information systems that intend to better suit customer expectations in terms of communication behavior. No focus on the customer at the design phase was set so far. Only the management of customer expectations is mentioned as one implication to follow. Customers are more seen as resources to optimize processes in terms of business outcomes. Viewing the support process from the perspective of customers allows the design of service systems with respect to customers' actual requirements and needs. Also, insights into learning theory are required to implement useful support offerings. Various theories and models for sustaining knowledge gaining can be depicted. Customer support, as a very specific variant of knowledge transfer, requires adequate models for the design of learning environments.

The publication „Designing services for customer support: ensuring high customer experience for the consumer electronics market" in section 6 extends state-of-the-art research in customer support environments by integrating the customer's view into the design process. The customer journey mapping method was applied and concrete business implications could be depicted. In addition, learning theory research was analyzed to determine models for implementations in context of customer support. Results can be found in the publication „Using New Media for Consumer Learning: Mapping practical and theoretical approaches on Information Service Design" in section 7.

2.3.2 Integration into products

Technical documentation belongs to a product or service and customers perceive it as a part of the actual product[80]. By utilizing modern information technologies both parts move closer together. For years now, the software industries delivers products with integrated help systems, merging both elements into the product itself. Software products rarely come with

[80] Cf. Gebert, "Gebrauchsansweisungen Als Marketinginstrument."

traditional manuals, as customers are expected to retrieve support directly via the product or online. Currently, non-software markets gain these opportunities too. An increasing amount of physical products are controlled by microprocessors and software components, creating possibilities for the integration of new logics for customer support.[81]

Integrations between product and support offerings can be realized either by collecting product usage data for support purposes or by embedding support offerings as product features. Collecting product usage data is a profound way to analyze malfunction causes in various markets. In the automotive sector, service stations plug a service device in a provided interface for reading out all kind of indicators for problem solving and checking conditions.

Data seems to be the new value in information systems due to tremendous usage potentials[82]. First, data has to be collected in some ways and second, beneficial services or product optimizations and implementations have be realized. The collection of data can be achieved by explicit user input or by implicit data gathering techniques. While the willingness of users for entering data highly depends on expected benefits to gain, implicit approaches can be realized anyways. As the automotive example already carried out, usage data while customers actually use the product can be collected and processed. Products are able to react to permanently analyzed usage data and respond to these usage scenarios. Information can be used to support customers by immediately guiding them through product functionalities while they learn how to use a product. This proactive form of customer support increases product adoption rates in early stages and represents a new way of integrating technical documentation.

A model for the integration of a proactive customer support environment was introduced in the publication „Model of a Personalization-based Agent System for Early Product Adoption Phases“ in section 8. The model includes an adaptable indicator-set to identify potential learning or usage shortcomings and a logic unit to perform support mechanism while using the product. The model was designed within a Software-as-a-Service context, as these distribution models allow customer to directly start using a product without any manuals.

Embedding support and learning environments into products also changes the design and manufacturing process of products. As already mentioned early, technical writers translate

[81] Cf. Beate Muranko and Rolf Drechsler, “Technical Documentation of Software and Hardware in Embedded Systems,” in *2006 IFIP International Conference on Very Large Scale Integration* (IEEE, 2006), pp. 261–266.

[82] Cf. Jer Thorp, “Big Data Is Not the New Oil - Jer Thorp - Harvard Business Review,” *Harvard business review*, 2012 <http://blogs.hbr.org/2012/11/data-humans-and-the-new-oil/> [accessed 21 April 2014].

product features from the language of engineers into a language the customer is expected to understand. Technical writers thereby act as an interface between engineer and customer. By embedding support mechanism into products, this workflow has to be adjusted.

The process on the left side of Figure 19 explains the traditional workflow for the creation of technical documents. Hereby the engineer develops the product, which acts as an input for the technical writer. The technical writer creates the documents that are then, together with the product, handed over to the customer. The right side of Figure 19 on the other hand demonstrates the process for the development of embedded support systems. Engineers, technical writers and marketers together develop a strategy to integrate an adequate support environment into the product. Only the product with the embedded support mechanism is handed over to the customer.

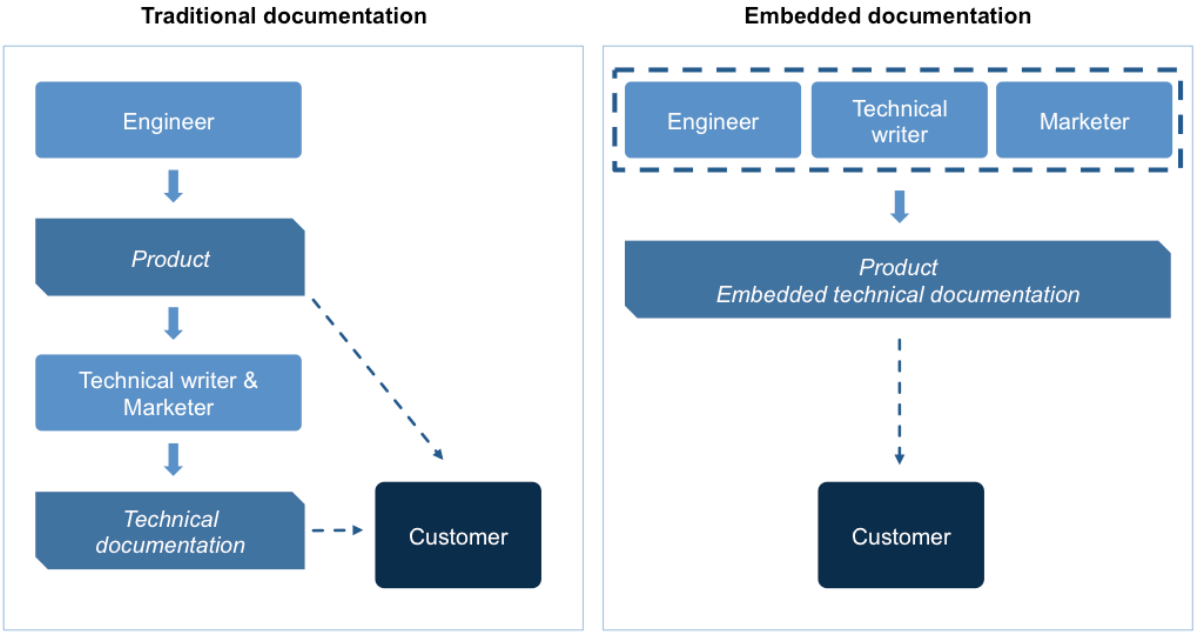

Figure 19: Difference between traditional and embedded documentation creation

While the traditional way of creating documentation in separated process steps requires specialists for each action, embedding support asks for an interdisciplinary approach. At the very beginning of conceptual product design phases, engineers are required to design embedded systems. Not only functional aspects have to be considered but also their role as touchpoints.

The publication „From manuals towards product embedded interactive learning environments“ in section 9 sets a focus on potentials and requirements of embedded customer support environments. Engineers require skills in technical writing as well as

marketing thinking for seamless integrations. This especially affects engineering education, as new skills have to be trained.

In a former subsection the rising importance of customer support as an instrument of marketing was argued. Support as a service on customers, allows businesses to differentiate from competitors. No example shows this in a more precise way than the 2013 introduced Amazon Mayday service offering. Amazon entered the competitive market segment of tablet computers by introducing their product range called „Kindle“. From the perspective of the customer, the tablet market offers a fast amount of products with similar technical specifications. Especially less technique-affine target groups demand for other criteria to make a buying decision. The Mayday system offers instant access to a real life person for all kind of support questions.

Figure 20: Amazon Mayday as an intergrated support service in the Kindle Fire HDX

Amazon is one of the first companies to promote their product, the Kindle Fire HDX, by highlighting a support feature. Commercials focus on the Mayday system to distinguish from other competitors. No other specifications or features of this technical product are even named in the commercial.

3 Narrowing Down Learning Research: Technical Documentation in Information Systems Research

The following article was authored by Thomas Puchleitner (University of Graz / evolaris next level GmbH), was published in the International Journal of Advanced Computer Science and Applications (IJACSA) and is a full citation with minor changes in formatting and numbering.[83]

3.0 Abstract

“Learning how to use technical products is of high interest for customers as well as businesses. Besides product usability, technical documentation in various forms plays a major role for the acceptance of innovative products. Software applications partly integrate personalized learning strategies but late developments in information and communication technology extend these potentials to the non-software sector too. Mobile devices as smartphones allow the linking between physical and virtual world and are thereby eligible instruments for product learning and the application of adequate learning theories. Very few scientific publications accurately addressing the learning of product features and functionalities can be depicted. By applying a research profiling approach as a stepwise analysis of available publications, relevant learning paradigms and their corresponding scientific areas are depicted. As this research topic relates to marketing as well as information systems research the applied approach may also show beneficial for other interdisciplinary intentions.

Keywords

problem-based learning, self-regulated learning, self-directed learning, product learning, customer learning, consumer learning

3.1 Introduction

It is said that the average European owns about 10.000 items [1]. These items are acquired because of personal needs and habits and later become part of daily routines and usages. Businesses compete to gain potential customer attention by applying various advertising strategies and techniques from simple printed and multimedia commercials to different kinds

[83] Puchleitner, T.: Narrowing Down Learning Research – Technical Documentation in Information Systems Research, in: International Journal of Advanced Computer Science and Applications (IJACSA), Vol. 4, No. 4, S. 23-28.

of less consciously strategies like guerilla marketing. Most of these strategies are based on the idea that the potential customer uses communication channels to fulfill communicational needs and therefore the same channel could be used for brand or product placements. Channels where marketing activities are placed have usually no relation to the product itself nor can the advertising message be timed with a potential usage scenario of the advertised product. Marketing activities while a customer is actually using a product, especially within the adoption process, allow the purposeful transportation of marketing messages. Besides the product itself as carrier of such information, additional product information, manuals or instruction sets act as connector between company and customer. Customers see these as part of the product and therefore include them into product evaluations and current or future buying decisions [2]. Software products allow the integration of learning techniques

The mutual relation between the product itself and its corresponding additional documents shows especially high importance for technical products and especially for software applications, as these require deeper product knowledge. Studies show that various experts for Internet, communication and media even doubt the disappearance of additional documentation for electronic devices [3]. Usability research focuses on different aspects of product design [4] where technical communication in form of external documentations [5] fulfills the purpose of guiding the user through a product related situation. Redish [6] gives a personal and detailed insight into the relation. While printed versions of product documentation only allow information flow from product producer to customer, recent developments in communication technology and diffusion of required hardware provide more versatile ways of information flow for physical consumer goods too. Technologies like machine-to-machine communications, cyber-physical systems or technologies to bridge virtual and physical worlds as NFC provide manifold ways of information exchange. Our ongoing research focuses on the transition from classic product documentation and information to the formation of a bidirectional one-to-one communication channel between businesses and customers. This is applied by personalized learning methods with high customer acceptance in the field of learning to use product functionalities. While customers profit due to faster and more convenient learning progresses, businesses gain insights not only into their products but also into customer requirements. This opens opportunities to analyze real usage scenarios and determine what functionalities are utilized and how customers apply them. Additionally, issues and mistakes users are recurrently facing while usage are spotted. Thereby businesses are given opportunity to adjust products and services for improved customer experience and higher user satisfaction [7]. Businesses applying such methods are able to gain competitive advantages and open new potentials for various marketing purposes. This area of tension between product marketing and digitally enabled product learning demands an alternative angle of view on learning theories with high relevance for information systems

research. E-learning is a contiguous discipline and field of research but focuses primarily on teaching aspects between teacher and student and thus does not cover aspects of marketing or product adaption.

3.1.1 Technical Communication in Marketing and Information Systems Research

Technical communication includes both internal and external information regarding the product where technical documentation refers to documents and information that is handed specifically to the user [2]. External documentation therefore acts as an instrument of marketing by allowing customers to enhance their product experience due to the application of feasible learning approaches. Literature for learning and learning paradigms in technical documentation rarely covers impacts for customer satisfaction or buying behavior while marketing and information systems aspects chiefly focus on the design and usability of products and their corresponding documentations. Technology acceptance research as well as usability research define the factor of *easy-to-use* as crucial for positive product adoption [8]. Nielsen [4] and Davis [9] both describe the easiness to learn how to use a product has especially high impact on “easy-to-use”. Products that are easy to learn therefore lead to a competitive advantage, which shows relevance whenever a potential customer enters the product adoption phase. Studies confirm that usage lifecycle for consumer goods decreases for various product groups like cars [10] or mobile phones [11]. Product groups with shorter usage lifecycle are rebought in shorter intervals and undergo these adoption phase more often, which also implies additional learning effort for customers and therefore higher product switching costs.

A bidirectional information flow in learning frees potentials for both businesses and customers. While businesses gain additional insights and knowledge according their product usage and handling customers benefit from the thereby improved product support and faster learning progress. In other words: an application of appropriate learning techniques and systems when using products fosters user experience in adoption as well as usage phases. The change in communication behavior and new technical possibilities allow new ways of knowledge and information transfer, which are addressed in research areas related to e-learning or m-learning. While these topics focus on the aspects of teaching little research is known in the context of learning how to use a product. Also a clear definition of product learning in terms of keywords or research areas is missing and corresponding literature is widely spread. This interdisciplinary research includes topics from the fields of learning, marketing as well as information systems research with an absence of connecting links between them. The here applied approach bridges this gap by providing an opportunity to determine accurate scientific literature due to the identification of the most relevant connecting terms used in publications.

By applying such an approach a broaden perspective is ensured and relevant publications in these areas are highlighted. Learning theory literature acts as a foundation as the awareness in human learning theories ensures the application of customer accepted product support.

3.1.2 Research Methodology

Learning in a scientific context is wide spread and reaches from various learning techniques to modern e-learning topics. In chapter 2 we focus on relevant terms related to learning contexts that take place while learning how to use a product. These theories on learning build the foundation for the following literature analysis as they reflect the concerning paradigms that correspond to users when exposed to product learning situations (Figure 21). Three major terms could be depicted which are then explored by a bibliometric literature analysis to determine their relevance in science and especially in the subject areas of marketing and information systems. Abstracts of the spotted publications in marketing and information systems research were analyzed to extract terms with high relevance for product-related customer learning. This first analysis is limited by the primarily determined learning paradigms, which may omit relevant keywords for further research. To overcome this eventuality a second analysis was conducted. Again a keyword-based literature approach was performed in chapter 3 to verify the relevance of these keywords according to the aspired research project as well as to identify other terms and research areas with high impact that could be excluded in the beginning due to the formerly selected learning-related keywords. Evaluation of results from the first attempt approved the selected terms but also additionally appropriate keywords were found. Finally chapter 4 gives a conclusion of the findings and also depicts limitations of the conducted research.

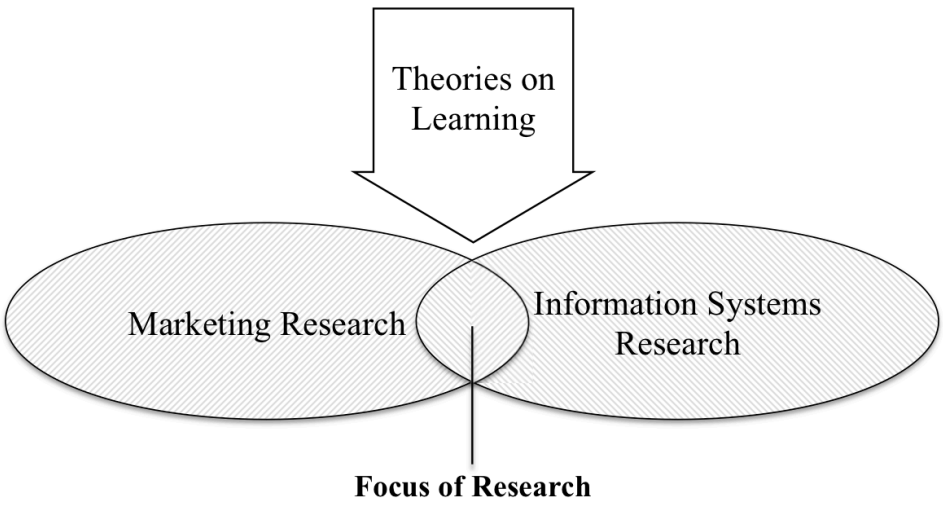

Figure 21: Applied research approach

3.2 Learning paradigms in Research

Various research fields such as Social Sciences, Psychology or Computer Sciences are related to learning theories but look at them from different perspectives. This chapter gives an insight into learning theory, which acts as an important foundation for further research in product and consumer learning. Product-related learning sets the focus on the learner and therefore requires adequate methods regarding style and format of learning to support knowledge building [12].

In literature various facets of learning are discussed. The Organization for Economic Co-operation and Development (OECD) defines three different forms of learning: formal, informal and non-formal learning [13-14]. While formal learning relates to an actively controlled process of knowledge transfer informal learning takes place without an intension of knowledge gaining. Learning is defined as non-formal when a formal learning environment enables learning in an informal way so an additional knowledge gain happens as a positive side-effect. OECD categorizes learning forms by learning awareness. Often mentioned dimensions of learning are self-regulated, self-directed and problem-based learning. These focus on the intention of learning and put personal learning habits into the center of attention. From a marketing perspective the respective intentions to learn how products work gives important insights for product positioning and feature implementation. This is highly related to personal learning habits, as product learning requires personalized actions to support a wide audience of potential customers. Research topics within the fields of self-regulated, self-directed and problem-based learning are expected to be applicable for further product learning research.

3.2.1 Self-regulated Learning, Self-directed Learning, Problem-based Learning

Learning situations in context of products are expected to take place when customers are not capable of performing a task to accomplish a goal. This is especially relevant for early product adoption phases where potential customers evaluate products by direct testing [15,16]. The customer identifies the gap between the current product related knowledge and an aspired outcome as a problem to overcome. This learning by doing approach puts customers in realistic usage situations where they encounter typical usage scenarios. Problem-based Learning is also well applied in pedagogic environments. Students get introduced to realistic cases, which enforce them to add additional meanings to the content of learning by applying problem-solving strategies. This matches with the problem situation to overcome when learning to use product features. According to Loyens, Magda and Rikers [17] two main related fields of interest related to Problem-based Learning are Self-directed Learning and Self-regulated Learning. Self-regulated Learning describes learning as

process where learners show active empathy and autonomy regarding their learning style and progress. Self-regulated learners are aware of their strengths and weaknesses and therefore react to these attitudes by individually set actions. Developmental, contextual, and individual boundaries and the self-motivated expansion of personal knowledge are the essential triggers for Self-regulated learners. Self-directed Learning on the other hand sets a wider focus on proactive learning, which is often described in adult education or as life-long-learning [18]. It originates from the idea that learning does not happen in isolated environments but rather in an open interchange with others. The willingness to extend existing knowledge plays a major role though, as personal autonomy and self-managed learning processes have to take place. Smartphones or tablet computers with permanent connection to the Internet support these learning paradigms as they allow access to requested information independently from location or time.

3.2.2 Research Method

All these aspects view learning from different perspectives but characterize situations that have to be considered for gaining a deeper understanding on how product learning takes place. To examine already existing state-of-the-art literature on product learning and to also determine related research areas a literature analysis was conducted. The research profiling approach as a bibliometric method showed beneficial in similar research situations [19] and allows a widen analysis of existing publications. In contrast to classic literature reviews this approach gives profound insights into the topic by including a vast majority of relevant publications. For our purpose not the total number of publications is of importance as results will be used to determine keywords with highest relevance, rather than as a final source for further research. The science database ‘Scopus’ as part of the ‘SciVerse’ platform was selected to perform this scientometric literature analysis as access to all publication abstracts was provided which showed beneficial for the second analysis. The research was conducted in February 2013. To give a wide overview of results no limitations but the search terms were set. In a first run the total available search results for the terms problem-based learning, self-regulated learning and self-directed learning within abstracts, keywords and titles of scientific publications were examined. After a first review the search terms were limited to keywords only as these are explicitly defined by the authors and therefore show more accurate results in terms of dealing with learning as key element of research.

3.2.3 Results

It can be stated that problem-based learning plays a major role in research in comparison to self-regulated and self-directed learning. While latters showed between 628 and 635

results problem-based learning outnumbers both with almost 85% of total related results in research.

	Self-regulated learning	Self-directed learning	Problem-based learning
Total results	1.170	1.959	8.338
Keyword results	628	635	6.796
2012	125	84	570
2011	125	102	607
2010	99	94	610
2009	72	78	653
2008	60	67	616
2007	30	47	532
2006	27	39	516
2005	14	25	434
2004	13	21	374
2003	11	18	352
2002	10	8	279

Table 3: Total amount of search results on science database Scopus

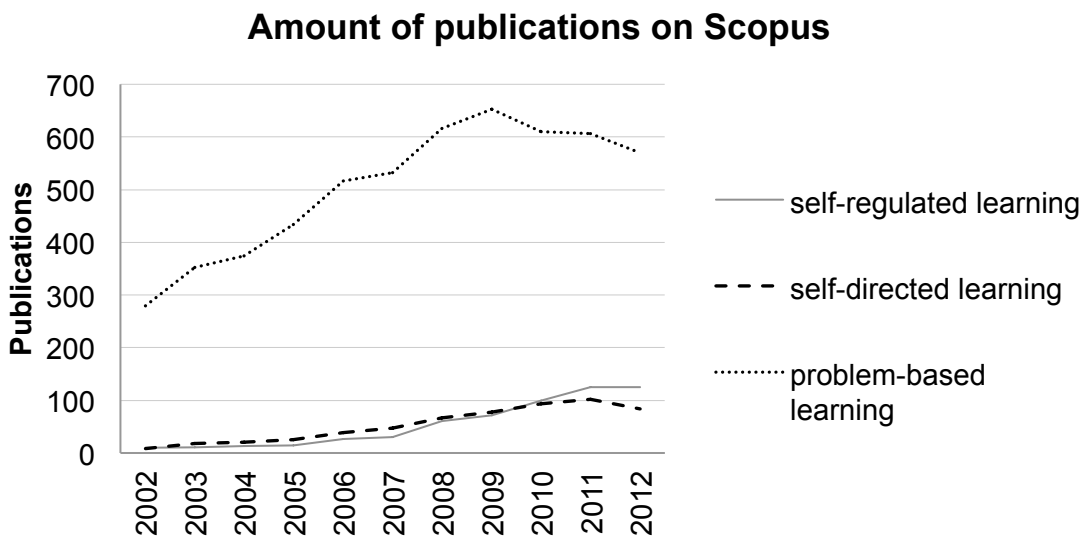

Figure 22: Search result growths on science database Scopus

Problem-based learning also shows a strong yearly growth in numbers of publications while only small increase in research related to self-regulated and self-directed learning can be spotted. More important than the number of publication are the subject areas where they got assigned to, as these show the fields of research with strong relevance for learning.

Self-regulated learning	**Self-directed learning**	**Problem-based learning**
Social Sciences (391)	Social Sciences (294)	Medicine (3.429)
Psychology (222)	Medicine (192)	Social Sciences (2.661)
Computer Science (185)	Computer Science (154)	Nursing (1.582)
Engineering (47)	Engineering (93)	Engineering (618)
Mathematics (32)	Nursing (65)	Computer Science (471)
Arts and Humanities (28)	Psychology (30)	Biochemistry, Genetics and Molecular Biology (311)
Business, Management and Accounting (18)	Business, Management and Accounting (27)	Pharmacology, Toxicology and

		Pharmaceutics (254)
Medicine (15)	Pharmacology, Toxicology and Pharmaceutics (27)	Health Professions (201)
Nursing (6)	Mathematics (26)	Psychology (188)
Decision Sciences / Economics, Econometrics and Finance / Neuroscience (3)	Biochemistry, Genetics and Molecular Biology / Arts and Humanities (19)	Dentistry (150)

Table 4: Subject areas of publications

Profiling showed 418 publications as undefined subject areas for the search term problem-based learning, which were excluded from final results.

	Discipline	Self-regulated learning	Self-directed learning	Problem-based learning	Totals
1	Medicine	15	192	3.429	3.636
2	Social Sciences	391	294	2.661	3.346
3	Nursing	6	65	1.582	1.653
4	Computer Science	185	154	471	810
5	Engineering	47	93	618	758
6	Psychology	222	30	188	440
7	Biochemistry, Genetics and Molecular Biology	1	19	311	331
8	Pharmacology, Toxicology and Pharmaceutics	1	27	254	282
9	Health Professions	2	14	201	217
10	Dentistry	0	5	150	155

Table 5: Most published research areas

3.2.4 Discussion

Medical related fields of research such as Medicine in general (3.636 results), Nursing (1.653) or Dentistry (155) show strong interest in learning paradigms. Here the main focus is

set on publications on the application of learning in working environments as these professions not only interact with but also attend other persons in a relationship between professional and patient. The second focus can be spotted in Social Science (3.336) and Psychology (440) as these areas relate to the behavior of students and teachers in learning environments. At third also technical fields like Computer Science (810) or Engineering (758) deal with learning paradigms. Publications here concentrate on the facilitation of learning due to innovations in technology and the technological application of learning systems. The gain in publications especially for problem-based learning shows an increasing interest for research in learning environments. While numbers in Social Sciences, Psychology, Engineering and Computer Science reflect psychological and technical aspects of learning, business related areas like marketing did occur far less often. The Scopus subject area Business, Management and Accounting lists 128 entries for the given search terms, which seems relatively under-represented compared to very specific research areas such as Dentistry. Outcomes here should build a base for a deeper study of learning paradigms in general and should allow implications for product related learning strategies as well.

3.3 Product related Learning Research

To identify the most represented keywords related to the application of learning in context of products or customers first study's search results were examined. An abstract analysis determined customer learning, consumer learning as well as product learning as relevant terms for the application of learning approaches on product adoption and product support. Based on the outcomes of these results a second research profiling run was undertaken. Results of this second attempt should (1) list publications specifically relevant for product related learning (2) examine other potential keywords for further research and (3) ensure the focus in marketing and information systems for spotted publications to proof the relevance for these research areas.

3.3.1 Research Method

Again Scopus as science database was conducted for this second study. No limitations in terms of publication date, scientific field or publication type were given. The three key-phrases customer learning, consumer learning and product learning were concatenated by the OR parameter to find all relevant publications containing one or more of these terms in abstracts, titles, keywords and available full text papers as well. A database-based information system was used to determine the amount of used keywords assigned by authors (author keywords) and the Scopus system (index keywords) [20]. Terms with different spelling in British and American English like behavio(u)r and behavior were merged to one result and numbers were added up when calculating result hits.

3.3.2 Results

Scopus allows the exportation of up to 2.000 search results containing all descriptive meta-data except the full text. 1.811 results for the given query were returned which were then exported, manipulated and imported into a database system where each used keyword got stored as one row. All results were transformed to lower cases.

	Author keywords	Index Keywords
Total keywords	5.465	7.503
Distinct keywords	3.648	4.259
Uniqueness of keywords	66,75%	56,76%

Table 6: Total and distinct keywords in Scopus

Authors assigned 5.465 keywords in total with 3.648 distinct results while the Scopus index system assigned 7.503 in total with 4.259 distinct. The results highlight the dispersed contexts of product-related customer learning with more then 2/3rd unique used author keywords. Researchers entering this research are faced with these divergent results when attempting state-of-the-art research. The application of a scientometric literature analysis like the here conducted shows beneficial for research projects in similar interdisciplinary fields. While researchers attempt to assign their publications to at least one established and therefore strongly used keyword this cannot be stated for scientific publications on learning of product usage.

Author keywords		Index Keywords		Totals	
Hits	**Keyword**	**Hits**	**Keyword**	**Hits**	**Keyword**
85	consumer behavio(u)r	63	marketing	99	consumer behavio(u)r
34	learning	63	article	88	marketing
32	advertising	60	learning systems	66	product development
29	brand equity	59	human	63	article

28	innovation	50	product development	62	decision making
27	internet	49	decision making	60	learning systems
25	marketing	38	female	59	human
22	consumer learning	38	mathematical models	58	customer satisfaction
21	customer satisfaction	37	customer satisfaction	56	learning
20	pricing	36	information systems	55	innovation
17	dynamic pricing	36	electronic commerce	53	electronic commerce
17	electronic commerce	35	adult	49	internet
17	brands	34	sales	45	advertising
17	new product development	33	male	38	sales
16	product development	31	neural networks	38	female
15	virtual worlds	29	costs	38	mathematical models
15	materialism	27	innovation	36	information systems
14	customer relationship management	26	adolescent	35	adult
14	e-commerce	26	project management	35	neural networks
14	knowledge management	25	product design	34	brand equity

Table 7: Author and index assigned keywords

Consumer behavio(u)r with a total of 85 hits is by far the most assigned keyword by authors with more generic keywords as *learning* (34) and *advertising* (32) following. Keywords seem to be dispensed as only these three have 30 hits or more. Index keywords on the other hand show higher repetition with 15 distinct keywords above 30 hits where 7 show more specific relation (learning systems, product development, decision making, customer satisfaction, information systems, electronic commerce, neural networks) to the field of research. In a last step all hits were again organized in one single list to show the total number of hits regardless if assigned by authors or Scopus.

3.3.3 Discussion

Results show essential for further research regarding product-related customer learning. It can clearly be stated that the topic is of high importance for the field of marketing. Beside the term *marketing* itself (88 hits), *consumer behavio(u)r* (99), *customer satisfaction* (58), *advertising* (45), *sales* (38) and *brand equity* (34) can be designated to the field of marketing. On the other hand also terms within the scientific discipline of information systems emerge such as *learning systems* (60), *internet* (49) and *information systems* (36) itself. Third, keywords are highly represented with a connection to marketing as well as information systems. Terms like *decision making* (62), *innovation* (55) or *electronic commerce* (53) belong to this third group, which also emphasizes the strong relation between both research areas in terms of product-related customer learning.

Marketing	**Information Systems**	**Marketing / Information Systems**
consumer behavio(u)r (99)	learning systems (60)	*decision making (62)*
marketing (88)	Internet (49)	innovation (55)
customer satisfaction (58)	information systems (36)	electronic commerce(53)
advertising (45)	-	-
sales (38)	-	-
brand equity (34)	-	-

Table 8: Most relevant search terms and corresponding research areas

By performing a content analysis for each single keyword an additional evaluation was processed. Except decision making where a strong focus on medical science areas can be spotted all determined keywords show high importance for the areas of information systems

and marketing. While result of the first conducted research listed relevant areas of science this second attempt widened the spectrum by determining the relevant terms within these research areas. Both approaches start with different premises and so mutually complete the final results. The field of marketing, and especially consumer behavior and consumer satisfaction, shows high impact on learning of product functionalities and is thus of prior interest for further research.

3.4 Conclusion and Limitations

Results point out that learning in context of product knowledge lists publications that mainly focus on the research fields of marketing and information systems. Of course the here-applied methodology approves less explorative for fields with clear assigned research. For wide spread areas such as product-related customer learning or other multidisciplinary fields this keyword-based approach shows the main involved scientific disciplines and the most relevant keywords for further research and is therefore beneficial in early research stages. This narrowing down of a very diverse field of research was conducted by a stepwise literature analysis. The first analysis represents the origins of research where a focus for a topic was set by the determination of relevant keywords for a bibliometric analysis. This analysis sets the base for the selection of relevant publications to determine required background knowledge before entering a research discipline. A second literature analysis based on keywords out of literature not only shows further meaningful keywords but also ensure the relevance of the selected keywords for specific research areas. Besides the three determined search terms customer learning, consumer learning and product learning new relevant terms within the disciplines of marketing and information systems could be depicted.

It should be stated that this research approach is also subject to some limitations. Although the popularity and dataset of the Scopus database by SciVerse, no other source in form of publication database was conducted. Even though for the purpose of this study the total amount of publications results is not of major relevance this limitation should be noted. Also the examined keywords were only revised in differences by spelling British and American English. No semantic relation between the terms was performed which therefore lists customer and consumer as different keywords although their similar meanings. At last also the assignment of keywords to disciplines of science is always nondistinctive as only the publication itself can directly be assigned to disciplines. For the purpose of this study the assignment was only performed to ensure a proper determined focus of research.

3.5 Further Research

The results determined in this paper lead to two main fields for further research. First, technical documentation for complex products as an important instrument of marketing has to be understood. Second, learning paradigms and theories are required to create beneficial product support for the customer. A mapping between both areas should demonstrate appropriate learning methods for different customer requirements due to new potentials in information systems. A strong focus hereby, as current results show, lies on increased customer satisfaction by applying mechanism to shorten learning efforts and building a support base for various forms of problem solving.

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4 Communication Technology as Enabler for the Communication Space

The following article was authored by Thomas Puchleitner (University of Graz / evolaris next level GmbH) and Michael J. Harnisch (University of Graz / evolaris next level GmbH), was published in the Proceedings of the IADIS International Conference e-Society 2012 and is a full citation with minor changes in formatting and numbering.[84] The copyright holds the International Association for Development of the Information Society (IADIS). The article is available under http://www.iadisportal.org/digital-library.

Keywords

Communication Space, Communication System, Communication Technology, corporate communication

4.0 Abstract

“The Communication Space is a part of modern corporate communication and therefore relevant when planning the communication policy of a company. This paper illustrates the change in corporate communication initiated by the developments in Communication Technologies and thus the emergence of Communication Spaces. Communication Systems as part of Communication Spaces are then analyzed in detail, where the matching of fundamental technologies, devices and needs of participants is seen as the main challenge to obtain a powerful Communication System, which can be used effectively for corporate communication in the Communication Space. Communication Technologies as the basic element of Communication Systems are therefore seen as the Enabler for Communication Spaces.

4.1 Introduction

The Communication Space is a phenomenon, which is seen recently in the field of corporate communication. Corporate communication itself is an element of each successful corporation and is defined as all communication processes, which provide a contribution to the task definition and fulfillment of profit- oriented business entities and which especially impact the internal and external coordination of actions and clarification of interests between corporations and its’ stakeholders. (Zerfaß 2007, p 23) Corporate communication is therefore important for each company which acts on a market and converses with stakeholders.

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Corporate communication is steadily in transition and subject of change by a number of environmental conditions. (Goodman & Hirsch 2010) During the last years it was especially influenced by the developments in new media and the improvements and shifts in Communication Technology. Hence corporations have to implicate technological issues into their marketing planning process.

These technological implications also affect the communication policy (promotion) as part of the marketing mix (Meffert et al. 2008, pp 632; Bruhn 2010) of corporations. Recently communication policy is touched by a phenomenon which is named Communication Space – as opposed to traditional communication channels (Grimm & Röhricht 2003). The Communication Space can be briefly described as the sum of all Communication Systems which are used and relevant for the specific aims and needs of the participant. Information can be injected into the Communication Space by using Information Units which build on the selected Communication Systems (Petrovic 2011). The emergence and profile of the described Communication Space is regulated by the development of the available Communication Technology.

The purpose of this paper is to describe the relevance of Communication Technologies as Enabler for Communication Systems and in the end Communication Spaces. To illustrate these relationships a detailed model of a Communication System, which includes the needs of the participants, fundamental technologies and devices will be drawn as contribution of this paper.

4.2 Corporate Communication and Communication Spaces

4.2.1 The Change of Corporate Communication

Corporate communication is strongly interconnected with social communication, which on the other hand relies on Communication Technologies. Communication Technologies have been alternated and renewed permanently throughout history and have therefore changed social communication. Each stage of development of social communication radically modified the way, corporations communicate - beginning from communication based on assembly (age of orality), continued by communication over distance with e.g. letters (age of literacy) until the introduction of electronic Communication Technologies with e.g. a telephone (age of electric mass media), which enabled electronically mediated communication. (McLuhan 1962; Schönhagen 2008) These three main stages of development can be enhanced by the age of digital interactive media or ‘new media’. (Logan 2010) This last period in the progress of social communication, which is based on electronically mediated communication and especially on online and mobile Communication Technologies, is the focus of interest and has to be further analyzed.

Several technological and environmental factors that influenced and changed communication can be identified. (Goodman & Hirsch 2010, p 45; Kolo 2010, p 284) When corporations plant a message into the Communication Space they are nowadays mostly *location-independent*. It does not matter where the communication participant is at the moment. Mobile and online Communication Technology enables communication almost independent of different locations, e.g. the front of a TV screen. But also specified *location-based* communication is possible, which means customers are especially approached with a message if they enter a defined place or area. Corporate communication also got *time-independent*. The message can be placed into the Communication Space independent of the participants' availability. He accesses the information independently whenever he has the need to do so or when a certain alert or filter is activated in an e.g. RSS-feed (*automation*). The participant also chooses the device with which the message should be retrieved, which meets the criterion of *platform-independency*. The message itself is *multi-modal*, which means corporations cannot only choose between text or graphics or audio, but have the possibility to generate a message in various hybrid forms. A special criterion of modern corporate communication is that customers can influence the communication itself, by participating in the communication process and generating individual content (*user-generated*). This enables a fast and easy feedback for corporations. Wikis, Blogs, Social Media or Forums are possible ways to express an individual opinion and participate. And these forms are *transparent*, which means a published message is available for a large audience within seconds. Most of the communication content is also *searchable*, which makes the retrieval of specific information out of the Communication Space easier for participants. All mentioned factors are dependent on the available Communication Technologies, their established fundamental technologies and the devices of the participants. This illustrates that the change of corporate communication is driven mainly by the development of Communication Technologies, which enhances the traditional thinking in corporate communication policy. Marketing literature proposes that the planning and development of a certain communication strategy is the first step in communication. Afterwards specific media are chosen out of the given set of available communication instruments. The media taken into consideration are designed to transport the message afterwards. (Kotler 2011, pp 789) The illustrated criteria show that change in corporate communication is based on Communication Technology. Therefore changes in Communication Technology should influence the communication instruments taken into consideration and finally the corporate communication policy itself. This extension of the traditional thinking could include evolving capabilities of Communication Technologies into the planning process and improve corporate communication. (Petrovic 1995)

As example to depict these changes in corporate communication, one can think about the coverage of the Austrian television program ORF1, which has decreased from 61.7% in 1991 to 31.3% in 2010. (Mediasearch 2011) To go back even further, in 1964 80% of all US-Americans read a newspaper on a daily basis. Nowadays these figures declined to just

around 40%. (Logan 2010, p 65) These examples indicate, that the increase of available Communication Technologies and media lead to the usage of even more different 'marketing technologies' and 'channels' to communicate. A so called "*Long Tail of Communication*" emerges. (Petrovic 2011) Corporate communication can not only focus any more on single channels to communicate the message – the Communication Space has to be taken into consideration. With this shift in marketing reality, also advertising spending as a strategic decision in communication policy is modified. Online advertising spending has been reallocated from 10.4 billion USD or 3.18% of worldwide advertising spending in 2000 to 63.0 billion USD or 16.13% of worldwide advertising spending in 2010. (Magnaglobal 2011) These figures depict, that corporations are slowly adapting to the changes in social communication reality.

4.2.2 The Communication Space

The change in corporate communication based on the developments of Communication Technology formed the Communication Space phenomenon. With the rise of electronic media in general, the theoretical models of a Mediated Communication Space (Krotz 1995) and an Electronically Mediated Collective Communication (Burkart & Hömberg 1998, pp 32-36) were developed. Designed on this model for electronic media, as representatives of the third age of social communication, the Communication Space was developed as a model for the description of the communication process for corporations in the fourth age of social communication respectively new media. (Rössler 1998; Petrovic 2011)

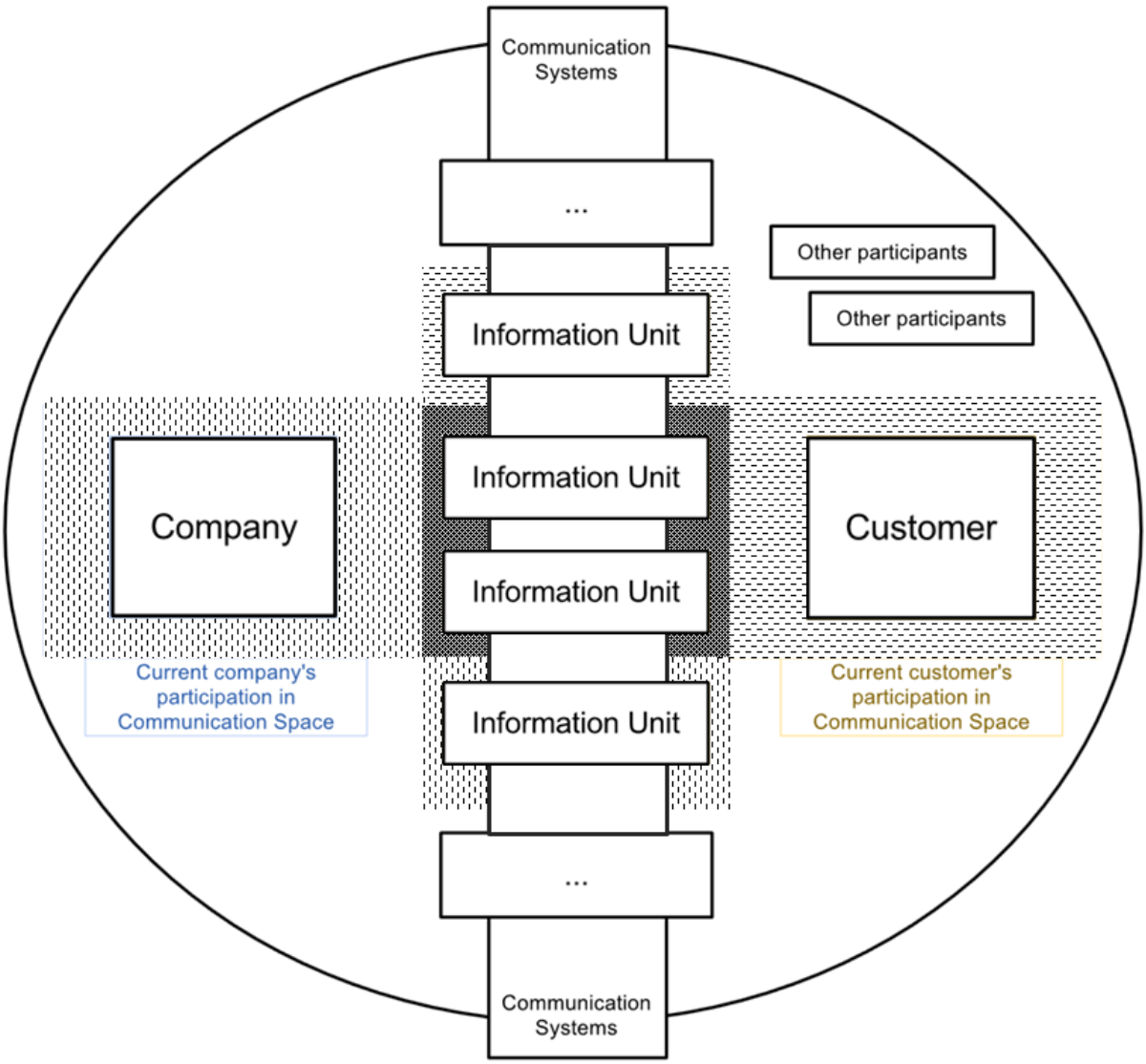

Figure 23: Model of the Communication Space

In Figure 23, this model is illustrated in detail. (following Petrovic 2011) The main statement of the *Communication Space* for corporate communication policy is that the target audience of the communication process moves from an individual receiver of a message to the Communication Space and his participants. Corporation should therefore aim to efficiently handle and effectively deal with the Communication Space as a whole. The Communication Space consists of companies and customers as participants of the Communication Space as well as of other participants, who could be customers, suppliers, other corporations but also uninvolved third parties. Communication Spaces do also have a various number of Information Units which use Communication Systems to transfer information between participants or to plant a message into the Communication Space.

Communication Spaces have *participants* as a fundamental element. On the one hand participants are *companies*, which use the Communication Space to communicate a message about their products or services or pursue any other aim of the corporate communication

strategy. On the other hand there are *customers*, who use the Communication Space to satisfy their communication needs and participate in the Communication Space by providing or sharing content or by specifically using individual Information Units. Finally there are *other participants*, who are not part of the shared Communication Space of company and customer but could possibly be a part of one of their individual Communication Spaces. These participants could be other customers who give ratings about products on the Internet, suppliers of the company who build their own brand image, other corporations who try to entice new customers or also uninvolved third parties who do not influence the relationship between company and customer at all.

Communication Spaces are based on *Communication Systems*. Communication Systems are strongly interrelated with Communication Technologies and include elements like established fundamental technologies and available devices. Communication Systems are e.g. Facebook, Websites in general or applications. It is important to mention, that Communication Systems are not a specific website, application or Facebook page, but the general system behind these structures or the provided functionalities. Corporations choose which of the available Communication Systems they use, depending on their individual communication policy. (Petrovic 2011)

Inside the personal Communication Space, corporations are able to choose which and how many separate *Information Units* they deploy. Information Units are e.g. single applications, a company website but also a TV spot as classic medium to transport a message. Information Units are used to place messages into the Communication Space. Companies are able to design these Information Units around the potentials, which the underlying Communication System is providing, but must also be aware of the limitations of the Communication System. The participants can choose which Information Units they would like to experience. They can also participate in the Information Unit, e.g. by providing user-generated content or sharing information. But these participants are also bound by the potentials and limitations of the used Communication System.

Companies, customers and other participants create their own *individual Communication Space* by their choice out of the available Communication Systems. The individual Communication Space is then the sum of all used Information Units. The participants act within, participate at and experience their personal Communication Space. Companies and customers generate a *shared Communication Space* when they use the same Communication Systems and Information Units. Thereby, the Information Units which are provided by the company but not used by the customer, fall out of the shared Communication Space, but are maybe relevant for the communication with other customers.

4.3 The Components of a Communication System

The provided Communication Space gives a new thinking about the actual possibilities in communications. The Communication System hereby acts as the major component between the participants and Information

Units. By the usage of these systems in combination with a communication aim one or more Information Units can be created to place a message in the communication space.

Communication Systems and their development are strongly influenced by the utilized technologies. New developments in areas of technology impact Communication Systems and even create new such systems. With the evolution of mankind also the possibilities for communication developed up to an immense step in the last decades due to the ongoing process of digitalization. Despite the digitalization also other technological developments in the area of communication technology took place and so had influence on the actual discussion. As all of these new systems belong to the tertiary systems of communication some kind of device to retrieve the message has to be used by the recipient. (Beth & Pross 1976) The user has to interact through these devices to participate in the Communication Space. Besides these physical components, technical functionalities play a major role to establish a new Communication System too. The functionalities work as a fundamental component that supports the communication process, enhances the possibilities and enriches the Communication System for a specific purpose. Both parts, the device as well as the fundamental technology, have a strong interrelation but do not always have to depend on each other. While some technologies like networking protocols are used within many different devices, others seem to have a more relating connection to a specific kind of device, like geolocation on smartphones. Devices as well as established fundamental technologies are both components within the area of communication technologies and both their developments have an impact on the Communication Space.

4.3.1 Devices as the physical environment of Communication Systems

Devices are the perceptible access point to information and therefore are often the only physical objects in the communication process. These objects had very different forms – starting from symbolic gestures to demonstrate power, than religious figures in statues or on coins to smartphones and tablet computers in the last years. (Frevel 2003; Würgler 2009) After Gutenberg's letterpress in the 15th century, the start of broadcasting via radio and television the so called Digital Revolution (Hiebel et al. 1998) starting in the last century brought new possibilities of mass communication to a broad audience. What these latter forms of communication have in common is their need for a device to receive the message, regardless if they require radio or television receivers or some kind of computer system. Schiller (2003) distinguishes communication devices into four categories: (1) stationary fixed

and wired, (2) mobile and wired, (3) fixed and wireless, and (4) mobile and wireless. Especially mobile wireless communication got into focus in the last years.

The mobile phones market shows that even if a device was initially created for a specific (communication) purpose it can capture other forms of communication too - in case of mobile phones the additional utilization of established fundamental technologies like network protocols to connect to the internet, or the integration of multimedia player for audio and video content. A device with its originally intentioned purpose can so be upgraded to further application areas. The possibilities for additional usages or upgrades depend on the matching between technology and device. An other example here are car navigation systems which were initially intendant as supporting systems, but the display's attributes like the size of the screen or the already integrated speakers also fit multimedia intentions like playing music or even videos.

Examples for devices in the communication process are radio and television sets, stationary and mobile computers, smartphones, tablet computers but also many other devices that take place in this process like navigation systems. Even company specific products that carry information and work in combination with another system can act as a Communication System in a wider range of view. Examples here can be the tracking device of the Nike+ system or near field communication (NFC) enabled carrier devices.

4.3.2 Established fundamental technologies as enhancement for communication

The historical development of fundamental technologies to well-established systems is a dynamic process of acceptance and distribution. Standardization is a crucial step for new technologies, which enables a wider spread and achieves compatibility to other systems. (Schmidt & Werle 1998)

Operating systems build the base for modern technology systems and provide the general functionalities of the underlying hardware. Acceptance, standardization and a wide spread are important enablers for operating systems and technologies in general, and lead to confidence for users to use them. In case of operating systems a well-versed workflow for all kind of operations is important to users whereas software developers benefit by reducing the amount of platforms to deploy their software to. Additionally open source code builds a stable and transparent basis for companies and developers to create further applications atop the provided code.

Like in operation systems, layers are important abstraction models in all areas of technologies too. Technologies are integrated in all different layers and supply other systems that work on top of them. QR codes are a modern way to interact between the real and the virtual world. By scanning a special tag from paper or other media the standardized system

interprets the symbolic image and matches it to a predefined function. The system can so be used to promote a website's URL in magazine advertisements without requiring the reader to enter the long URL but just scan a tag. The technology utilizes many other technologies it is based on. It combines photo or video capturing with the Internet protocol HTTP to redirect the user directly to a website. The QR code technology adds a protocol to interpret the tag and manages the linking between the scanned image and the corresponding subsystem, like opening a website or displaying contact details in case of virtual business cards. (Knuchel et al. 2010) The thinking of one technology depending on others can be narrowed down as far as low-level protocols or finally the instruction set of a microprocessor.

Usually technologies enable the communication process between humans and computer (human-computer interaction) but also communication between different machines is gaining focus. The "Internet of Things" describes systems that interact between each other without the involvement of humans due to the use of standardized technologies. The already mentioned technologies of tagging through QR codes or near field communication (NFC) are the most mentioned technologies in this field.

Examples for established fundamental technologies in the communication process are network protocols like TCP/IP or UDP, networking technologies like WIFI or 3/4G, operating systems, multimedia systems like movie, image and audio compressors, tagging technologies like the QR code, near field communication systems or geolocation systems to locate where the act of communication takes place.

4.3.3 Needs as motives for Communication System usage

After specifying the importance of devices as physical objects and the integrated technology layers, the participant's need is the trigger for using any of these communication technologies. Humans have motives for using media and technologies, which can show manifold characteristics. Maslow showed with his pyramid how different levels of need could be seen to determine human needs. (Maslow 1943) In the context of media and the consumption of media the most rational aspect is the *cognitive motive* to gather information or knowledge. The focus of the *affective motive* is to get entertained, while the interaction with other human beings is a *social motive*. The last motive of media consumption is a *self-expressing* one, which indicates that media is used to build an identity towards the utilization. (Schweiger 2007)

The traditional sender-receiver communication model implicates the coverage of cognitive motives whereas the thinking in Communication Spaces allows integrating other motives too. When the communication process is just defined by a sender transporting a message via media to a receiver, no interaction, no direct feedback is expected. The connectivity opportunities thanks to Social Media, Weblogs and other systems brought the customer closer to the sender and created new ways of interaction. Like two-way communications also

the possibilities for entertainment and self-expression grow due to the evolution of technology and their widely acceptance. Besides the usefulness of new technology also the ease-of-use shows high importance in the acceptance process, which can be determined by the Technology Acceptance Model (TAM). (Davis 1989)

4.4 The interdependent factors of Communication Systems

Instead of media channels, Communication Systems build the basis for the implementation of Information Units, that hold the information or message, which should be distributed. These units are built on already established Communication Systems where a target group is expected to participate. Innovative companies may even develop new Communication Systems to realize new ideas and deploy individual Information Units. The message creator as well as the customer participates in their own Communication Space by the utilization of different Communication Systems. When creator and target utilize the same Communication System the implemented Information Unit can connect both parties and therefore unfold a managed communication process.

The process implicates that generally the customer, as a user of a system, already participates in a Communication System and is also well versed in using it for his own personal purpose. This is generally linked to the person's need where the person tries to find satisfaction by using the specific system. The need is the trigger to participate in a Communication System and so has no direct relation to an Information Unit. The systems are not necessarily built for marketing purposes but for an interaction between participants – gradually possibilities for marketing and promotion activities may evolve. As already mentioned companies may also create new Communication Systems with Information Units to initiate new ways of communication. In this case the Communication System may act as a part of an exploited product.

Communication Systems require and use different communication technologies. The here presented model divides the term of technology into physical devices and fundamental technologies. As different devices are used in different contexts, environments and opportunities, Communication Systems and their access differ by the characteristics of each device. This does not implicate an utterly independence between devices and their integrated and used fundamental technologies, but explains that not all technologies combine well with every kind of device. While some rudimentary technologies like protocols for network operations empower devices to interpret data on a standardized level, others are associated with specific chances of use.

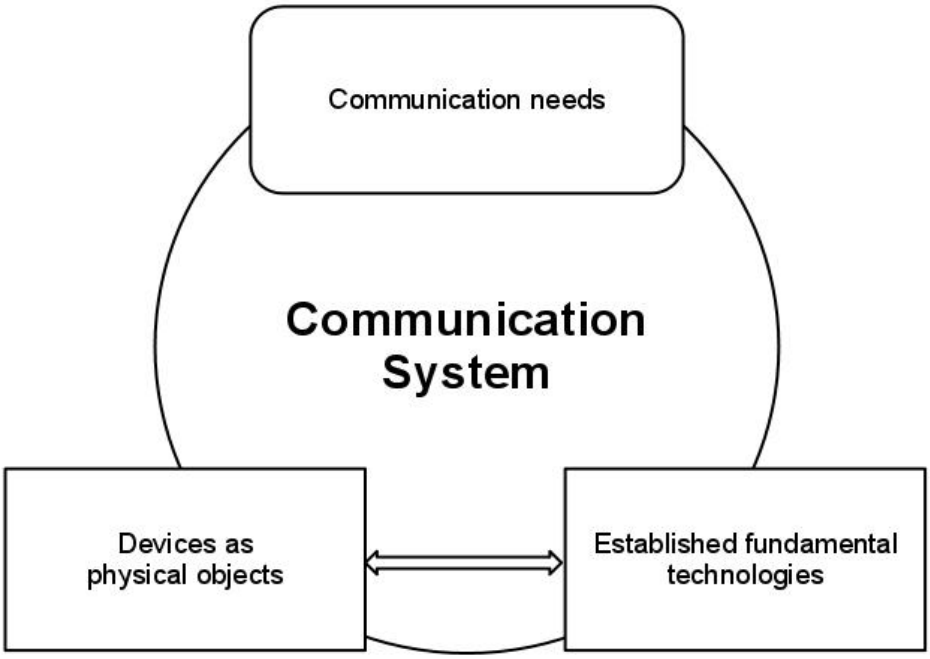

Figure 24: The interdependent factors of Communication Systems

As Figure 24 shows, a Communication System is described by following three factors: the communication needs, the physical devices where the system is used on, and fundamental technologies the system is based on and also connects to. All three elements work in a connected environment, which are important parameters when thinking about developing an Information Unit based on a Communication System. Facebook or the location- based social networking website Foursquare are examples for different possibilities of Communication Systems due to varied combinations between used communication technologies. The concept of building a connection between people through their current location is realized by geolocation technologies like GPS or network triangulation. Thanks to the same latter technology this works on stationary computer systems too, but only the mobility of smartphones keep people in permanent contact and allow to constantly check-in to different locations. Tagging via QR codes is another technology that is typically used in combination with smartphones but not stationary computers. Although both devices integrate the same fundamental technologies (video camera, network protocols) only the more context-specific opportunities of the usage by smartphones create a sufficient additional benefit.

4.5 Conclusion

By reflecting the factors the change in corporate communication was shown. The immense possibilities due to the usage of new communication technologies changed the way of corporate communication from a traditional sender-receiver model to the more complex model Communication Space. This Communication Space is based on Communication Systems that enable the transport of information between participants. The introduced model

of Communication Systems explains how the needs of participants are satisfied by the utilization of communication technologies that consist of fundamental technologies and devices.

The employment of the model allows marketing strategists to specifically select appropriate Communication Systems as these factors characterize the system.

Based on the model, Communication Systems cannot only by selected but also the implementation of Information Units will be supported. The development of an Information Unit is supported and new marketing possibilities are emphasized when the three factors that characterize a Communication System are kept in mind.

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5 The Impact of Technological Development on the use of Technical Product Documentation

The following article was authored by Thomas Puchleitner (University of Graz / evolaris next level GmbH), was published in the Proceedings of SOTICS 2013: The Third International Conference on Social Eco-Informatics and is a full citation with minor changes in formatting and numbering.[85] The copyright holds the IARIA XPS (Xpert Publishing Services).

5.0 Abstract

"Late technological developments show strong impacts on customers' communication behavior. While only years ago customers perused printed manuals in case of technical problems, they now request new ways for support. It is of crucial importance for businesses to identify these changes in communication behavior and to adopt their support offers to match customers' expectations. This paper utilizes a multimethod-multisource approach to give insights into the new importance of technical documentation as link between customer support and product marketing. After indicating the ongoing change in media consumption, creators of technical documentations as well as product users are analyzed regarding the usage scenarios of technical product documentation. Finally, major implications for businesses are built on customers' changed requirements of virtual support systems.

Keywords

technical documentation; product support; communication behavior; customer support systems; technological development

5.1 Introduction

Consequences of late developments in the areas of information and telecommunication systems are still taking place in various application fields. Technical communication [1] in form of different kinds of documentations and manuals plays a major role for the adoption of new products and is thereby strongly influenced by these technical developments [2]. While only years ago every newly acquired product obtaining some level of technical complexity (like the consumer electronics industry) required bulky manuals, hence product enclosures only aim to support customers by guiding them through first installation processes. Especially in the software industry these changes can conspicuously be observed. Product packaging

[85] Puchleitner, T.: The Impact of Technological Development on the use of Technical Product Documentation, in: Proceedings of SOTICS 2013: The Third International Conference on Social Eco-Informatics, Lissabon (2013), S. 28-33.

for software like image processing applications or operating systems contained often one or two CDs as carrier medium but required thousands of sites of printed manuals resulting to boxes with several ponds of weight [3]. Thanks to digitalized content and developments in product usability, modern software products require far less printed documents or no need for printed manuals is given any more at all. In other branches like the automobile industry these potentials are not fully released yet. Still many car manufacturers deliver their vehicles with a set of diverse and impersonalized booklets and manuals, consisting of sections referencing extras and features that are not even integrated in the specific car. So how do developments in information technology affect technical documentation and how will businesses have to react on those changes?

5.1.1 Marketing aspects of Technical Documentation

Technical communication includes both company- internal as well as external information regarding the product. Technical documentation is defined as the pool of information that is specifically handed to the user [4]. From a customer's point of view any kind of documentation fulfills one single need: to gather the relevant information required with as little afford as possible [5]. Thereby two main triggers for the demand of support can be spotted. First, in an early phase within the product lifecycle support to learn how to handle the product is required. Later on this changes to more problem-orientated support scenarios when product failures are to overcome. While customers therefore only notice the functional aspects of product support, businesses have to consider every touch point with its' customers from a marketing point of view as well [6]. The importance of customer support is already acknowledged in marketing literature, determining forms of product accompanying documents as instruments of marketing [4]. By the ongoing transition from classic printed documents to alternative digitalized variants companies are forced to adopt their format of customer and product support. It is of crucial importance to not only offer up-to-date products but also adequate support for existing as well as potential future customers. The structure of the paper is described in the following section.

5.2 Research Gap and Methodology

The increasing importance of technical documentation for marketing purposes forces businesses to react according to their customers' changes in communication behavior. Businesses have to identify the new roles of communication technologies for customers and how they utilize these technologies. Thereby businesses gain the opportunity to adopt their marketing communication activities in an appropriate way to offer relevant information wherever and however the customer expects the information. This paper contributes to an ongoing research project regarding new marketing potentials in modern customer support by

the utilization of state-of-the-art application of information systems. The paper plays a crucial role within this research process as one key question relates to the change in users' communication behavior. Only by the identification and adaption of customers' communication behavior in support cases are businesses enabled to build adequate information systems. We therefore analyze the impact of new communication technologies to allow implications on how customers expect businesses to place their support mechanism.

To assure relevant as well as rigorous implications a mixed methods research approach was chosen. By utilizing a variety of research methods (multisource and multimethod) a higher quality on an evidence of results is given [7].

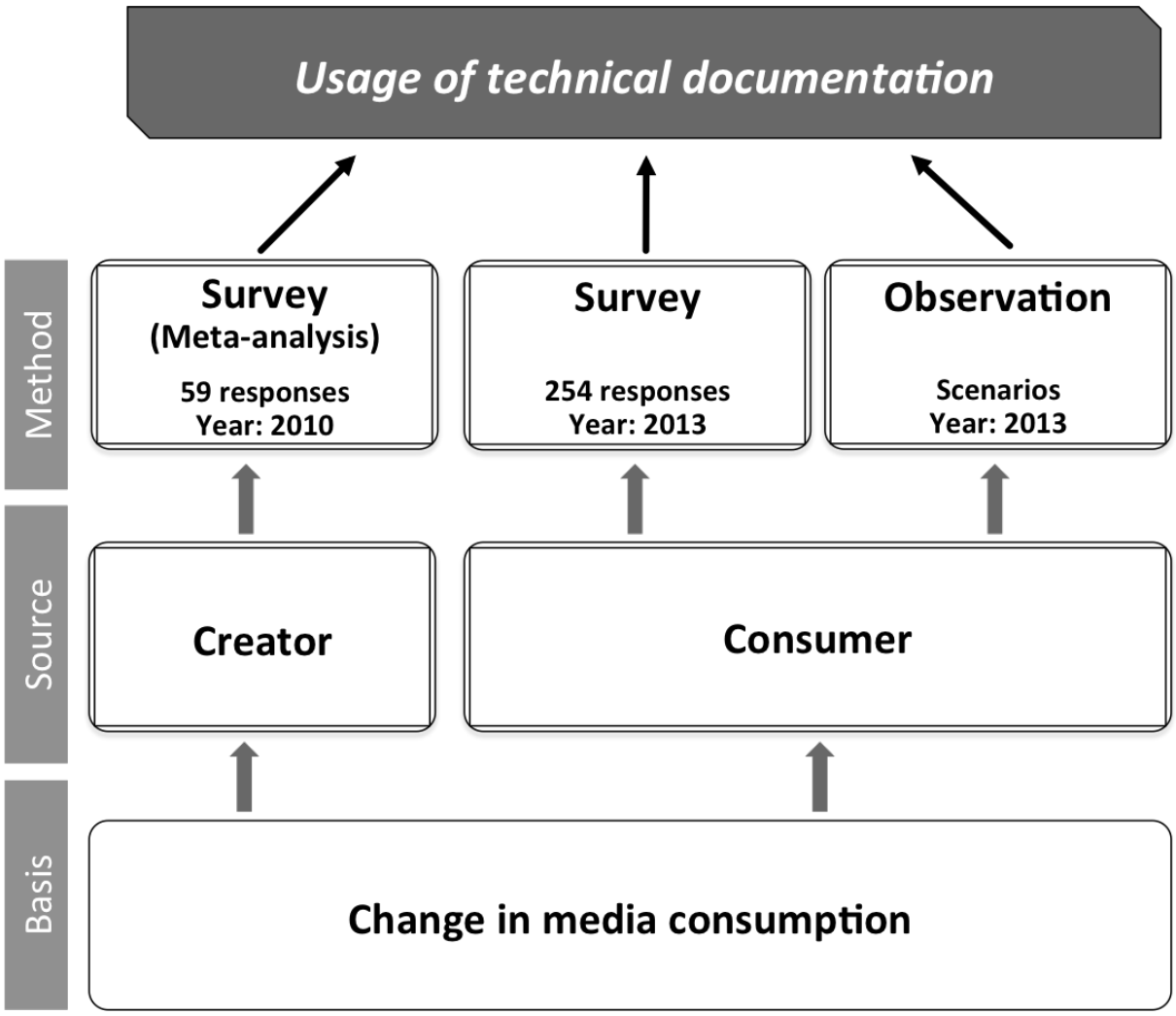

Figure 25: Research methodology

Figure 25 shows the applied research methodology. The basis for all changes in communication behavior lies in the adoption of new technologies. Section 3 focuses on these developments by a detailed analysis of relevant indicators for the last years. In section 4, insights on how the usage of technical documentation is developing from the perspective of

content creators is given by applying a meta-analysis of a survey that was conducted in 2010. As the main focus of a study on customer behavior is the customer himself the fifth section focuses on statements and observations regarding the user. Results of an online survey are presented to show customer opinions as well as a research observation was performed to allow a comparison between customers' statements and their actual behavior.

5.3 Technology as Enabler

Developments in technology build the foundation for changes in customers' usage behavior. Therefore it is of relevance to monitor and build awareness for such developments as only by analyzing these data and indicators trends can be identified. In cases of technology monitoring it is of high importance not only to highlight current statistics directly related to a specific topic but also to include close-by areas. This allows a more holistic view and the implication of tendencies, which may impact a specific field of interest. Some of the analyzed data shows therefore no direct relation to technical documentation, but by the holistic view on these studies implications for further developments in the concrete field can be given.

5.3.1 Customers are online and mobile

The most influential transition in the last decades was the rise of the Internet. As more and more people gather their information online or use the Internet in its many other ways, businesses are expected to be reachable in the web. While in the year 2000 less than 400 Million people were online this number increased to around 2.5 Billion in 2012 [8]. As an example in Germany more than 76% of all age groups are online in 2013 [9]. Besides the rise in online rates also the medium to get online is of importance for content providers. The worldwide traffic caused by mobile devices increased from 6,25% in the end of 2010 to more than 23% in the last quarter of 2012 [10]. Smartphones and tablet computers are becoming more and more popular for daily online routines, with leads to about 70% Germans using their smartphone to access the Internet on a daily basis [11].

5.3.2 Changes in Media Consumption

These developments caused be the pervasion of the Internet had tremendous impacts on various business models. Especially business models dealing with reproducible digital data had to be adopted. The music as well as the movie industry was directly affected but also the television and radio market is still changing. All forms of printed newspapers, magazines, books and of course manuals exist in some kind of duality between an online and an offline version. Depending on the target group these changes seem more or less dramatically. Results of the ARD/ZDF Longtime Study on Mass-communication [12] allow two different

propositions. First, more different ways to consume media emerge, and secondly the usage behavior is highly dependent on the age.

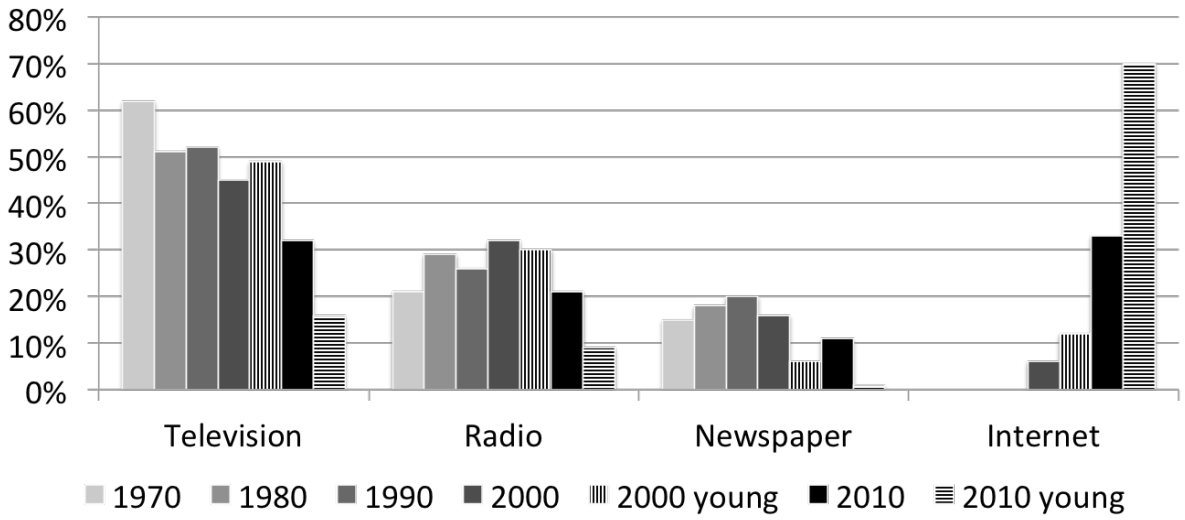

Figure 26: Change in media consumption

Figure 26 shows results of this study. A transition of media consumption from the three classic forms of TV, radio and newspapers to online content can be determined. More interesting is the separation in overall and young survey participants as these numbers show that younger customers are mainly reachable by online channels.

5.3.3 Social communities are still growing

Again the Longtime Study on Mass-communication [12] gives detailed insights on how people use the Internet. Besides typical leisure activities like watching videos or sharing photos also functional aspects are still relevant. In fact gathering information and gaining knowledge is the most utilized private usage scenario with Wikipedia and various forms of online communities at highest ranks. Especially social networks like Facebook play a major role for most Internet users. Regardless if a company decides to utilize such networks for marketing purposes, customers do communicate product-related issues in the public. The traditional thinking in sender and recipients becomes obsolete due to social interactivity between users. Communication Space models [13] better describe these settings where companies lose some kind of control regarding their communicated messages. Improper support may therefore directly influence potential customers on their decision as existing customers state their experienced treatments. Hence, every company-performed action may initiate a new reaction, which could get communicated to the public.

5.3.4 Merging physical and virtual World

The last significant change affecting technical documentation and product support from a technological point of view is the merging between the physical and the virtual world. Technologies start from simple Quick- Response (QR) Codes, where an image is scanned and interpreted to perform an action, to radio-frequency technologies like Near-Field-Communication (NFC). While research often focuses on the technical differences between QR-codes and the NFC technology the latter allows much wider fields of potential applications. Active two-way communication could enable display-less products to transport messages or status codes to smartphones where an output could then be displayed. Products showing error- codes where the user has to look up the meaning of the code would be simplified in many ways. In 2015, more than 250 Million smartphones integrating the NFC technology will be sold leading to more than 25% of all sell-through smartphones [14].

Augmented Reality as one of the most advanced fields of application allows a direct merging of both worlds on the device's display by adding an additional layer on top of the cameras output. Thereby the display not only shows a live picture on what the camera is filming but also identifies specified objects or schemas and shows some extra information regarding these elements. Hence, for technical documentation this merging is of high interest, as many physical products without displays require manuals in form of virtual contents such as text or video instructions. By utilizing a bridging technology users would be able to receive context-sensitive information depending on the product version or support situation.

5.4 Writers as Creators of Technical Documentation

Developments and numbers in the last section are gathered by various research institutions and organizations and represent facts in technical and societal incidents. To allow feasible implications for technical documentation also opinions of experts in the area seem beneficial. A study on technical documentation by Broda [15] in 2010 analyzed survey answers of experts and technical writers. Technical writers create all forms of technical documents, for company-internal usage as well as for customer usage.

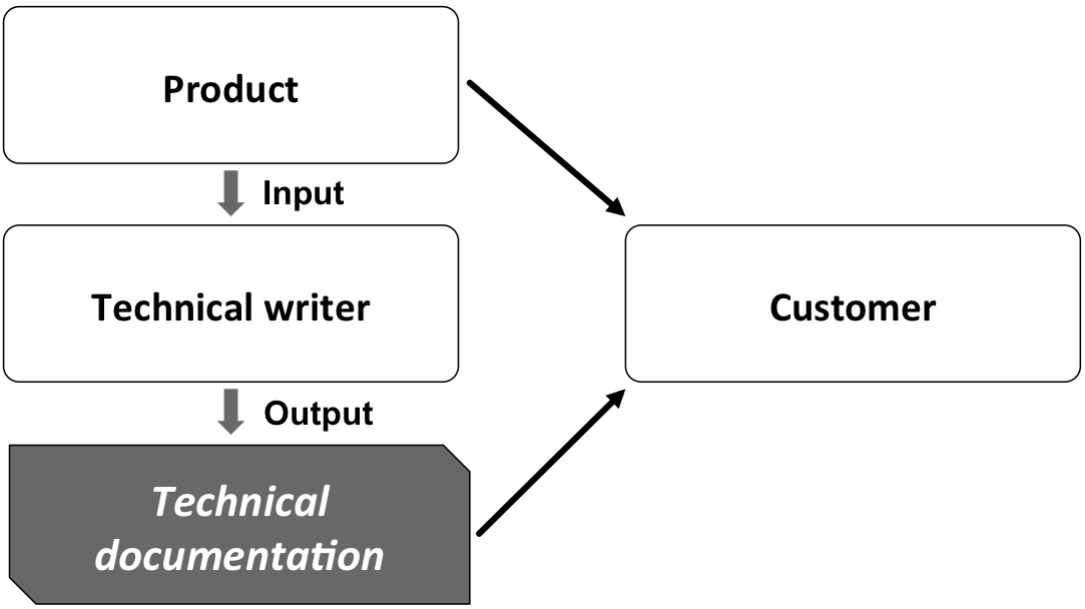

Figure 27: The role of technical writers

Figure 27 shows the important role of technical writers as they take the product as an input to produce various forms of technical documents as an output. Technical writing is therefore associated to the scientific field of translation science as writers translate product features into customer- orientated manuals. As already mentioned in the first section technical documentation is gaining importance in the field of marketing because such manuals directly transport company information to the customer. Technical writers therefore are more and more required to closely interact with marketing personnel or are even organized within the marketing department itself.

5.4.1 Results

Broda received 59 entirely filled out questionnaires. 10 out of the 59 were entitled as experts in the field of technical documentation, 49 were service providers for technical documentation. Another 13 service providers did not finish the survey and are therefore marked as incomplete. The survey took place in Germany from August to September 2010. The study focused on aspects of technical documentation in mobile environments as on smartphones or tablet computers. Overall practitioner gave more skeptic answers then experts, which leads to the assumption that current limitations also occur at the level of the creation of documentation. Typical limitations of surveys have to be considered such as bias effects. While experts may answer in a more general context, answers from service providers directly relate to their work. Two main results can be highlighted: there are obstacles to overcome for new technologies entering the technical documentation market and the content representation is expected to depend on the usage intention.

5.4.2 Obstacles to overcome for new Technologies

Participants were asked to list the three main reasons why printed standard documentation will not vanish in the next years. 40 participants voted with “legal issues” as top answer (see Figure 28). Highly restricted countries like Germany or Austria still require some kind of printed and product-accompanying form of documentation. The second most significant reason is the availability of documents. While printed manuals are in physical possession of the customer and can be attached in cases of reselling, participants worry about these aspects for digital versions.

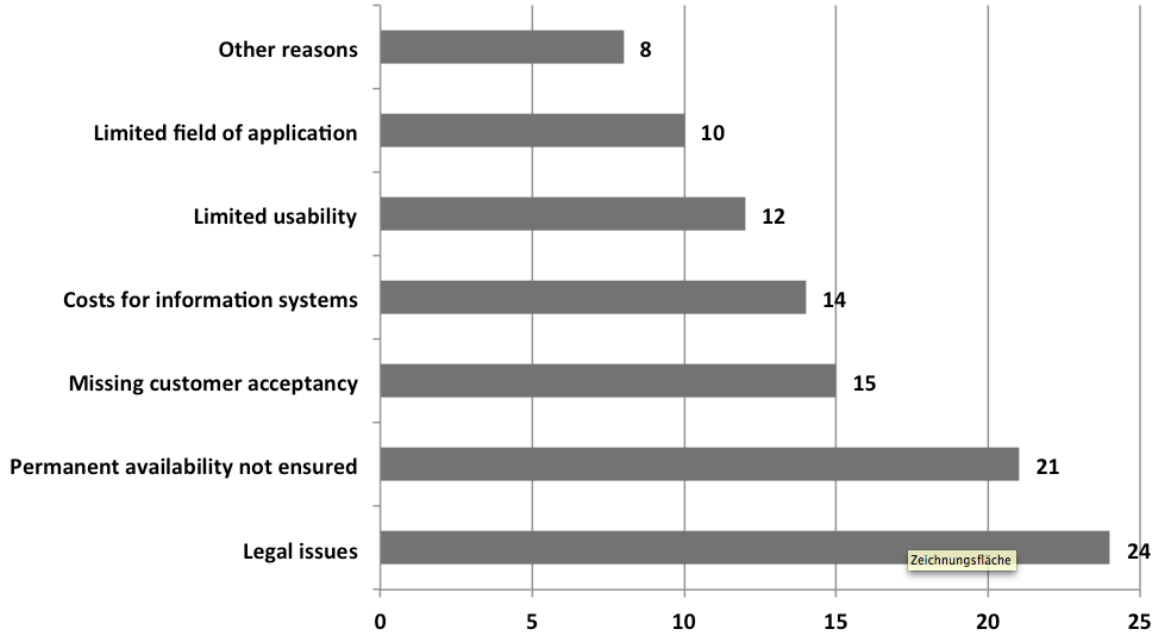

Figure 28: Obstacles to overcome for new technologies

5.4.3 Adequate application of content representation

Secondly, the study gives also insights on how content could be represented for different usage scenarios of product support. This information is especially beneficial as the participants are the most significant target group for such a complex question. Experts as well as practitioners both have knowledge on the advantages and disadvantages of these representation forms and are therefore empowered to match both entities.

Unsurprisingly of low relevance are audio representations, with the classic text and pictures at the very top as Figure 29 shows (ratings between 0 and 5). Augmented Reality is expected to be beneficial in total but especially for maintenance activities. Screen casts are an example for a very diverse form of information representation. While suitable for teaching materials there is no, match for more product-related content.

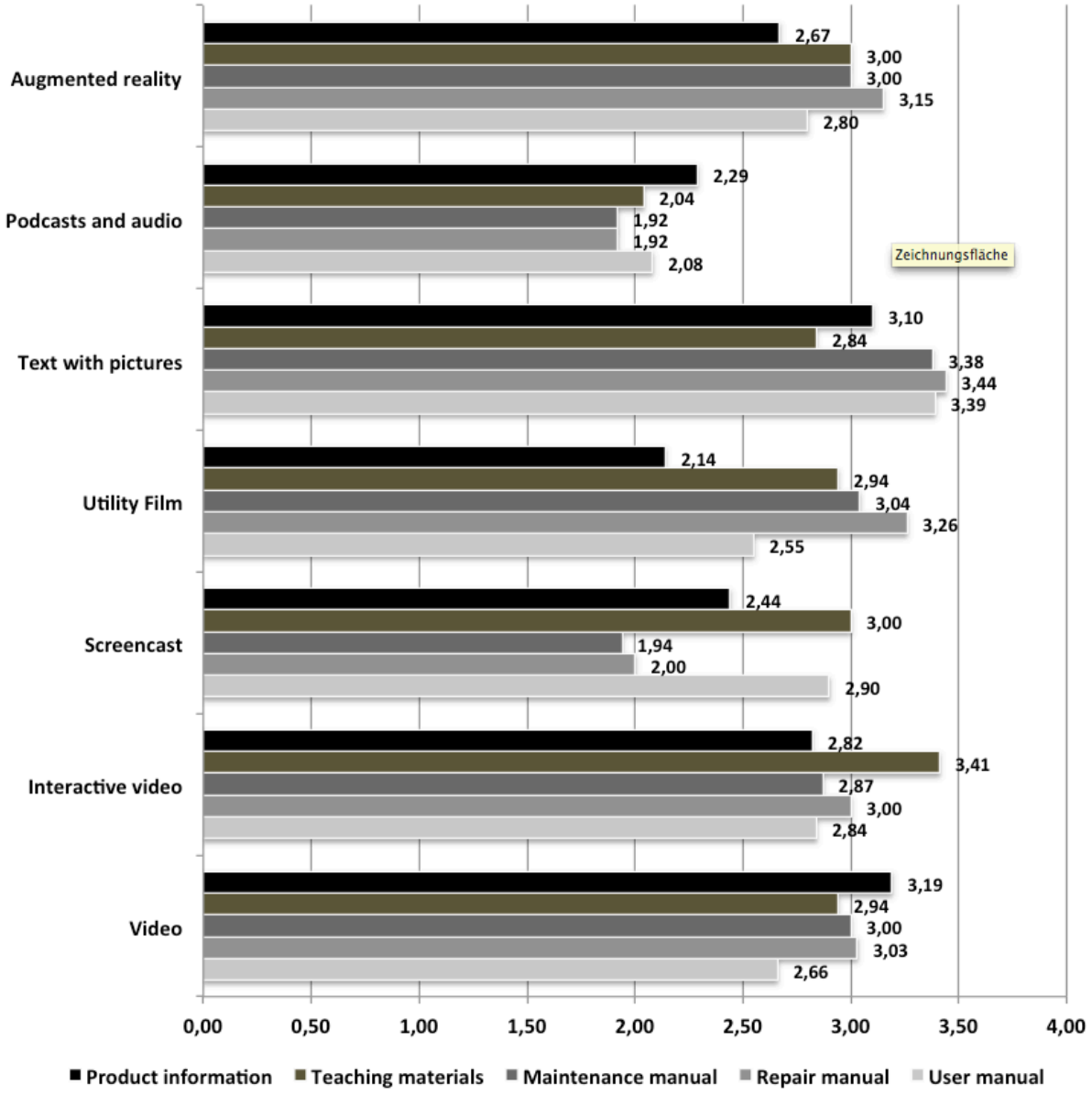

Figure 29: Forms of documentation and suggested content representation

5.5 Using Technical Documentation

Even more important than content creators are opinions of actual users. Therefore, an online survey was conducted to identify current usage behaviors related to technical documentation as well as to get impressions on customers' attitude on professional product support. Like in other social science research methods also participants of surveys intend to naturally bias their answers. To allow the forming of implications from a customer behavior analysis a multimethod approach was undertaken. Parallel to the survey a method to detect the actual behavior in form of an observation was required. Google Trends [16] as a feature of the worlds most popular search engine Google allows the comparison of different search terms. By utilizing this tool an observation on how users perform their search in problem

situation was conducted. The combination of both research methods pictures a change in communication behavior.

5.5.1 Survey results

The survey took place in Austria with a total response of 254 questionnaires. Average age was 25.7 years (standard deviation 7.64) with 71% female and 29% male participation. Results for this research paper are grouped into three categories: (1) dependence of used support method on product type, (2) online search behavior and (3) obstacles for online support systems.

1) Dependence of used support method on product type

Results in Figure 30 highlight that the type of product (software or non-software) strongly influences the utilization of support methods. While in the software industry help systems can easily be integrated within the product, non-software product may not facilitate such mechanism. The media format discontinuity for using online support systems on physical products plays a major role here.

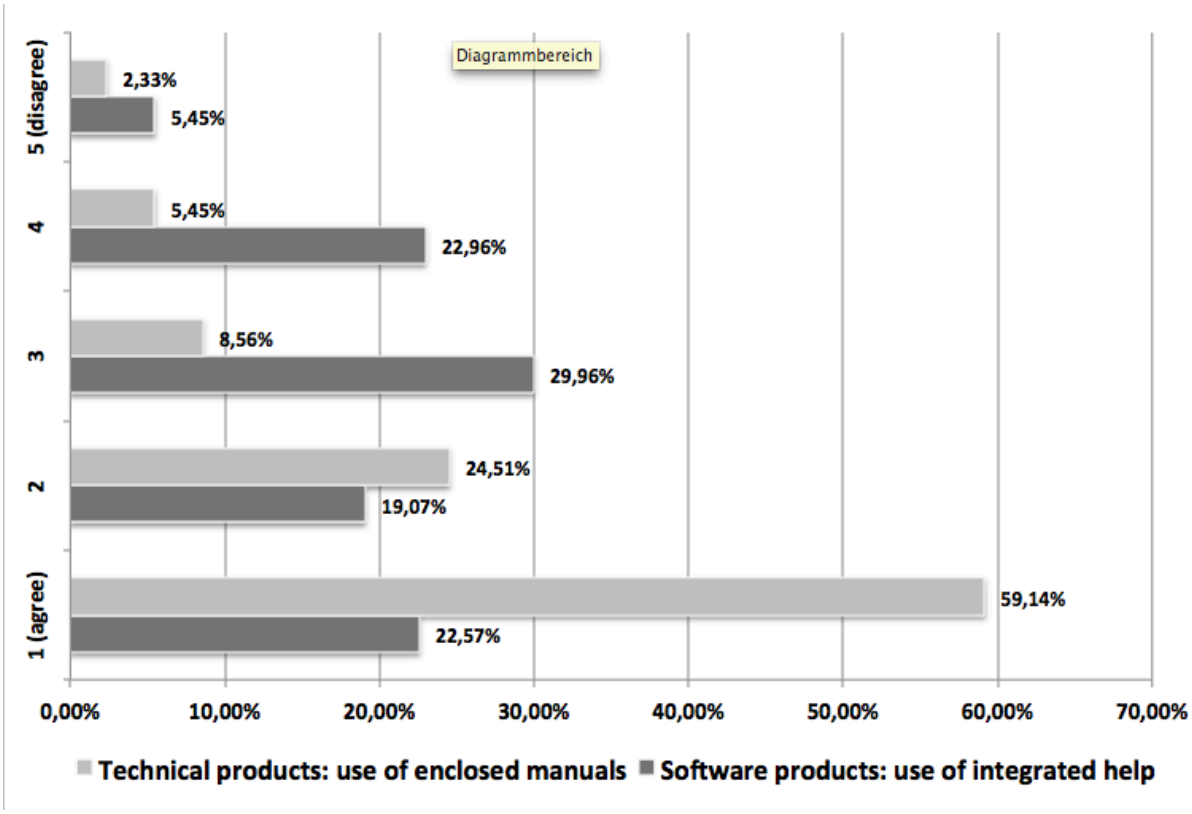

Figure 30: Use of support method is depending on product type

2) Online search behavior

The second important result of the survey relates to the customers' behavior when requesting support online. While from a traditional perspective a strong relation between product and manufacturer is given in support cases, customers rely on generic search engine providers to find adequate solutions for their problems. Figure 31 shows that with more than 50% of all participants more users rather use such a search engine than to directly visit a support site provided by the manufacturer. This means a tremendous change for support service providers as search engines are operated by an algorithm and can therefore hardly be manipulated by content providers.

3) Obstacles for online support systems

While customers are aware of online support systems and how to search for requested information, they seem also familiar with some limitations of online platforms. For the majority the permanent availability of support is of high importance. On the one hand customers have to be connected to the Internet to use online services, on the other hand customers rely on the availability of the support service itself.

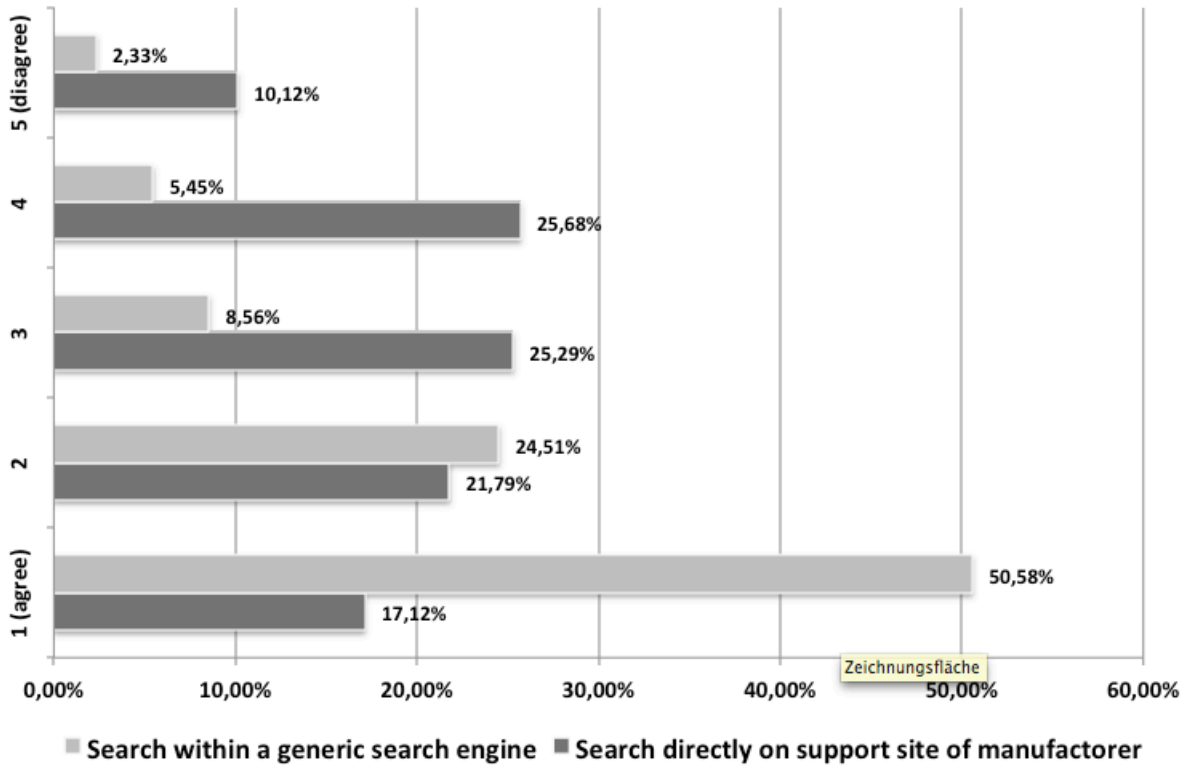

Figure 31: Search engines are used before manufactorer's support site

Printed manuals or documents in digital form are in possession of the customer and guarantee this requirement. As Figure 32 illustrates, participants could not clarify if support platforms may entirely replace traditional manuals.

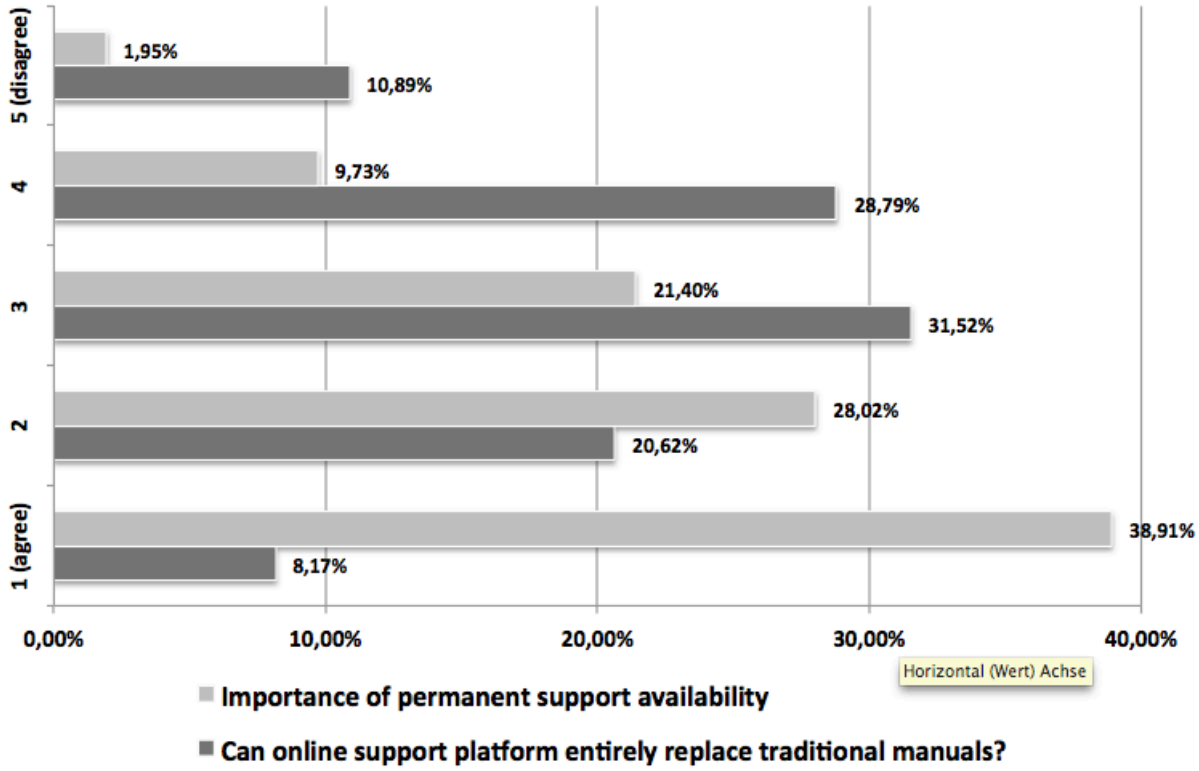

Figure 32: Availability as trigger for traditional manuals

5.5.2 Observations

In a second attempt Google Trends was used to ensure rigor and relevance of the empirical survey data. While obstacles of online support can barely be acknowledged by such a method, differentiations in usage scenarios depending on product type (see point 1 in empirical results) as well as implications for general search behavior (point 2 in empirical results) are more feasible. In a first test a software-related problem was simulated to see how customers search in case of software problems. Second, a technical non-software product was chosen. Apple's Iphone 4 was the subject of interest in these queries, as the product is known for a problem with its integrated antenna affecting the phone's reception. When the problem first occurred customer did not know that it was caused by a manufacturing error. This incident builds a perfect occasion for an observation as customers were in a typical product support situation. Both products do not include an extended amount of manuals since the software comes with an integrated system and Apple represents products of high usability. As Google Trends allows the comparison between terms in form of percentage relations only, no absolute numbers of search queries can be given.

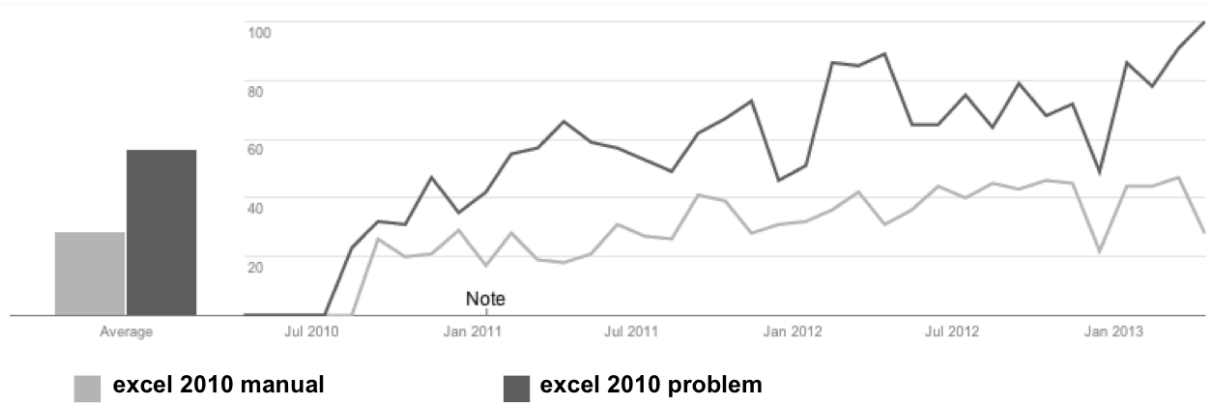

Figure 33: Context-sensitive search outnumbers the demand for manuals (geographic location: United States)

The software-test was processed by querying for a typical Microsoft Excel problem. While traditional manuals do not provide context-sensitive help, search engines are used to query for an answer directly related to a problem. Therefore, while searching for the traditional manual would indicate the need for technical documentation in the typical structure, customers intend to directly enter the question resulting into endless search query variations. As Figure 33 shows even a comparison between the search terms manual and problem demonstrates more queries for the latter. Including the variations of real appended problem situations would outnumber requests for traditional manuals.

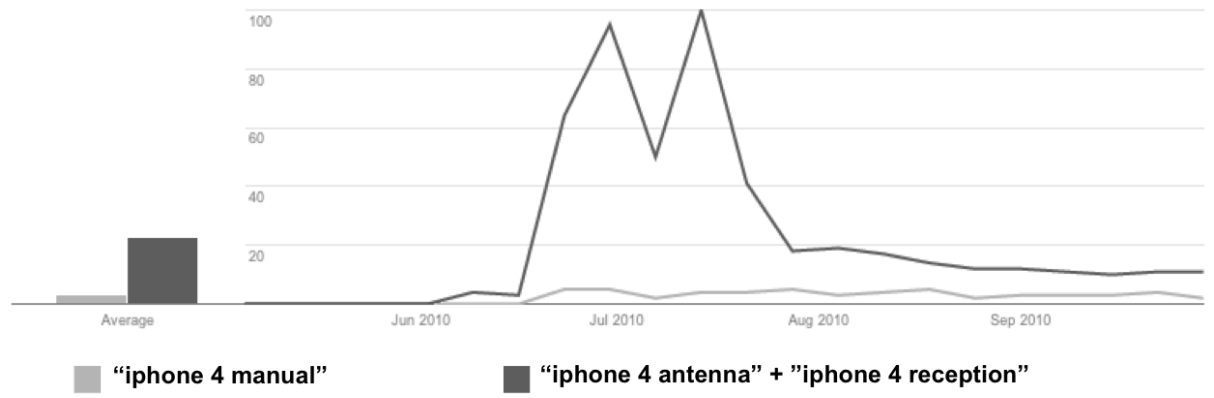

Figure 34: Search engines directly link to support content (geographic location: United States)

Figure 34 highlights an online search behavior. Again customers directly enter their problem into the generic search engine without any demand for manuals.

5.6 Implications and Further Reserach

Businesses have to adopt their external communication to meet customers’ demand for product support. Results show the traditional user manual devolves into online support

systems where context-sensitive and location-independent information is made available. Users directly transform their support questions into queries, which implies that businesses have to build their support offerings search-engine-optimized. Additionally the media format discontinuity is an obstacle to overcome by utilizing linking technologies between the physical and virtual world. At last the availability of support plays a major role for customers, which businesses have to ensure.

This publication is a crucial contribution to marketing as well as information systems research. Both disciplines put the customer into the center of attention. Further research will be done to identify how virtual online support systems have to be implemented to match requirements of customers as well as businesses.

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6 Designing Services for Customer Support: Ensuring high Customer Experience for the Consumer Electronics Market

The following article was authored by Thomas Puchleitner (University of Graz / Graz University of Technology / evolaris next level GmbH), was accepted for presentation at the 13th EBES (Eurasia Business and Economics Society) Conference and is a full citation with minor changes in formatting and numbering.[86] The article will be sent for review to EBES 2014 Anthology. After publication, the EBES Research Consulting Education Publishing and Organization Co. Ltd. will hold the copyright of this article. See http://online.uni-graz.at for a current status of the publication.

6.0 Abstract

"Technical communication and customer support is gaining importance in commoditized markets such as consumer electronics. Customers' experience within the overall consumer lifecycle becomes the major competitive advantage, requesting business to adapt their support offerings according to changed customer demands. The aim of this research is to develop a framework for the design and implementation of customer-orientated support environments for consumer electronics. To keep the focus on customers and center all design actions regarding their needs, a customer journey map is developed. Finally, business implications for implementations are given based on the journey map.

Keywords

customer support, customer journey, customer experience, consumer electronics, virtual customer environments

6.1 Technical Communication in Consumer Electronics

The consumer electronics market shows a steady growth in sales, especially segments where products undergo fast technological developments (Accenture, 2012). Many of these products nowadays are technical products like smartphones or tablets and cause complexity in usage. Additionally, due to the increasing permeation of technology in society, more and more formerly simple or mechanical products also integrate technical components like microprocessors or sensor systems. Examples reach from the developments in the television

[86] Puchleitner, T.: Designing Services for Customer Support: Ensuring high Customer Experience for the Consumer Electronics Market, Working Paper, University of Graz (2014). Accepted for presentation at the 13th EBES (Eurasia Business and Economics Society) Conference in Istanbul.

sector to software-based components in modern vehicles with integrated navigation systems and Internet access. The qualitative and quantitative increase in surrounding complexity of consumer electronics requires human-centered interfaces for simplification (Oviatt, 2006) and customer-orientated approaches in support (Negash, Ryan, & Igbaria, 2003).

Changes in customers' communication behavior also influence the relationship between manufacturers and users. Manufacturers need to adapt their communication channels according to these changes to fulfill the customers' expectations. Customer experience (Kraft, 2012) approaches focus on all potential contact points and center the attention on relevant impacts from a customer's point of view. Marketing literature (Gebert, 1988) already acknowledges the importance of customer support for positive experiences and therefore defines manuals and support systems as instruments of marketing. Hence, changes in personal communication behavior require the adapted usage of tools to offer purposeful support with positive effects on customer experience. Investments in customer experience improvements do have significant impacts on business' success. A study by Watermark Consulting (2013) shows the relation between customer experience leadership and stock performances. While the average gain in stock performance of Standard & Poor's S&P 500 stock index reaches 14,5 percent, customer experience laggards lost 33,9 percent in average. Customer experience leaders even reach an increase of 43 percent in company value. Fornell & Mithas (2013) came to a similar conclusion regarding their research on costumer satisfaction. Businesses achieving high rates generate better financial returns than low performer. Listening to customer needs becomes a factor of success for future business growth. A study by Maritz (2010) analyzed how companies perform regarding their focus on the customers' voice. Only 34 percent of participating companies believe in doing a good job in listing to customer voices as their basis for taking actions. Numbers decrease to about 20 percent when businesses were asked if they link customer information with other business or operational metrics to take actions based on aggregated data. This implies potentials for systems to integrate the customer closer into the businesses' operational tasks to further improve the customers' experience.

The transition of support from printed manuals to information systems shows evidence for changed demands of customers. Acceptance and information systems research both state that such systems have to overcome functional as well as psychological barriers for positive adoption (Antioco & Kleijnen, 2010). While consequences and impacts of information and communication technologies (ICT) are extensively discussed (Prasad, 2012), hardly any insights in the design of virtual customer environments (VCE) (Nambisan, 2002) for product support can be depicted. This is particularly surprising as studies show that product-related documents and information systems have direct influence on the customer's experience and

are therefore highly marketing relevant (Gebert, 1988). Two major criteria build the basis for successful information systems: their focus on customer needs and their excellence in implementation (Delone, 2003). Starting our intense research in customer support environments in 2011 we continuously analyzed studies, collected data and conducted qualitative and quantitative research methods to observe customer needs, requirements in product support as well as potentials of online information systems. We now summarize all this data to give business implications for the design of virtual customer environments. We address practitioners responsible for marketing and support activities, as well as the scientific community requesting implications for further research within this topic.

The structure of the paper is as follows. Section two gives a theoretical background on technical documentation as form of technical communication (Blakeslee, 2009) and the gaining importance for implementing customer support services. VCEs and their marketing impacts are discussed in section three. A customer-centered service design process with customer journey mapping as conducted methodology ensures to keep focus on the customer's experience. The journey map for customer support in consumer electronics is developed in section four. Customer stages and observed dimensions are described in detail. Finally, business implications are given in section five.

6.2 Technical Documentation and Customer Support

Technical documentation and customer support are very related topics (Steehouder, 2002), but are still embossed by different mindsets. While ordinary written technical documents base on the translation of product specific features and applications, support focuses on the assistance of customers to help overcome a problem. Support covers various different interaction points between customer and business. Goffin (1998) divides customer support into five main categories: installation, user training, maintenance, repair and upgrades. Different forms of technical documents address these categories (Puchleitner, 2013a), which lead to two main triggers for customer support:

- Product learning in early product adoption phases
- Problem-solving and product maintenance

While the former is naturally requested at first usage of the product or the usage of new features, support and problem-solving offerings are requested at all times. Studies already highlight the importance of prior product knowledge levels on learning progress and product adoption (Wood & Lynch, 2002; Cowley & Mitchell, 2003). In recent years usability research gained importance as one way to support the customer by producing products that are

intuitive in usage and easy to understand and learn (Nielsen, 1993). The product's design and ability to explain itself reduces customer's demand for initial instruction manuals. Studies by Gebert (1988) or Wiese, Sauer and Rüttinger (2004) give insights into the utilisation of instruction manuals. Both come to the conclusion that strongest influence of usage is simply the customer's attitude on reading manuals and enforcements show rarely effective.

Overcoming product malfunctions or complex maintaining processes on the other side require deeper product knowledge or assistance, not addressable by usability optimizations. Here, customer support services provide requested information and guide customers through problem-solving processes. Customers experience these services as part of the actual product and therefore imply levels of service satisfaction on product satisfaction (Gebert, 1988).

Customer support plays an uprising role for businesses to distinguish their products from competitors (Reinartz & Ulaga, 2008). Especially technical products are developed and produced in standardized processes and outsourced to countries with low labor costs, reducing potential differentiations in terms of technology or functionality. While these alignments reduce product costs, customers quest for new recognition values and ways to connect with brands. Customer support shows one chance to form a competitive advantage by developing support as a key competence for positive customer experience.

6.2.1 Virtual Customer Environments

Research already highlighted potentials, benefits and usage scenarios of online communities (Hoegg, Martignoni, Meckel & Stanoevska-Slabeva, 2006), self-service technologies (Yeh, Chuang & Kuo, 2012) and customer forums (Nambisan & Baron, 2007). While most research addresses specific aspects of these systems, Nambisan & Nambisan (2008) depict five roles customers can play in businesses value creation process by applying online environments. They can act as resource, co-creator, buyer, user and also as the product itself. Online communities, where customers change into some or all of these roles, are entitled as virtual customer environments (VCE).

VCEs are intended to bond businesses with their customers by providing various benefits. While VCEs in general allows the application for implementation processes like product testing or prototype evaluations, we focus on aspects of product support. VCEs fulfill the customers' need for information exchange in multiple ways. First, the customer gathers new knowledge out of these environments by company-provided information. Instruction manuals, learning materials, FAQs and other product-related documents can be integrated. Second, customers can get personal one-to-one assistance. Depending on the provided

services, live-help systems via online chats or online webcasts show beneficial. More important, customers may actually place questions regarding their problematic situation by querying for them in a yielded database. Customers are not required to convert their problem situation into a predefined searchable form like in immutable manuals. Instead, a user-centered approach is applied by allowing customers to gather information directly in the way of their context. Third, customers may not only query for solutions but can also interact with other customers. In this third case customers not only act as a consumer of the support environment, but also actively participate in discussions to solve problems.

6.3 Relevance of Virtual Customer Environments for Marketing

In this section we discuss the marketing aspects of technical support and highlight the benefits of including the customer's perspective into the service design process. We discuss methodologies to depict the customer journey map as a powerful tool to convert customer requirements into business actions.

6.3.1 The impact of VCEs on Customer Experience

Technological development caused a tremendous change in personal communication behavior. The pervasion of the Internet and increases in mobile communication due to smartphones effected customers' way of information exchange. Businesses have to adapt to these changes to keep their communication offerings within the customer's communication space (Puchleitner & Harnisch, 2012). Only by entering the customer's communication space a potential support process can be established. A study by Puchleitner (2013b) demonstrates the customer's online support behavior and thereby argues that customers rather use generic search engines for problem-solving than demand support on the specific website of product manufacturers. Besides manufacturers implemented support environments, also company-independent forum systems may already respond to customers' demand. This implies several effects for the businesses' communication capabilities, as the communication process is not under control of the manufacturer anymore. Challenges similar to those of social media interactions occur (Aula, 2010), displacing the manufacturer's position as exclusive communication initiator.

This change also implies the new role and power of customers. Applying VCEs enables customers to actively engage in proactive communication. They become essential parts of company's value creation by participating in discussions, giving feedback or even co-designing products (Yeh, Chuang & Kuo, 2012). Every contact between customer and business intensifies the impression and image the customer gains. These contacts act as marketing touchpoints (Duncon & Moriarty, 2006) and have to be designed according to the

overall marketing strategy. Touchpoints do not directly relate to an actual product, but especially moments with high emotional situations like product malfunctions influence customer's satisfaction, influencing overall customer experience and repurchase (Feinberg, Widdows, Hirsch-Wyncott & Trappey, 1990). Meyer and Schwager (2007) define customer experience as follows: "Customer Experience is the internal and subjective response customers have to any direct or indirect contact with a company. Direct contact generally occurs in the course of purchase, use, and service and is usually initiated by the customer. Indirect contact most often involves unplanned encounters with representatives of a company's products, service or brands and takes the form of word-of-mouth recommendations or criticisms, advertising, news reports, reviews and so forth". Accomplishing high customer experience in customer support is of increasing importance for businesses' future competiveness. Berry, Wall & Carbone (2006) put it this way: "By definition, a good customer experience is good customer service, thus the customer experience is the service". Analyzing services from the view of the customer allows businesses to design their support environments closer to customers' expectations and enhance the overall experience (Edvardsson, Gustafsson & Roos, 2005).

6.3.2 The Customer-centered Service Design Process for VCEs

Two main design approaches for services can be depicted in literature: service engineering and service design. Aschbacher (2011) draws a matrix to show the major differences between both approaches. While the service engineering domain is mainly driven by engineers identifying changes in technology as the main trigger and focus for all design actions, service design requires a non-engineering domain knowledge and puts the focus on the customer experience. Although engineering expertise plays a crucial role for the implementation of virtual customer environments, customer-centered design requests for a service design approach with the focus on the customer's point of view. "Service design addresses the functionality and form of services from the perspective of clients. It aims to ensure that service interfaces are useful, usable, and desirable from the client's point of view and effective, efficient, and distinctive from the supplier's point of view." (Erlhoff, 2007). Various methodologies and tools exist to support the service design process and ensure the focus on the customer's perspective (Servicedesigntools.org, 2014). Figure 35 shows the service design process demonstrated by Elliot (2011) in 5 steps. The company vision sets the general frame for further actions and also defines the alignment of all service offerings according to the business strategy. Personas, as a methodology to communicate customer motivations and behaviors, are utilized to represent the customer along all design stages (Miaskiewicz & Kozar, 2011). The central part of the design process belongs to the customer journey map, which illustrates the feelings and thinking of the customer in its different steps

when applying the service. Next, service blueprints (Lee & Karahasanović, 2013) transport the (by the journey map) identified implications into operational actions across different communication channels. Testing of services is finally performed by the implementation of prototypes.

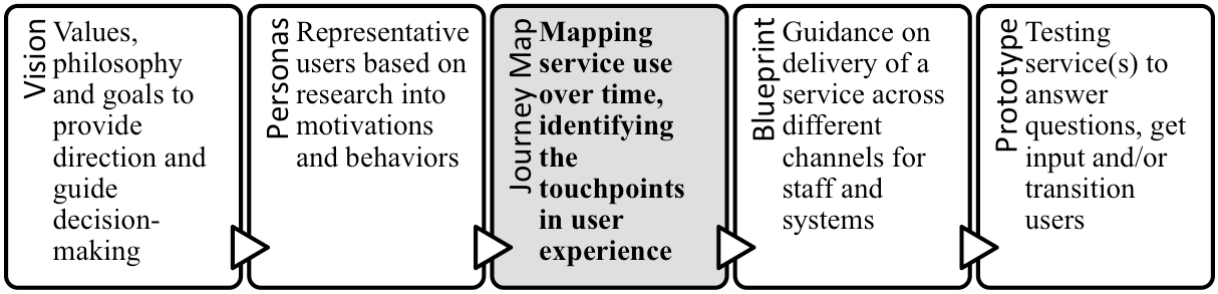

Figure 35: Service design process (Elliot, 2011)

Research often struggles with giving relevant business implications by interpreting single research results. The combination of rigor in science and relevance for applicable actions is the purpose in application-oriented research such as the design science (Hevner, March & Park, 2004). The consolidation of single rigor studies allows the recognition of mutual connections and influences, leading to more accurate implications. Customer journey maps (CJM) highlight the interrelation of studies and their influence within the customer's support process. Customer requirements and actions as well as related research and studies on customer behavior are illustrated in one single artifact to deduct recommendations of action (Norton, 2013).

6.3.3 Customer Journey Maps to picture Customer Experience Potentials

Measuring customer experience is controversy discussed in research. While some approaches intend to develop generic identifiers of positive experiences like customer loyalty or retention and monitor them (Shaw, Dibeehi & Walden, 2010), customer journey approaches focuses on "moments of truth" within the customer support process (Mangiaracina, Brugnoli & Perego, 2009). Marketing literacy uses touchpoints as a definition for every contact between customer and business. Every touchpoint leads to a comparison between customer's expectations and experiences (Meyer & Schwager, 2007). They represents potential memorable experiences to differentiate from competitors (MacMillian & McGrath, 1996). Commoditized products or services ask for experiences to influence the memorable moments with a brand (Pine & Gilmore, 1998). Moments of truth are not strictly implying an interaction between customer and business but rather represent critical moments where opinions are formed. Thus, third parties also form opinions on businesses and represents moments of truth for the customer. Common examples are competitor offerings or

opinions of other customers via social media. By identifying moments of truth within the customer's journey, businesses are able to focus on these key elements for further improvements (Temkin, 2010). The measurement of customer experience by using customer journey maps relates to "the total time well spent" (Norton, 2013).

6.3.4 Methodology

Based on our research we analyzed the customer when requesting assistance in product handling. Customer journey maps are specific according to the particular topic of investigation (Shaw, 2004). Accuracy can hardly be proven, maps are rather useful or not. The structuring has to be derived from existing theories and best practices. Research is based on three sources. First, secondary literature for rational explanations was included from multiple research fields such as technical documentation, customer support, communication and information systems research as well as from marketing research. Second, a survey regarding the usage of technical documentation was conducted in 2013 to analyze consumer's behavior in case of product support. The focus of the survey was set on future developments with an average participant's age of 25.7 years (standard deviation 7.64). The survey took place in Austria with a total response of 254 questionnaires. Results and implications are marked with the label "survey".

Third, a team of customer journey and information systems researchers was conducted. An analytical research was performed to verify statements and conclusions. Results and implications are marked with the label "focus group". To ensure rigorousness, either secondary sources or results of own conducted studies are referred and approve finally given implications (Hevner, March & Park, 2004).

We started by applying the journey canvas method of Jakob Schneider & Marc Stickdorn (2014). The canvas shows the examined field of research within the overall lifecycle between business and consumer. We then developed the information retrieval process for support based on the customer experience lifecycle process Touchpoint Dashboard, *Cooking Up a Winning Customer Journey Map* (Kansas, 2012). and adapted notations. The dimensions we focused our research on come from Richardson (2010), supplemented by the examined moments of truth. Finally, implications for actions complete the map. Due to their importance, implications are described in detail in a later section.

6.4 The Customer Journey Map for Customer Support

This section describes the canvas of the customer lifecycle, followed by the actual journey map. Customers' processes and journey map dimensions are described in detail to state identified moments of truth for each process stage.

6.4.1 Customer Journey Canvas

First, a canvas for support service processes is visualized to state the customer's initial situation when requesting assistance. The canvas model by Jakob Schneider & Marc Stickdorn (2014) was adapted for support actions in Figure 36. The customer buying cycle from marketing literature explains the three main stages of customers: presales, sales and aftersales. From the viewpoint of the support process all three stages belong to the pre-service period, where customers potentially enter support activities in aftersales. Before entering a support process, customers unconsciously develop expectations regarding product support.

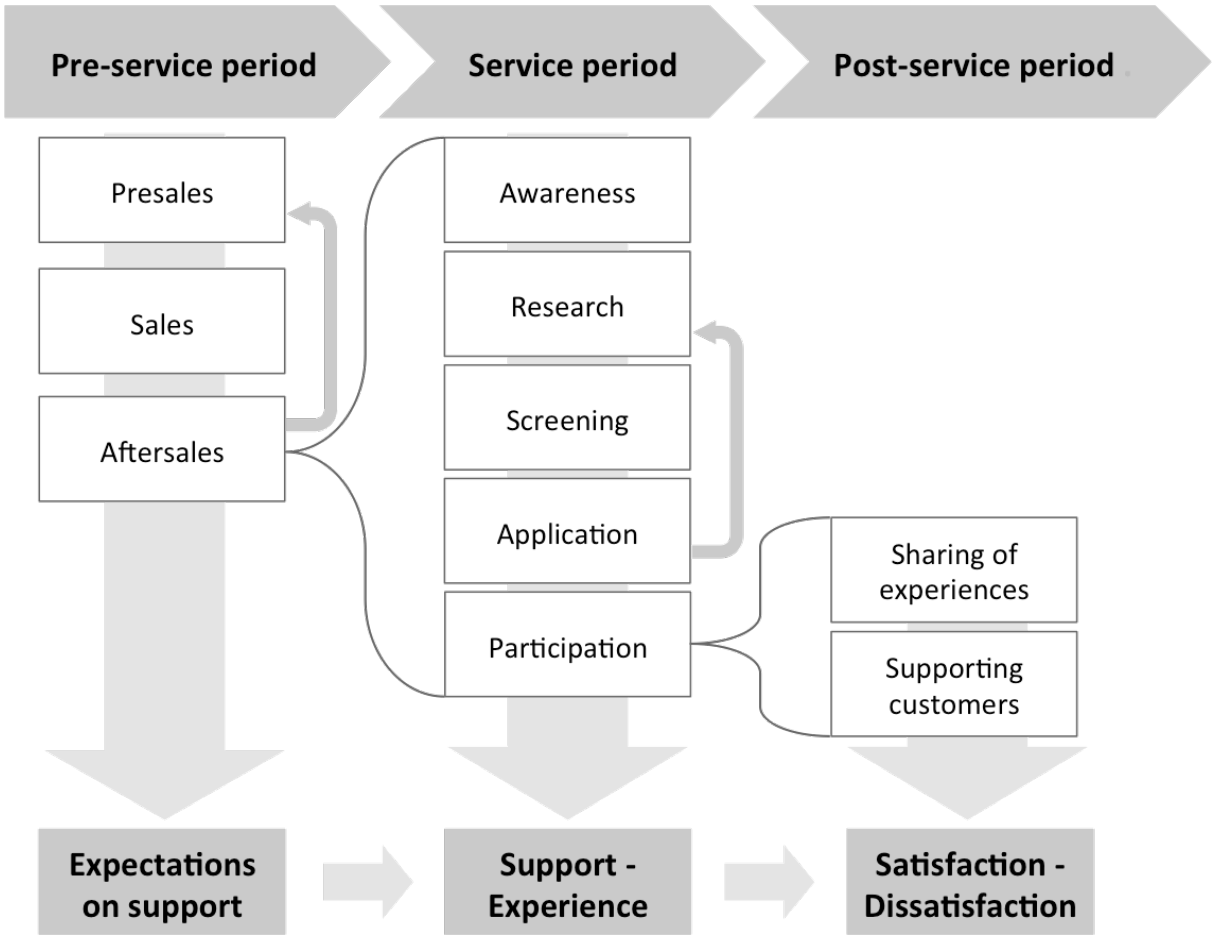

Figure 36: Customer journey canvas for customer support

When entering the actual support process, customers undergo five major steps, which are the main process stages of the later depicted customer journey map. Within the service period, customers experience the employed services and verify these experiences with their former expectations from the pre-service period. After consuming the service(s) customers may actively participate in support actions. They may either share their positive or negative

experiences with the provider or with other customers. Depending on communication offerings, customers can even become an active part of a community by helping others.

6.4.2 Customer journey map

The developed customer journey map is the result of more than two years of research in technical communication and information systems. It acts as a framework for customer support optimizations and the design of support services. Businesses can apply the framework by adding their currently offered touchpoints. Comparing current implementations of touchpoints with the here developed implications for implementations highlight potential gaps in fulfilling customer expectations. Figure 37 shows the developed map with all processes and dimensions. Business implications were clustered into five major categories and described in detail in a later section.

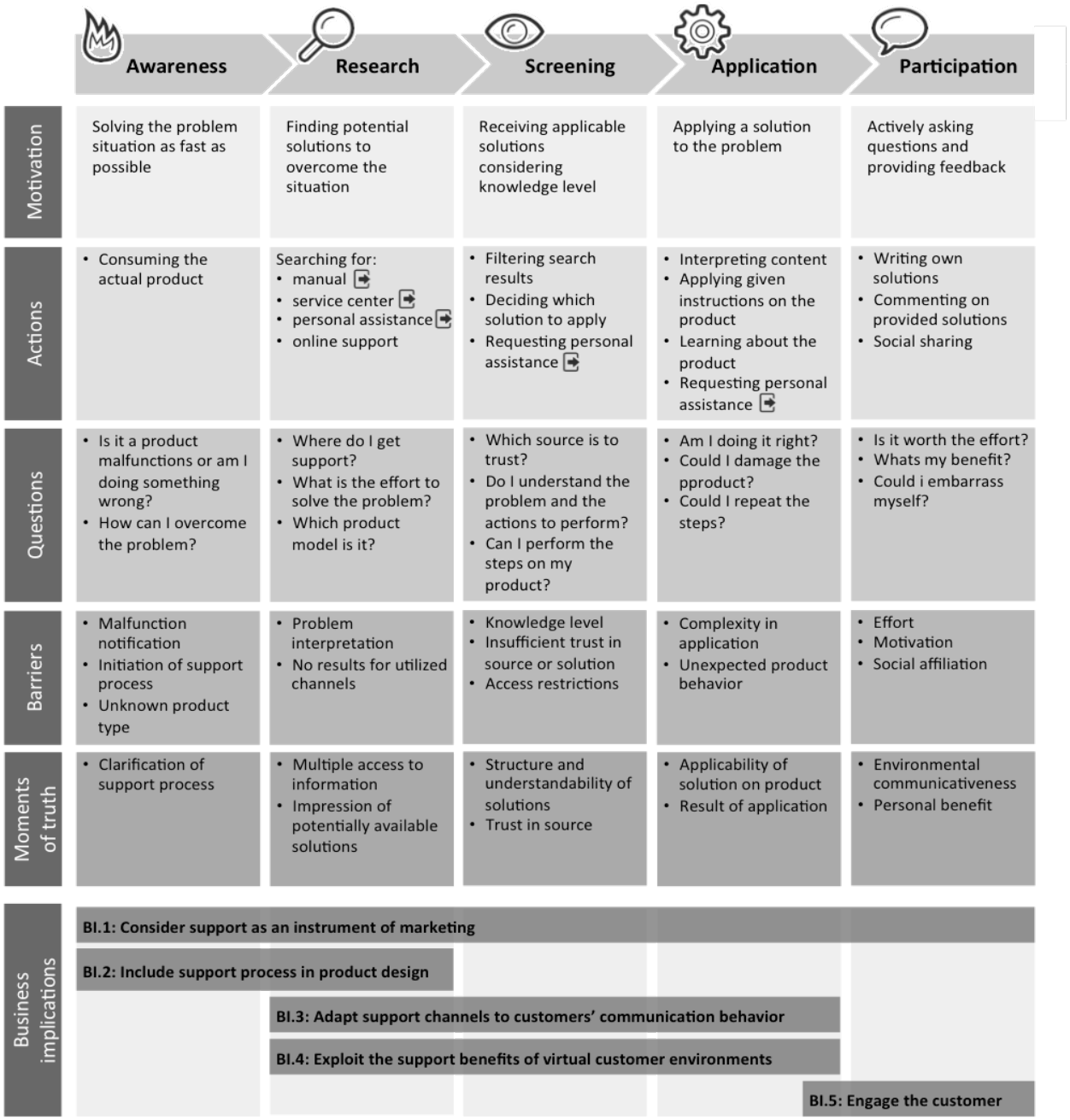

Figure 37: Customer journey map with business implications for customer support

The first step to develop a journey maps requires attention to the processes the customer undergoes within the service period. A framework has been chosen which has already proven beneficial in practice (see methodology section). Stages are described in Table 9.

Stage	Description
Awareness	Customer is using the product but gets stuck in a situation. Customer does not know how to overcome the situation and gets aware of the need for further assistance.

Research	Customer considers potential way of getting assistance. Customer hereby decides how the problem should be solved. Research of this publication focuses on virtual customer environments. Customers may also request help via other channels, which represent exits (marked as exit) of the developed journey map as they enter a different support offering.
Screening	Customer has to screen and filter potential solutions. Depending on the conducted research in the previous stage, multiple problem-solving possibilities are shown and have to be reviewed. Process ends by the selection of a solution to apply.
Application	Application of a solution on the product. Represents the actual problem-solving actions performed. Unsuccessful application may trigger multiple cycles of screening and application.
Participation	Finally, customer may take an active part within the support environment by participating in a discussion. This reaches from giving feedback to the support provider to assisting other customers facing a similar problem.

Table 9: Customer support stages

Dimensions were taken from approved mapping approaches (see methodology section). They represent the different viewpoints to observe within each of the described stages. Table 10 explains the dimensions by showing the major questions to answer for every stage.

Dimension	**Questions**
Motivation	What is the reason to be here? Why should the customer continue the journey?
Actions	What are the customer's major actions within this stage? What is the customer going to do to enter the next stage? Actions exiting the map for virtual customer environments are marked with an exit symbol (⍈).
Questions	Which questions is the customer facing within this stage? What are the customer's uncertainties?
Barriers	What circumstances prevent the customer from entering the next step? Which events lead the customer to leave the journey?

Table 10: Dimensions and questions of each customer support stage

The four dimensions build the foundation of the journey map for customer support. Multiple revisions were conducted to finally complete the map in the shown format. Entities for each relation of phase and dimension were built to cluster entities to final items.

6.4.3 Moments of truth

Moments of truth are the most critical elements within the journey, as they relate to all of the above dimensions. Moments of truth represent potential gaps between expected offerings and experienced perceptions. Each of these moments stands for an evaluation the customer is conducting to decide between satisfaction and dissatisfaction (or even over-satisfaction). Again, multiple items where clustered to simplify the map.

Moments of truth in stage of "awareness"

Within the first stage, customers require a trigger to start into a support process.

Clarification of support process	Customers encountering a situation where assistance is requested face two initial barriers to overcome. First, they have to decide which communication channel they are going to use and second, they need to know the exact name or type of product. The conducted survey shows that about 49 percent of the participants do not know where they find their manuals (survey). 28 percent answered that they do have problems naming their products by their full name or type to search for (survey). To initiate a support process, customers demand for a lead where to start the stage of research.

Moments of truth in stage of "research"

Customers entering the actual support process demand for ways to search for solutions. The ease of information access and the impression of quality are both critical moments for further actions.

Multiple access to information	Customers use diverse ways to access information. While only 17 percent of users would visit the manufacturer's website at first place, more than 50 percent directly utilize a generic search engine for support Thomas Puchleitner, "The Impact of Technological Development on the Use of Technical Product Documentation.," in *Proceedings of the 3rd International Conference on Social Eco-*

	Informatics (Lissabon, 2013), pp. 28–33.. Depending on the factor of knowledge within the product's domain, customers use different forms of content navigation such as structured navigation, unstructured search, tag clouds and recommendations (Nizam, Watters & Gruzd, 2012).
Impression of potentially available solutions	Quantitative (number of results) as well as qualitative (similarity to the customer's wording and problem thinking) aspects of listed solutions allow implications for potential problem-solving (focus group).

Moments of truth in stage of "screening"

Filtering potential results demands for patience and trust in the source of support. The comprehensibility of solutions by giving simple instructions to follow and using the customer's wordings and problem thinking are critical in this stage.

Structure and understandability of solutions	Besides the information itself, the representation and structure of content influence the customer's ability to apply given instruction as intended. Prior knowledge levels affect the feasibility of product application (Wood & Lynch, 2002).
Trust in source	Crucial for an application of potential solutions is also the factor of trust in the source (Jøsang, Ismail & Boyd, 2007). This includes the service provider as well as solutions provided by other customers, in case forum functionalities for direct exchange between customers are offered.

Moments of truth in stage of "application"

Moments of truth in the phase of application focus on the actual problem-solving attempt. Shown solutions lead to a positive or negative support outcome, influencing the support service satisfaction.

Applicability of solution on	Applying instructions finalizes the problem-solving and marks the outcome of the support process. The product has to react to the instructions exactly as described in the solution leading to the

product	expected result (focus group).
Result of application	In case modifications on the product were performed, all changes have to impact the product as described and must not damage it (focus group).

Moments of truth in stage of "participation"

The last phase is optional. The already discussed levels of participation depend on the provided environment. Regardless the participation within the environment also other communication channels may be utilized by the customer.

Environmental communicativeness	VCEs allowing customers to participate in various phases of the company's added value create benefits for both parties. Social factors such as helpfulness or friendliness of participants influence the motivation for participation (Nambisan & Nambisan, 2008).
Personal benefit	The second moment of truth relates to the fulfilling of personal benefits. Only if benefits prevail efforts, active participation will take place, which also aspires voluntary participation (Nambisan & Baron, 2009).

Based on the depicted moments of truth within these five customer phases, businesses are able to analyze their current offerings. Designing customer-orientated VCEs requires a permanent focus on customers' needs and behaviors. Design science research quests for rigor and relevant artifacts. The applicability in business settings is the aspired research objective in information systems research Hevner, March and Park, "Design Science in Information Systems Research.". Thus, business implications for application are discussed in detail in the following section.

6.5 Implications

We developed the customer journey map with the four fundamental dimensions of motivation, actions, questions and barriers to depict the moments of truth within a support process. Based on our qualitative and quantitative research over the last years we identified consumer needs and changes in business communication with high relevance for technical

communication. We collected implications for actions and clustered them to finally outline five major business implications to follow for a customer-orientated implementation of VCEs.

Business implication 1: Consider support as an instrument of marketing

Before giving implications for specific customer stages, organizational settings have to be considered. Research already highlights the relation between technical communication and marketing in research Thomas Puchleitner, "Narrowing Down Learning Research : Technical Documentation in Information Systems Research Convergence of Research Areas for Customer Learning of Technical Product Functionalities," 4 (2013), 1–6. and in practice Dörte Gebert, "Gebrauchsansweisungen Als Marketinginstrument" (Wiesbaden: Forkel-Verlag, 1988).. Product attached documents such as manuals but also further *service offerings directly influence product and brand experiences*.

Technical communication extends usability attempts Janice Redish, "Technical Communication and Usability : Intertwined Strands and Mutual Influences Commentary," *IEEE Transactions on Professional Communication*, 53 (2010), 191–201.. The conducted survey shows that customers intend to first use a product before reading manuals. While customers answered with 68 percent to read instructions before first use of a new product category, percentage drops to 39 if the have formerly used a product of the same category (survey). *Technical documents are therefore still first touchpoints of customers* with new products, especially products of categories never used before, where no usage connection to a former product can be assembled.

Last, businesses have to consider *customer support as an essential service stream to distinguish from competitors*. This impacts the roles of marketers, technical writers as well as engineers. Excellent customer support requires the combination of all three disciplines, which affects business internal competences and responsibilities.

Business implication 2: Include the support process in product design

Within the stages of awareness and research, initial barriers occur due to insufficient information about support possibilities and the process itself. We already argued that support is experienced as part of the product. *Product-embedding support offerings bridge the gap* for these stages and ensure high service satisfaction as examples show (Puchleitner & Petrovic, 2013). Where technical limitations do not allow the direct initiation of a support process, manual actions have to be supported. Software industry shows the importance of *reliability even in unexpected situations or during* (Neufelder, 1992). Providing reliability is also essential for non-software products, conveying control over product actions. The conducted survey shows that customers do not necessarily know the name or type of

product they are using. *Placing an identification label* for querying assistance is a rather simple improvement in product design.

Product designer have to be aware of the potentials of collecting data while in usage. Analyzing actual product usage scenarios by *permanently evaluating product indicators give new insights* for further product improvements or allow automatically initiated guidance or support actions (Harnisch, Puchleitner, Reinisch & Uitz, 2013).

Business implication 3: Adapt support channels to customers' communication behavior

After the first barriers of initiation, customers enter the three productive phases where an actual knowledge transfer within the VCE takes place. Hence, businesses need awareness regarding the *preferred communication channels* and utilize them to get in contact with the customer in the first place (Goodman & Hirsch, 2010). The selection of physical medium to transport information is depending on the type of product and information. A study by Broda (2011) identified relevant limitations on providing mobile support and utilizing state-of-the-art technologies. Our survey showed demand for *reliable availability of technical documentation*. Less than one third of the survey participants see virtual customer environments as a replacement for manuals. Results also show that customers want to posses some kind of document to not feel reliant on technical infrastructure (survey).

When entering stages of screening and application *focus has to be set on aspects of consumer learning*. Especially theories of discovery learning or situated learning have to be considered. Models like the ARCS model by Keller & Kopp (1987) or the ADDIE model (Branch, 2009) are more concrete and give a framework for the development of VCEs from a learning theory perspective. Depending on the customer's knowledge level and interpretation of the support situation, approaches within these stages differ. Like in learning theory, *personalized offerings* improve personal service quality and ensure successful problem-solving (Wood & Lynch, 2002; Cowley & Mitchell, 2003). One already discussed way to gather information is by utilizing search functionalities. Customers formulate questions *according to their interpretation of the situation*. Solutions written by product-trained employees may not match customer's language. Forums, where customers support each other are written by and for customers of similar knowledge levels and may therefore fit their formulations. By integrating such forums, businesses gain deeper knowledge on how customers demand support. Bundling these aspects implies the providing of a VCE for customer support. Combining different functionalities into one centralized and integrated service environment exceeds the management of single detached systems.

Business implication 4: Exploit the support benefits of virtual customer environments

The implementation of *VCEs for support purposes shows beneficial for businesses as well as customers* in many ways. Nambisan & Nambisan (2008) already did extensive research within this topic but focused on multiple forms of customer integration such as co-creation or product testing.

Due to the integration of forums, messaging tools and product knowledge bases, customers deliver support services to other customers. They do not only use the same language and sympathize due to facing same situations, but also develop support information for further assistance. *Product improvements can be placed by customers* or implied by product developers. *Customers act as communicators* and perform marketing activities with higher credibility than marketers. They may also act as *lead users for new products or services*, gaining businesses competitive advantages in product development (Füller, Bartl, Ernst & Mühlbacher, 2006).

Within the phase of research, customers demand for feasible problem-solving suggestions. Our research showed that they do not visit manufacturers websites but rather use generic search engines. Search results linking to company-external resources lead customers to services not under control of the business. Thus, the usage of *VCE forum entries and their optimization for search engines is of tremendous importance*.

VCEs require *multiple paths of navigation* and *levels of support personalization*. Typical forms of content structures are navigations, tag clouds and search possibilities. *Customer-to-customer forums have to be integrated*. The *support process should be structured as a cascade* according to the level of personal assistance needed. Customers may start with more generic problem-solving approaches to finally end with personal forms of assistance (one-to-one communication). *Filtering results according to the customer's product* prevent frustrations when applying a solution.

However, the introduction of a VCE does not automatically imply its usage. Like for other self-service technologies, also VCEs apply to the law of critical mass (Meuter, Ostrom, Bitner & Roundtree, 2003). *Triggers have to be defined to facilitate active participation of customers*.

Business implication 5: Engage the customer

The last implication relates to the engagement of customers within support processes. Businesses need to decide either to open VCEs for public without any registration or offer

specific services to registered customers only. As *provided solutions should be publicly available for search engine results*, customer contributions are advised to be at least accessible for passive consumption. *Active contributions require administration to ensure service quality*.

Forums consisting of postings from unsatisfied customers or postings without verified problem-solving results will frustrate visitors. Forum *contributions that actually solved a problem have to be marked,* so customers can filter by a "solved" flag. A barrier for active participation is the lag of expected (and later experienced) benefit the customer gains by joining a VCE. Nambisan (2002) identifies three types of benefits: product-related, community-related and medium-related benefits. He depicts *community-related benefits* (e.g. appreciations, member rankings) as most important for the participation in support environments.

Finally, participation does not necessarily imply to communicate within the company's communication space. Sharing functionalities and social media integrations exceed their area of influence. While the implementation of such services can be discussed, the dealing with this loss of control requires a *more patronizing than controlling mindset regarding direct customer interactions* (Harnisch & Puchleitner, 2013).

6.6 Conclusion

Before concluding it is important to also mention the limitation of the current work. First, the object of research was the business-to-consumer market for consumer electronic goods. Although other business-to-consumer markets are expected to involve similar support processes, the map was developed with focus on consumer electronics only. The second limitation corresponds to business-individual touchpoints. To take further actions, company-specific gaps between the described moments of truth and current implementations have to be analyzed.

Customer support shows strong influence on customer experience, which becomes the most important differentiation between competitors. When products become commoditized, service offerings are getting more important for customers to base their buying behavior on. Facing these developments, it is particularly surprising how little effort businesses still put in their support offerings. Virtual customer environments connect businesses closer with their customers and allow businesses to enrich problem-solving and gain deeper insights for product and support optimizations. Customers on the other hand benefit from higher support quality.

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7 Using New Media for Consumer Learning: Mapping practical and theoretical approaches on Information Service Design

The following article was authored by Thomas Puchleitner (University of Graz / evolaris next level GmbH), is in working paper status and is a full citation with minor changes in formatting and numbering.[87] It has been sent for review to the International Journal of Information and Communication Technology. In case of the publication of the modified working paper, the International Journal of Information and Communication Technology would hold the copyright of the final version of this article. See http://online.uni-graz.at for a current status of the publication.

7.0 Abstract

"Consumer electronics is a market segment with constant growth for the last years. Average product lifecycles are dropping and consumers possess a growing amount of technical products for shorter periods of time. Learning how to use a new technical product or how to react in situations when support is required are the two key triggers for technical documentation. At the same time, products resemble each other in terms of technical features. Offering high overall customer experience beyond solely proper product specifications is highly valued by customers and will therefore be a major future competitive advantage for businesses. Utilizing information technologies allows the development of customer support environments for high product learnability. In our practical part of research we analyze existing forms of learning aids for customers. Embedding intelligent information systems into products can ensure appropriate support for product learning. Findings are used to identify relevant theoretical research regarding the learning of product usage. Results are structured in a concept map including references to the depicted studies. By considering the practical as well as theoretical aspects, implications for the implementation of customer support environments with focus on product learnability are given.

Keywords

consumer learning; information design; learning technologies; embedded environments

[87] Puchleitner, T.: Using New Media for Consumer Learning: Mapping practical and theoretical approaches on Information Service Design, Working Paper, University of Graz (2014).

7.1 Introduction

Late research regarding learning chiefly focuses on the utilization of information technology in form of e-learning or m-learning from pedagogical perspectives. Only little research regarding the knowledge transfer process of customers when learning how to use a product, also referred to as product-related learning, can be depicted. While researchers highlight the potentials of new information technologies in classic student-learning environments, fields of application for product manufacturers and customer service departments and are left out. According the various studies, digital media dramatically changed how information is obtained and processed (Anonymized, 2013b). Online platforms and social media channels allow the exchange of product or service experiences between customers, with tremendous impacts on business communication. Presales and aftersales are phases off the product, but with high impact on the overall customer experience. Yet, online within the usage phase the potential customers can actually decide whether the product fulfills their requirements or not. Optimal customer assistance within the usage phase by providing accurate information allows businesses to build a competitive advantage. Research in technical communication clearly indicates the need and benefit of different forms of technical documentation, as customers in different usage or problem situations also require diverse kinds of support (Borelli, 1997; Wiese, Sauer, & Rüttinger, 2004). Within our ongoing research we noticed two main challenges in consumer learning. First, a divergence between actions research indicates as beneficial in learning and what practitioners actually perform can be depicted. Second, focus in research also varies tremendously and findings are therefore barely straightforward, neither for researches nor for practitioners. We therefore determined the demand for a keen insight into product-related learning in both, current research as well as practical implementation. This research paper conforms to these requirements by mapping both fields and drawing implications for the implementation of state-of-the-art customer support systems.

7.1.1 Conducted Methodology and Publication Structure

To consider both practical as well as theoretical aspects of product-related learning, research was undertaken in both fields with appropriate methodologies. The conducted methodology is therefore twofold separated into a practical and a theoretical approach. While for the first part results from practical implementations were analyzed and transferred into a morphological box (Ritchey, 2013), theoretical findings from research are identified and categorized. A mapping methodology to structure the findings was applied. Concept maps (Coffey, Hoffman, & Novak, 2003) are an often-utilized method to show the relationship between theory and practice. Additionally, links between different concepts and their relation

to product-related learning can be highlighted. Figure 38 illustrates the structure including the gathered results.

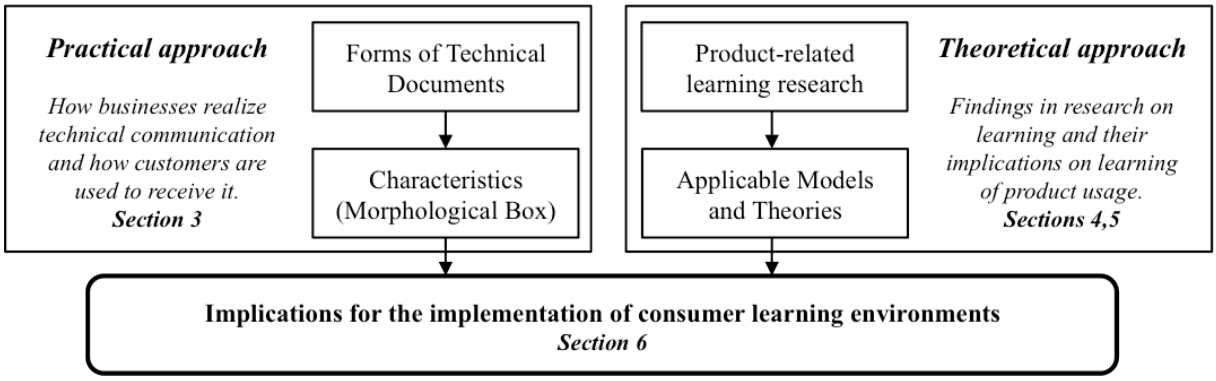

Figure 38: Research methodology and publication structure

The structure is as follows: In section two, the relevance of customer support and product learning in marketing is highlighted. Support is recognized as part of the actual product, which implies that impressions of support are reflected on the product's final impression. Within the marketing discipline, customers' impressions gained across multiple phases are described as the customer's experience. Section three focuses on practical approaches on technical documentation and customer support. Current forms of technical documents with their variations and implementations due to their diverse fields of application are identified. Results are summarized and transferred into a morphological box to illustrate variables with their characteristics in current implementations. In sections four and five, insights into the vast literature we encountered are given. First in section four, research on product-related learning and findings within the pedagogic discipline regarding customer support are assorted. Findings are categorized into the generic field of paradigms, into specific contexts of learning and research on the impact of learning methods. Based on the research results of chapter four, in section five models and theories are determined to build an applicable foundation for implementations of eligible support systems. Finally, an elaboration of results from the practical as well as the theoretical approaches allows the deduction of implications. Due to the relevance for business implementations, findings are of high interest for marketing practitioners, product managers and authorities responsible for customer support. Researchers within the scientific fields of customer support and product development find a foundation to gain extensive knowledge for further research.

7.2 The uprising Relevance of Technical Documentation for Marketing

The user's experience while interacting with a product or service plays a major role for acceptance and therefore for further usage. A product's usability is highly dependent on such factors as "easy to learn", "efficient to use" and "easy to remember" (Nielsen, 1993). To fulfill these requirements producers not only have to put effort on product design to simplify operation, but also need to become aware of product related enclosures and supplements. All these additions fulfill two aims: first, customers depend on them to utilize the product for their need and second, these items represent the company and the product and therefore have representational functions. Technical documents deal with both subjects, focusing directly on the user to overcome a situation and representing product and brand in a positive and marketing-orientated way.

Regardless the form and representation of technical documents, the focus is set on learning and maintaining products. Marketers already consider product related information and documents as a channel for communication and marketing purposes (Pepels, 2002; Aubert, Trendel, & Ray, 2009). The relevance for marketing is emphasized by considering the customer's view on products or businesses. Shaw, Dibeehi and Walden (2010) differentiate between three experience levels (see Figure 39). While "usability" describes the interaction with the product, "user experience" extends the view by including such factors as the product's utility or reliability. "Customer experience" represents the overall impression the customer is experiencing regarding the product. Hence, beside a product's usability and user experience factors, characteristics like image or values are typical influencers for an overall customer experience. For markets where products are hard to distinguish by technical or design aspects like in the computer or smartphone market, a stronger focus on customer experience acts as an important competitive advantage.

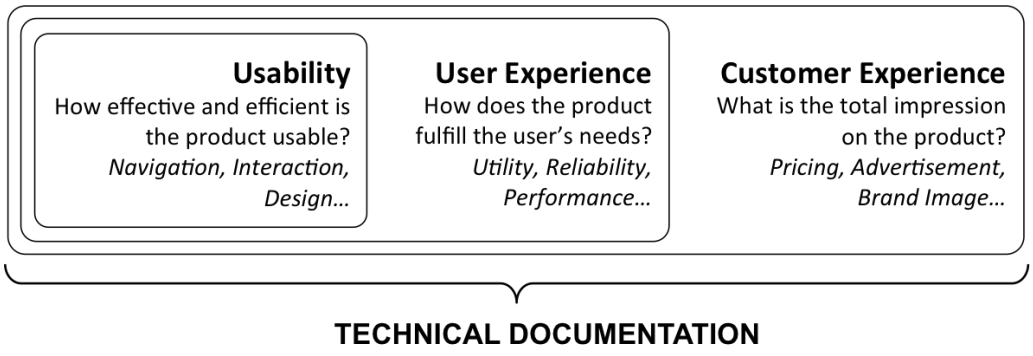

Figure 39: Marketing relevance of technical documentation

While technical documentation is not feasible to redeem usability limitations, manuals are employed when potentials of usability are exhausted or deeper explanations are required. They therefore have impact on the user experience to values such as utility, reliability or product performance. Due to user's reflection on the brand's image, product accompanied

documents are eligible to have high influence on customer experience. From a customer's perspective though, the helpfulness of these documents stands in the foreground. Only by providing adequate ways to learn how to handle product features or trouble-shoot situations, users will intend to utilize manuals. To assure this usefulness, technical writers have to put effort on the theoretical backgrounds of how learning happens and knowledge transfer can be initiated.

The mediation of knowledge represents a topic very much related to the scientific field of social and educational sciences. Late developments in information technology brought new attention to the educational field by applying new forms of time- and location-independent teaching. E-learning and later on also m-learning gained high interest for scientific fields formerly less related to learning theories. Scientometric studies (Anonymized, 2013a) show information systems research as driving force in areas such as computer mediated learning or gamed based learning. Marketing research on the other hand focuses on aspects of customer behavior, but only little research relate to the impact of product learning on product usage and customer experience. Theory shows a vast number of theories, paradigms, methods and models of learning and teaching mainly for educational purposes. While the main goal for learning of product functionality does not utterly distinguish from educational learning some peculiarities apply. The following chapter gives insights into relevant aspects of learning theory on product related learning.

7.3 Current practical Approaches on Technical Documentation

Technical communication belongs to the discipline of translation science. Before manuals got considered as instruments of marketing such manuals were created with the purpose to translate complex product features into a language the user actually understands. Like in computer technology, where in the beginnings terminal software without graphical interfaces required the user to learn commands to operate the system, also in the non-software segment developments in terms of usability occurred. Human oriented design or human centered design gained tremendous importance in science as for businesses. The ability to utilize a product in the way the user intents to requires different support mechanism depending on the current user's need. Various forms of technical documentation to support technical communication emerged resulting in printed and digital forms of customer support.

7.3.1 Types of Technical Documents

The following Table 11 gives an overview over the most common types of technical documents and texts. The 'time' column represents the typical moment where a user consumes the type of document or text (either initial or continuously). The 'trigger' column on

the other hand stands for the common reason of users to require the specific type (SE = servicing, PL = product learning, PS = problem solving).

Time	Trigger	Type	Focus and Definition
Initial	SE	Installation Manual	**Product installation and commissioning** Installation manuals intend to explain all required steps for a first installation and configuration of a product. Depending on the type of product these manuals reach from simple step-by-step introductions to detailed explanations for complex product setups.
Cont.	SE	Maintenance Manual	**Product maintenance activities** Products requiring specific maintenance steps in regular as well as irregular intervals collect all such steps in maintenance manuals. In some cases also confirmation of processed tasks are protocolled in these documents for highlighting the fulfillment of safety procedures.
Cont.	PL	User / Instruction Manual	**Learning of product functionalities** User or Instruction Manuals are the minimum a producer encloses into packaging, either in printed or in digital form. If no other document is handed by, these manuals deal with all the major issues and therefore also fulfill typical functions of other here listed types. Many countries also provide statements of requirements for user manuals.
Initial	PL	First-Use Manual, Hands-On Manual	**Quick introduction on installation and handling major functionalities** In contrary to Installation Manuals the focus of First-use Manuals or Hands-On Manuals is more related to the functionality and usage of the product instead of the first-time installation. Depending on factors like the complexity of installation or pre-configurations, they may complement or replace Installation Manuals. Especially products where users are not expected to

			read a full manual (e.g. self-explaining products with high usability), compact First-use manuals allow the highlighting of major instructions for usage.
Initial (Cont.)	PS	Frequently Asked Questions (FAQs)	**Simple answers to most frequently asked questions** Companies depict the most asked questions by users and bundle them in FAQ-lists. Besides giving answers for product users, FAQs are also an often-utilized format in presales. Especially e-commerce websites list the most relevant matters for potential customers within the decision making process.
Cont.	PL, PS	Glossary	**Index of most relevant terms or attributes** Explanations or instructions for technical products may assume prior knowledge of terms or require some minimum level of experience with product attributes. Glossaries summarize often used and relevant terms related to the product's specifications as well as keywords and phrases with general importance for explanations in other manuals.
Cont.	SE	Release Note	**Information regarding changes on product** Products that are continuously enhanced in features or other improvements like software publish these updates as new releases. Relevant information on updates is communicated in Release Notes to give insights into performed changes. Based on these information user and maintenance personal is able to decide whether the update is mandatory and which further steps have to be performed when upgrading the product.
Initial / Cont.	SE	On-Product Information	**Information and Instruction placed on product** On-Product information is placed on physical products when some attention while usage is required. As physical objects provide limited space to place notices and reading time during usage is limited, information

			may only contain warnings or simple step-wise instructions.
Initial / Cont.	PL, PS	Software/Online Help	**Context sensitive and problem orientated support** Due to late developments in information systems and the worldwide spread of the Internet, support in form of Online Help Systems in various forms emerged. Software products directly integrate help systems and allow instant context related support.
Initial	-	Buyer's Guide	**Product information prior purchase** The purpose of buyer's guides is not to directly support the customer in terms of product usage questions but to act as an important document in presales. The intention is to inform customers in buying decision by describing relevant product attributes which are required for a decision making process.

Table 11: Types of technical documents

As Table 11 points out, forms of technical documents vary by the intended objective. While some forms specifically focus on 'getting-to-know' the product like first-use manuals or installations guides, others support customers long after purchasing the product like maintenance manuals. However, the better part of documents addresses users during the whole product's lifecycle. To separate the dimensions and attributes of technical documents depicted, a morphological box is developed.

7.3.2 Dimensions of Technical Documentation

Based on the forms of technical documents in the previews subsection the following morphological box in Table 12 structures the encountered dimensions of support documents. The corresponding attributes are provided for each dimension. The usage trigger describes the intended objective for the documentation, target levels, target groups and audience relate to the aimed group of users. The dimensions of medium as well as presentation demonstrate in which representative forms the documentation is provided. Content preparation and structuring differentiates forms of access to the information. At last, a distinction between content that is updated and static content is done.

Dimension	Attributes					
Usage trigger	Learning of usage		Problem solving		Maintenance	
Target level	Beginners		Intermediates		Professionals	
Target group	User		Service personal		Sales personal	
Audience	Company intern			Company extern		
Medium	Print		Digital	Online		Product-embedded
Presentation	Text	Figures	Audio	Video	Inter-active	Mixed
Content preparation	Descriptive			Instructive		
Content structuring	Use case centered		Product centered	Context orientated		Narrative structured
Content updateability	Static			Dynamic		

Table 12: Morphological box for variations of technical documentation

The morphological box represents observable representations of technical support. No direct implication on thoughts regarding the learning approach intended by the provider can be given. Like in pedagogic a concept usually frames the way of learning and thereby ensures quality and progress. Various models and theories on learning exist in literature to apply in practice. Research on how knowledge is processed by learners builds the foundation for theses models and theories. Their application is a widely discussed research subject and builds a fundamental selection for all further steps in preparing and representing support materials and services. Businesses implement current forms of technical support for a reason as they identify a demand in a practical context. Proposing implications by only evaluating theoretical aspects of learning would omit practical knowledge for implementations. Therefore, theoretical approaches in section five are restricted by the potential of practical realization and their reference to product learning. In the following section these main learning references are listed and categorized. Research publications

and studies are stated for each reference to provide deeper understanding and foster further research in the specific topic.

7.4 Research on product-related Learning

Conducting an intense literature review on a dispersed topic like consumer learning requires the utilization of an appropriate research method to structure findings and build relations among them. While in a first attempt (Anonymized, 2013a) a primarily quantitative approach was undertaken to determine the most relevant research domains as well as corresponding institutions and researchers. This research paper depicts qualitative findings in literature research. Starting from institutions and researchers on the one hand and a database-based research on the other hand, learning-related topics were reviewed. The focus for all research was set on the learning of product usage. Authors focus on product learning from various different perspectives. Solely pedagogical theories were kept out, as their major attentions are not set on product learning topics.

7.4.1 Concept Mapping

The concept mapping approach (Novak & Cañas, 2006) was conducted to structure these findings as suggested in literature for similar undertakings (Schira, 1992). Concept maps themselves have their origin in a constructivist interpretation of learning, where the learner actively builds his own knowledge. Concept maps allow the representation of concepts, theories and other abstractions. Logical relations between these elements can be integrated as connections. Figure 40 gives an overview for research in consumer learning.

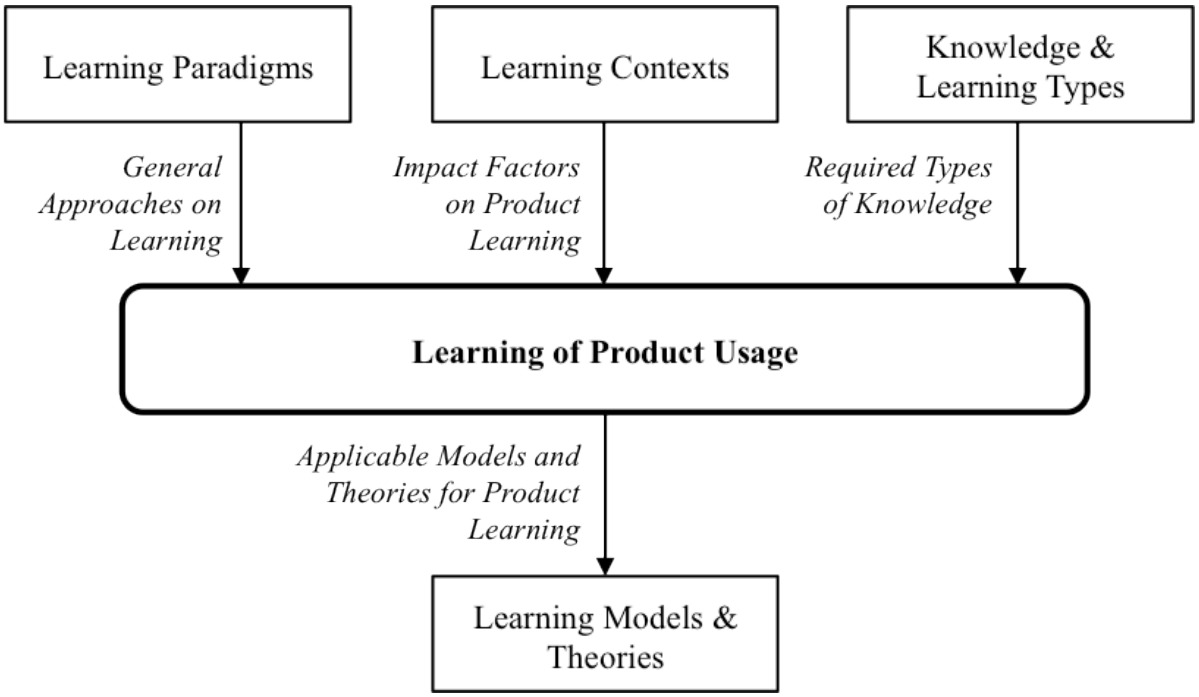

Figure 40: Concept map for research in consumer learning

Paradigms build a rough basis for underlying concepts and patterns. In terms of learning theory especially psychologists and philosophers developed a diverse set of paradigms how people learn and knowledge transfer takes place. In consumer learning, literature specifically handles two types of required knowledge and learning types. Learning contexts on the other hand determine the correlation between different learning dimensions. These dimensions are separated by the impact of learning methods by the learning provider such as product manufacturers in case of product functionalities. Based on this research, which acts as an input of product learning, also some models and theories exist which intend to describe learning patterns. These models and theories are discussed in very controversy ways as they try to allow implications on learning by giving a theoretical framework of learning. The explored elements are described in detail. Interested researchers are given literature references for further information, directly relating to product learning where feasible. Some of these references are generic nature but demonstrate their relevance for the topic. Definitions are kept out due to their pedagogic nature without any direct applicability regarding customer benefits (e.g. open-space learning), others seem too generic or share intentions with other included terms (e.g. visual learning, learning by discovery).

7.4.2 Paradigms

Various theoretical paradigms on learning can be encountered in literature as seen in Figure 41. These paradigms also represent a chronological evolution regarding the understanding of knowledge processing in educational psychology. The behaviorism

paradigm formed by research experiments on animal behavior of John Watson in the late 19th and early 20th century initiated discussions on the psychology of learning. The observable behavior instead of actions and reactions acting in the learners' mind build the center of attention. The gestalt movements from the German word for pattern or figure widened this perspective in the 20th. By focusing on patterns of behavior instead of observing overt behavior, insights on why reactions take place are provided.

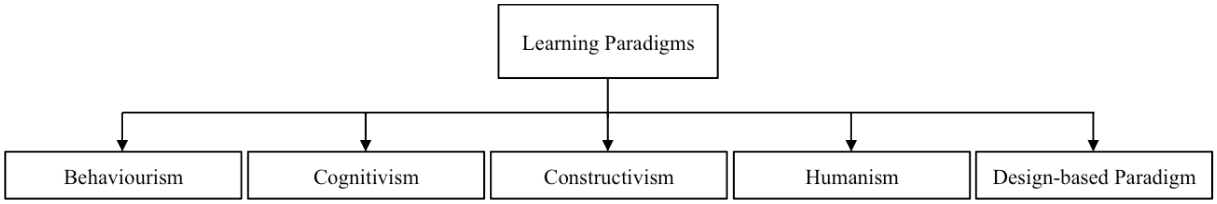

Figure 41: Learning paradigms as excerpt from the concept map

Behaviorism as paradigm of the school of psychology was strongly formed by John B. Watson in the early 20th century. In behavioristic thinking all behavior are responses to a stimulus, which are trained by our environment. By arguing that inner experiences and feelings could not be properly studied, the focus is set on observations of reactions.

Later the **Cognitivist** paradigm responded to these limitations by developing inferences about inner human processes. Mental events are acknowledged to take place. They have to be identified to understand how people learn. Knowledge is seen as a mental construction in the learner's mind with the schemata transformed when learning occurs.

Constructivism widens this approach by taking credit of already discovered knowledge and experiences. The learner is seen as a constructor of information in dependence of prior knowledge. Every learner therefore builds his own subjective reality by linking new information to the existing mental representations. In terms of learning the focus is set on a self-directed and creative ways of learning to allow learners the building of relations while processing knowledge.

The **Humanism** paradigm concentrates on the free will of learners to extend their knowledge. Starting in the 1960s learning is seen as a chance to fulfill the personal potential. The person itself and its motivation come into focus, as these are the essential components when learning takes place.

Design-based learning is a relatively new paradigm, which relates to the importance of an experienced relation between theory and practice in learning. In a learning-productive

environment learners experience outcomes and connect the knowledge to real-life contexts. Learning for real world situations (as a “pull” for information) is therefore favored to solely theoretical inputs (“push” of information).

7.4.3 Learning Contexts

While paradigms act as a theoretical background in learning, literature specifies a vast amount of contexts when and how learning happens. A deep literature study was conducted to gather contexts with relevance to product-related learning. Contexts in Figure 42 are separated into two main groups, depending on the impact of a provided learning method by the instructing party. Depending on the type of context, contexts can be influenced by the instructing party (level of activity) or are solely affected by the learner (learning schedule). References are given to highlight the contexts with its characteristics for learning of product features. Where feasible, direct relations to product learning are referenced.

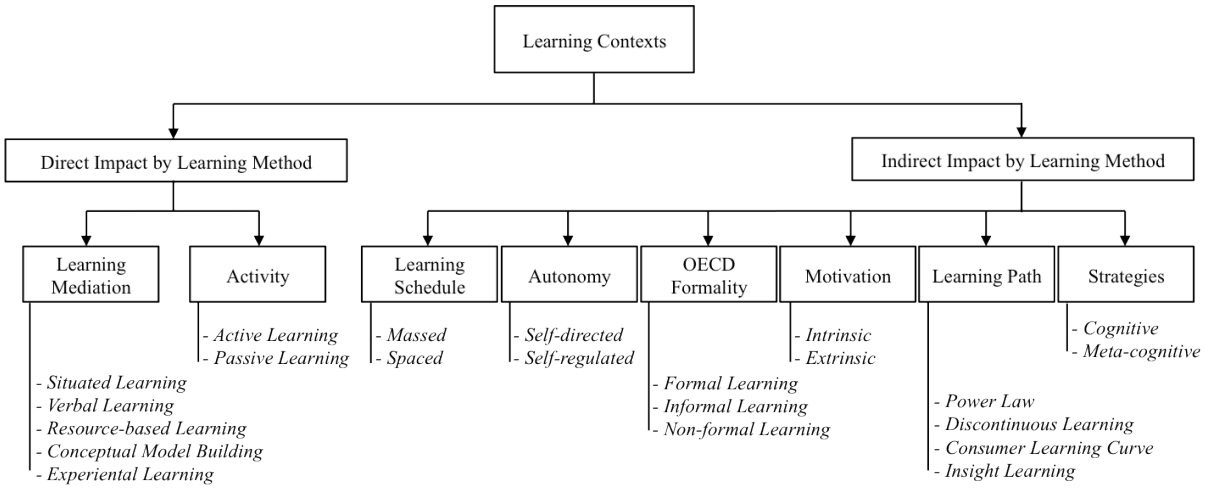

Figure 42: Learning contexts as excerpt from the concept map

Direct Impact by Learning Method

The ***mediation of learning*** relates to the overall environment of how the learning process is designed by the instructing party. While one way could be to put the learner in a specific situation with a product or service, also the classic verbal learning in form of presentations and explanations of features may occur. Resource-based learning centers the situation on a source or material of attention – starting from handbooks to prototypes of the product. Experiental learning focuses on real-world applications and therefore demonstrates the utility of the product. Mediation in form of conceptual learning or model building allows users to understand complex products by building a model in mind. Additionally, the instructing party can influence the ***level of activity*** in learning contexts. Either an active way

of transferring knowledge (in form of a direct participation) or a more passive form of learning can be supported. Table 13 lists findings and references in a structured form.

	Types	References
Learning Mediation	Situated Learning	Herrington, J & Oliver, R. 1995, `Critical characteristics of situated learning: Implications for the instructional design of multimedia´, in ASCILITE 1995 Conference, Meldbourne.
	Verbal Learning	Fergus, CI & Lockhart, RS 1972, `Levels of Processing: A Framework for Memory Research`, *Journal of Verbal Learning and Verbal Behavior*, vol. 11, no. 6, pp. 671–84. Lakshmanan, A, Lindsey, CD & Krishnan, HS 2010, `Practice Makes Perfect? When Does Massed Learning Improve Product Usage Proficiency?´, *Journal of Consumer Research*, vol. 37, no. 4, p. 599-613.
	Resource- (Source-/Material-) Based Learning	Hannafin, MJ, Hill, JR, & McCarthy, J 2002, `Designing resource-based learning and performance support systems´, in *The instructional use of learning objects.* eds DA Wiley, Association for Educational Communications and Technology, Bloomington.
	Conceptual Model Building	Sein, MK & Bostrom RP 1989, `Individual differences and conceptual models in training novices users.´, *Human-Computer Interaction*, vol. 4, pp. 197-229.

	Experiental Learning	Moon, J 2004, `A Handbook of Reflective and Experiential Learning: Theory and Practice', Routledge Falmer, London.
Activity	Active Learning	Benware, CA & Deci, EL 1984, `Quality of Learning With an Active Versus Passive Motivational Set´, *American Educational Research Journal*, vol. 21, no. 4, pp. 755-765.
	Passive Learning	

Table 13: Findings and references regarding a direct impact by learning methods

Indirect Impact by Learning Method

Various learning contexts play an important role in learning but are barely influenced by the instructing party. The ***schedule of learning*** is mainly set by the learner. The same implies for the factor of ***autonomy***. Self-directed or self-regulated learning are depending on the learner's attitude. Also the ***Organisation for Economic Co-operation and Development (OECD)*** differentiates learning contexts by the recipients' awareness. While differences in ***motivation*** obviously implicate variable learning outcomes, also the ***path of learning*** shows influential on the progress of learning. ***Learning strategies*** refer to cognitive aspects or even meta-cognitive aspects of knowledge transfer approaches. Table 14 includes references to the relevant studies.

Types		**References**
Learning Schedule	Massed	Lakshmanan, A, Lindsey, CD & Krishnan, HS 2010, `Practice Makes Perfect? When Does Massed Learning Improve Product Usage Proficiency?´, *Journal of Consumer Research*, vol. 37, no. 4, p. 599-613.
	Spaced	
Autonomy	Self-directed Learning	Zimmermann, BJ 1990, `Self-regulated learning and academic achievement: An Overview.`, *Educational Psychologist*, vol. 25, no. 1, pp. 3-17.

	Self-regulated Learning	Chee, TS, Divaharan, S, Tan, L & Mun CH 2011, `Self-Directed Learning with ICT: Theory, Practice and Assessment´, Ministry of Education Singapore, Singapore.
OECD Formality	Formal Learning	Werquin, P 2010, `Recognition of Non-Formal and Informal Learning: Country Practices´, Organisation for Economic Co-operation and Development (OECD).
	Informal Learning	
	Non-Formal Learning	
Motivation	Intrinsic	Ryan, RM & Deci, EL 2000, `Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions´, *Contemporary Educational Psychology*, vol. 25, no. 1, pp. 54-67.
	Extrinsic	
Learning Path	Discontinuous Learning	Lakshmanan, A & Krishnan, HS 2011, `The Aha! Experience: Insight and Discontinuous Learning in Product Usage´, *Journal of Marketing*, vol. 75, pp. 105-123.
	Consumer Learning Curve	
	Insight Learning	
Strategies	Cognitive	Johnson, EJ, Bellman, S & Lohse, GL 2003, `Cognitive Lock-In and the Power Law of Practice´, *Journal of Marketing*, vol. 67, pp. 62-75. John, BE & Packer, H 1995, `Learning and using the cognitive walkthrough method: a case study approach´, *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 429-436. Kolb, A & Kolb, D 2009, `The Learning Way: Meta-cognitive Aspects of Experiential Learning´, *Simulation & Gaming*, vol. 40, no. 3, pp. 297-327.
	Meta-Cognitive	

Table 14: Findings and references regarding an indirect impact by learning methods

7.4.4 Knowledge and Learning Types

The conducted literature review depicts a divisiveness regarding the type of knowledge as well as the type of learning as relevant for consumer learning as seen in Figure 43.

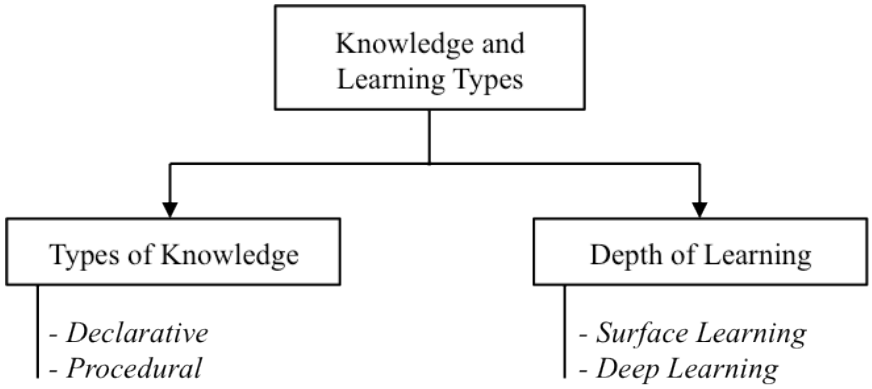

Figure 43: Knowledge and learning types as excerpt from the concept map

First, the ***type of required and therefore mediated knowledge*** varies depending on the features to learn as well as the product itself. More professional digital cameras build an example for products requiring declarative knowledge, as some general knowledge regarding photography is required to take proper pictures. On the other hand, procedural knowledge relates to aspects of "how" something is operated and therefore concentrates on performing specific tasks. In literature the required ***depth of knowledge*** to learn is stated as dependent on the learning objective. While some products allow an adequate operation by superficial engagements, others require deeper learning efforts for sufficient operation. Again, findings and corresponding references are listed in Table 15.

Types		References
Types of Knowledge	Declarative	Ashby, FG & Crossley, MJ 2010, `Interactions between declarative and procedural-learning categorization systems´, *Neurobiology of Learning and Memory*, vol. 94, pp. 1-12.
	Procedural	Berge van, T & Hezewijk van, R 199, `Procedural and Declarative Knowledge: An Evolutionary Perspective´, *Theory & Psychology*, vol. 9, no. 5, pp. 605–624.
Depth of Learning	Surface learning	Chin, C & Brown, DE 2000, `Learning in Science: A Comparison of Deep and Surface Approaches´, *Journal of Research in Science Teaching*, vol. 37,

	Deep learning	no. 2, pp. 109-138.

Table 15: Findings and references regarding knowledge and learning types

7.5 Applicable Models and Theories

To summarize the above-depicted paradigms, contexts and types of knowledge processing, some models and theories on how learning of product usage takes place can be stated. While some of these are more concrete and build a basis for application of learning environments (eg. ARCS Model of Motivational Design), others are more theoretical attempts (eg. Situated Learning). The models and theories shown in Figure 44 build a foundation for implementations of customer support systems with a high emphasis on consumer learning. Businesses are advised to align future implementations on such a theoretical basis to foster learning outcomes. This directly acts as a positive effect on customer support. Implications for the implementations of intelligent consumer support environments are highlighted in italic font type.

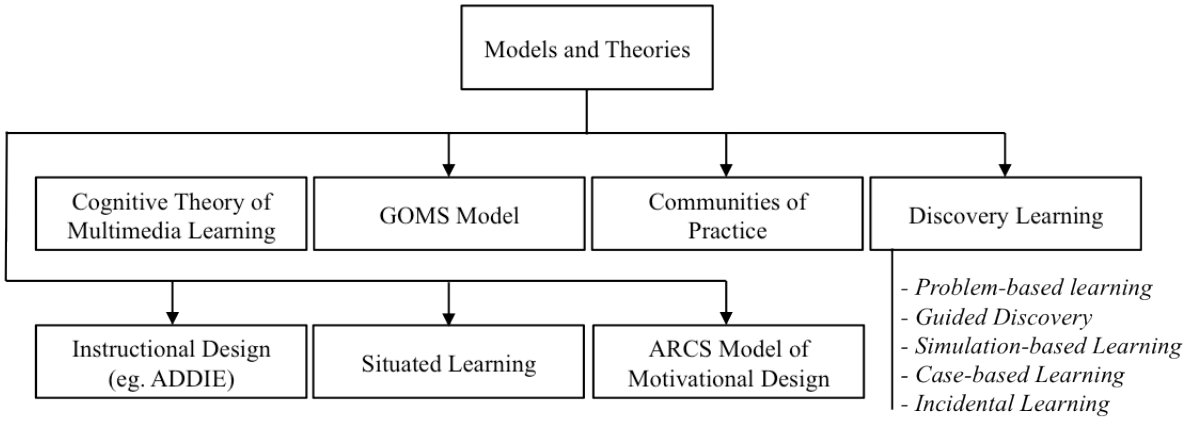

Figure 44: Models and theories as excerpt from the concept map

The Cognitive Theory of Multimedia Learning by Richard Mayer indicates that information is processed in a visual and an auditory form. Learners have limited capacity to process the incoming information. The product user is therefore forced to filter, select, order, and to organize the information based on prior knowledge (see Constructivism) (Mayer, 2001). For technical communication the focus should be set on keeping documentation and support as simple as possible. Additionally, the user should be allowed to get information in context to the current problem to overcome, excluding irrelevant attached information.

The GOMS (Goals, Operations, Methods, and Selection) model is also an information-processing model that tries to predict the reaction of skilled users in unpredictable situations. It is often used in contexts of human-computer-interaction (HCI) and software development.

Four components characterize as users behavior: Goals (what does the user want to achieve?), Operators (actions to accomplish the goals), Methods (procedures of operation) and Selection rules (decision which method to follow in specific circumstances) (Card, Moran, & Newell, 1983). Separating these four elements, the model allows detecting inefficient methods for frequently requested goals and therefore acts as a starting point for usability optimizations. By analyzing the demand of support for specific product functionalities, implications for redesigns of the product as well as the documentation can be established.

Communities of Practice are social learning environments where people with common goals meet to achieve better learning results. People form up such communities to exchange information and knowledge. They thereby support others and in the same time request help from participants. In contrast to simple interest groups, participants in Communities of Practice are practitioners within the community's topic. Exchanged information is therefore more of practical than theoretical relevance to the members. The development from simple text-manuals to customer-oriented support systems allows the integration of interaction mechanism between customers. By providing technical systems to form an online community customers not only receive support from the product's manufacturer but also get impressions, opinions, ideas and solutions from other customers. This shows beneficial in many ways, as customers not only get instant support from an independent source, but also effects of social affiliation may occur. Companies have to be aware of potential negative aspect of such an open communication exchange between customers, as also negative feedback and critique can be spread.

Whenever the solving of concrete problems is the main intention of learning, the pedagogic theory of Discovery Learning has to be noticed. Discovery Learning believes in the self-motivation that occurs when learners discover facts and gain knowledge on their own by inquiry-based instructions only. The learning situation is therefore initiated by a problem to solve and requires the learner to expose himself with the specific topic. Besides the development of new knowledge also general problem-solving skills are trained. On the other side, Discovery Learning also may lead to information overload in case no external support is provided, such as Guided Discovery intents to do. The learning situation can be initiated by various causes such as problems, simulations or specific cases, but also incidental forms of learning lead to Discovery Learning. In situations where assistance is requested, customers intend to get support by the product's manufacturer. In this case the customer finds himself in a situation that can be assigned to the theory of Discovery Learning. The balance between a self-orientated approach and guidance is of high importance. While a too restricting support

system would limit the potentials of information exchange between customers, a reasonable structuring of available content allows the implementation of a narrow-down approach.

The Situated Learning theory is very similar to the theory of Discovery Learning as both theories focus on external triggered situations. Again, the context plays the major rule to initiate learning. An existing authentic environment fosters cognitive learning, but also social activities between learners are relevant. Collaborative interaction not only leads to new learning situations but also may support learning itself. As already mentioned, the Situated Learning theory equals both theories of Discovery Learning and Communities of Practice. For that reason, similar implications apply. Context plays a major role in learning and leads to solutions where customers have to receive support in exactly the context they are experiencing problems.

Keller and Kopp (1987) developed a model of Motivational Design to highlight the main factors that foster the learning process. They promoted Attention, Relevance, Confidence and Satisfaction as these factors and named the model 'ARCS Model'. Keller and Kopp give very accurate definitions and examples for each of these four factors. Attention is gained either by curiosity due to inquiries or by surprises for the learner. To assure Relevance practical examples should be used, Confidence is established by the definition of goals and objectives to reach. At last Satisfaction is caused by a representation of already achieved results and appreciation. The ARCS Model is a very concrete model to implement consumer-learning environments. Also motivational aspects of the customer are considered. While Attention and Relevance is usually given by the support context, factors of Confidence and Satisfaction motivate the customer to further expose himself to the product and additionally feel comfortable handling problematic situation. This emits that products are ease to learn, even when not intuitive in the first place. Also lock-in-effects may occur as customers imply that they learned the usage of one product and intend to re-acquire products with equal functionality. Products with different usability, like from competing businesses, would once again require learning how to use it.

Another model that structures the learning process into steps to accomplish is the 'ADDIE Model'. It belongs to the concepts of Instructional Design and stands for Analysis, Design, Development, Implementation and Evaluation and reminds of process-models in software development. Like the Waterfall Model (Sun, 2004) also the ADDIE Model intends to finish each step with an outcome that builds the start for a following step. In the Analysis phase, learning requirements and goals are defined to later identify potential learning mechanism in den Design phase. Next, content is created in the Development phase and all preparations are done in the phase of Implementation. At last the Evaluation takes place, where learner

can give feedback for further improvements of the learning environment. In contrary to the former theories and models this model is very concrete and implementation-orientated. Technical communicators can adopt the ADDIE Model according to the company's requirements and develop a support environment with an open feedback channel for customers. Especially for businesses considering an extensive and professional support system the model allows a broader view on technical communication and still provides a framework to implement such a system.

7.6 Implications for using new media in consumer learning

Theoretical approaches regarding learning of product functionalities, as wells as applications of technical documents, give insights into current state-of-the-art from very different perspectives. Practical implementations originated from evident demands. They represent relevant requirements for customer support on the one hand, but also demonstrate current customer habits on the other hand. The depicted studies show results of various learning paradigms and contexts, and lead to concrete applicable consumer learning theories. Both aspects, theoretical and practical, have to be considered to allow the building of implications with high relevance as well as ensured rigorousness. Four implications for the implementation of intelligent information systems for consumer support with the focus on high customer experience are given.

1) Conscious and active design of the support process

Lately, growing interest on usability of products can be observed. Product designers not only improve product functionality but also focus on factors like simplicity, easiness-to-learn or the intuitiveness of usage. This trend will gain interest for following up services as well, as all these factors directly influence the customers' experience. Every customer touch point has to be designed according the aspired experience, including environments for customer support. A conscious design of the support process allows the arrangement and coordination of different communication channels and support mechanism. Besides potential company-intern advantages like cost savings, more importantly customers benefit by comprehensible and perspicuous forms of assistance. Implementation theories like the ARCS or the ADDIE model not only confirm this implication but also build frameworks for implementations. Especially the latter defines the optimal construction of learning environments by applying a five-step approach.

One important requirement for state-of-the-art implementations is the possibility to extend the environment according to customer needs. This includes content due to product changes

as wells as forms of representation. As the customers' communication behavior and therefore their expectations are changing, also the supported offers have to be adapted.

2) Aligning the support process to the customers' behavior

Like already noted, the communication behavior is in ongoing change. Younger users are used to work with mobile devices like smartphones or tablet computers. They will keep their habits to directly search for potential answers in a specific context, while elderly people may expect support in a printed form or by personal assistance. Multiple ways to access support are required according to the specific user groups. The customer builds the center of attention for support environments, not the product anymore. Like in section three highlighted, different forms of technical documents transport different types of information. Digital personalization technologies allow a user-centered experience, where support is provided in context and according to the customers' needs. Information can be structured in respect to different knowledge levels to realize a stepwise support progress. Exemplarily, users may first take a look at FAQs, then enter a support forum, even raise a question on their own, and for direct contact initiate personal one-to-one calls.

To motivate customers when utilizing support environments, theory highlights the importance of demonstrating learning progresses. In case of problem solving, customers should have an option to confirm or decline whether the proposed problem solving approach was successful or not. Product learning can be structured in steps, which allows the demonstration of the ongoing learning improvements.

3) Adapting the support environment to the product

Learning theory research depicts the importance of direct applicability of learned content for successful learning outcomes. Newly gathered information regarding a product should directly be applicable to the product. Contrariwise, information is needed right at the time when a problem occurs and support is requested. Support environments are therefore highly dependent on the actual product. While software problems allow the utilization of support forums or video manuals, assistance during driving a car requires other forms of communication. Customers expect information to be addressed according their current situation. Information has to be in context.

The adoption between support environment and product also refers to product design and company image aspects. Customers assign product-related documents and services to the product. Disappointing support therefore negatively influences customer experience and impressions of product and brand are lowered.

4) Utilizing appropriate technologies

At last, technologies have to be adopted according to the customers' communication behavior. While the transportation of content via multiple channels or devices is one aspect, the more important one relates to the real usage scenarios of information requests. These scenarios usually start with the usage of the product, which leads to a need for assistance. Virtual customer environments may fulfill all needs but customers are required to visit the platform and interact with the implementation. Display incompatibilities between systems, documents in specific file formats or complex navigation mechanism have to be avoided. Also the customers' process between problem identification and visiting the support environment has to be analyzed. Customers may not directly visit a specific system but use more generic information providers like generic search engines. Businesses are required to identify these scenarios and create ways to accompany the customer in every step.

Communication changes also include the social interaction between customers. Businesses have to implement strategies to face the loss of control, but benefit from social media in marketing. Monitoring technologies for social media activities have to be considered to be able to react to these changes.

All implications very much relate to two main shifts in technical communication. First, changes in personal communication behavior have to be accepted. Support strategies, actions and offerings have to continuously be adapted according to these changes. Second, technical documents and support are part of the customer's experience and therefore highly marketing relevant. When competing products list similar technical specifications, customers focus on other comparative aspects. Offering products that are easy to learn and providing customer-friendly support lead to a competitive advantage. Businesses are confronted with the challenge to actively adapt their support and marketing strategies to satisfy their customers. This paper summarizes relevant research within the field, giving researchers an outline for further research as well as providing implications for practical applications.

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8 Model of a Personalization-based Agent System for Early Product Adoption Phases

The following article was authored by Thomas Puchleitner (University of Graz / evolaris next level GmbH), Michael J. Harnisch (University of Graz / evolaris next level GmbH), Manuela Reinisch (Graz University of Technology) and Iris Uitz (Graz University of Technology), was published in the Conference Proceedings of the 2013 46th Hawaii International Conference on System Sciences (HICSS) and is a full citation with minor changes in formatting and numbering.[88] The copyright holds the Institute of Electrical and Electronics Engineers (IEEE). The article is available in the IEEE Xplore Digital Library under http://ieeexplore.ieee.org. DOI: 10.1109/HICSS.2013.409.

8.0 Abstract

“Businesses that offer Software-as-a-Service (SaaS) often allow a ‘tryout’ phase to immediately test their system. The loss of control during this phase forces providers to offer simple ways of product learning for the demonstration of product features. We therefore develop a model of a hybrid personalization agent and logic, which is able to match predefined actions to the specific users’ needs to enhance product learning. The logic communicates the selected action to an IT-agent system that subsequently executes the action. By applying this model, businesses obtain a competitive advantage by regaining the possibility to assist and influence the user in the product adoption process. We construct our work on a product adoption process and customer lifecycle model as well as the research areas of usability and technology acceptance research to depict ways of interactive learning support. Indicators are monitored which are finally utilized to enhance the attribute ‘easy to learn’.

8.1 Introduction

Suppliers of information systems are striving for excellence in their offered software packages to enhance consumer adoption rates and boost sales. Alternative delivery

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concepts like “Software-as-a-Service” (SaaS) [2], a user-centric view on the usability of the software itself (“Usability Engineering” – UE) [19] or underlying factors of the Technology Acceptance Model (TAM) [6] are often consulted to increase the chance of product adoption.

As SaaS allows direct product testing, this could lead to several downturns in product learning. One of these downturns arises, when potential customers test and evaluate products in competitive software markets. By permitting non-guided tryouts before purchasing, the provider allows users to explore the product without further assistance through personal support, which limits the possibility to explain how certain features work. This stresses the product to explain itself in the adoption process of the customer. Increasing the “easy to learn” ability of the product could hence create an immense advantage in competition due to the reason that products that seem hard to understand have a lower customer acceptance rate. [31] We therefore propose the “model of a hybrid personalization agent and logic” to enhance the systems learning ability and foster product adoption. By monitoring a list of indicators, our logic chooses a personalization-based action that enhances product learning, which will be executed by an IT-agent and result in an increased probability of a positive product adoption.

The work is structured as follows: We begin by giving a short introduction into SaaS and the underlying product adoption theory and connect technology acceptance and usability research (chapter [8.2]). Subsequently, we display that product adoption is depended on “ease-of-use” and the attribute “easy to learn” that can be found in the TAM as well as in the usability theory (chapter [8.3]). Afterwards we provide a list of indicators that can be used to assess the users learning behavior (chapter [8.4]) and aid in choosing an appropriate action to enhance product learning. An introduction into personalization theory (chapter [8.5]) completes the background of our work. We then describe our proposed “model of a hybrid personalization agent and logic” in detail (chapter [8.6]) and illustrate its application with short use cases (chapter [8.7]). Finally we conclude our work by depicting the main findings as well as future research steps.

8.2 SaaS Adoption Process

In this chapter, we are giving a short introduction into SaaS as underlying delivery concept and depict the product adoption theory where our work is based on and its connection to technology acceptance and usability research.

8.2.1 Software-as-a-Service (SaaS)

Software-as-a-Service gained popularity as a delivery concept in the mid-2000s after the emergence of several innovative Internet technologies made it possible to enhance the

Application Service Provider (ASP) approach, which originated in the 1990s. SaaS is a form of software outsourcing, where companies rent software from a provider as a service. The service provider incurs all the infrastructure, maintenance and basic software costs and sells access to the software over mostly web-based and platform-independent software clients. Benefits of this approach lie in the increased flexibility and reduced costs for the customers. Disadvantages can be seen in the non-customizability of software solutions as well as in relatively high switching costs. SaaS is especially suitable for highly standardized processes. [2]

8.2.2 Product adoption process

Software products in general have a clear adoption process that can be divided into certain levels and stages. A more detailed insight into these processes is needed if the adoption of SaaS should be positively influenced. We are therefore utilizing a customer lifecycle model for web based services and information systems. It describes the continuous steps a customer undergoes when considering and purchasing a product or service. [7] The adoption and acceptance model developed by Rogers [23] and later extended by Wiedmann and Frenzel [36] defines three levels in the customer lifecycle to distinguish between phases before, during and after adoption: level of attitude, level of action and level of usage (see Figure 45). Within these three levels, the user changes his attitude regarding the product. Starting with a given opinion of the product in the level of attitude, he gains more knowledge concerning the system in the level of action. In this second phase, the user compares his expectation of performance and the actually received satisfaction. Gained impressions have a direct impact on the positive or negative decision about product adoption.

The levels of attitude and usage are not the main focus points of the conducted research, because during the level of attitude the user is not confronted with the software itself. If the level of usage is reached, the adoption of the software has already taken place. Therefore, we center our efforts on the level of action where we find the tryout stage and the adoption stage. It is obvious, that the tryout stage is influencing the adoption stage. Additionally, the tryout stage is the first contact point of the prospective customer with the software itself, where the learning abilities of the product could be utilized to enhance the adoption. Especially two research areas are describing the influence factors around these phases and are the basis of our research. On the one hand, technology acceptance research, where the Technology Acceptance Model (TAM) by Davis [6] is often utilized because of its simplicity of dependencies and adoption of additional influence factors. On the other hand, usability research is important. Both areas developed factors that influence product adoption, which we will analyze for further usage in our system.

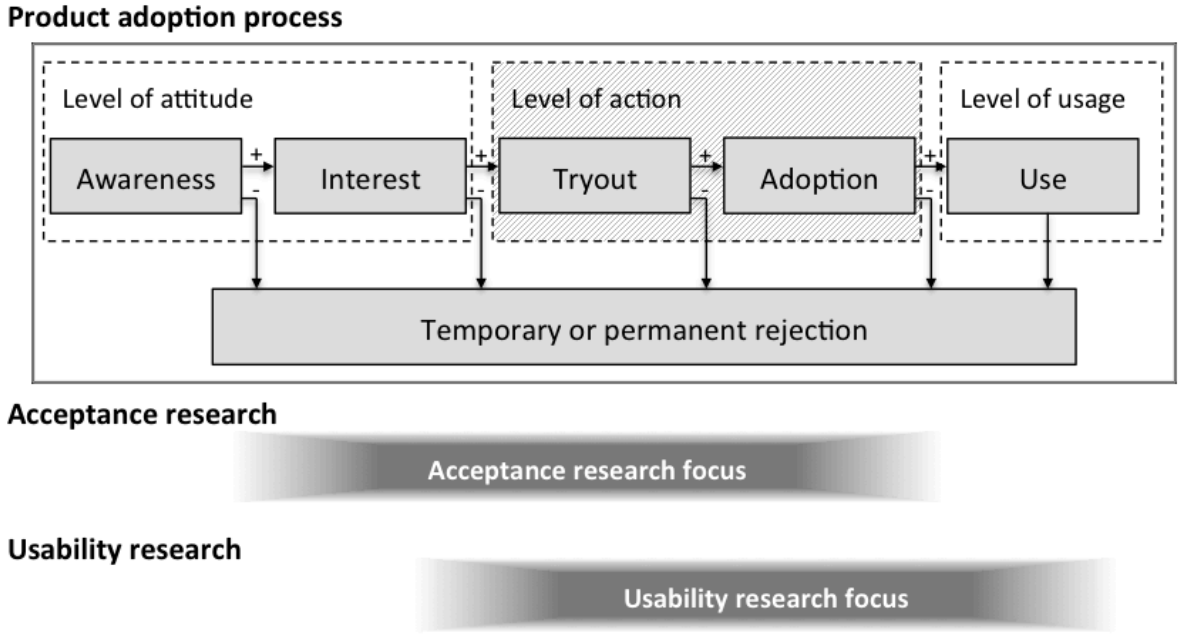

Figure 45: Product adoption model and related research areas, © 2013 IEEE.

8.3 "Easy to learn" as adoption attribute

We will now introduce models of usability and acceptance research and especially their interconnection, which will be subsequently used to identify indicators that picture the users' usage and learning behavior during the adoption process. Although both research areas focus on the relation between product and user, they do differ in their approaches.

8.3.1 Models of usability and technology acceptance

At the level of action, the first interaction between the user and the system takes place. This interaction lies in the main focus of usability research and therefore has to be considered to find relevant indicators regarding the usage of a system and how the usability of a product can be optimized to finally enhance the product adoption. Additionally, technology acceptance models focus on the influence of single factors on the acceptance of products and thus try to predict if and how the product will be used.

For each research area an appropriate model was selected to show interconnections between both areas and to highlight the importance of the easiness of product learning. The already mentioned Technology Acceptance Model (TAM) by Davis [6] is a commonly used model to depict the acceptance of product usage in information systems. The model (see Figure 46) is built on the idea that when users are introduced to new technologies the factors of "perceived usefulness" and "perceived ease-of-use" have a strong influence on the system usage. Thereby Davis identifies "easy to learn" as one of the attributes of the "perceived ease-to-use" factor and describes it as "how easy a system is to learn for users" [6].

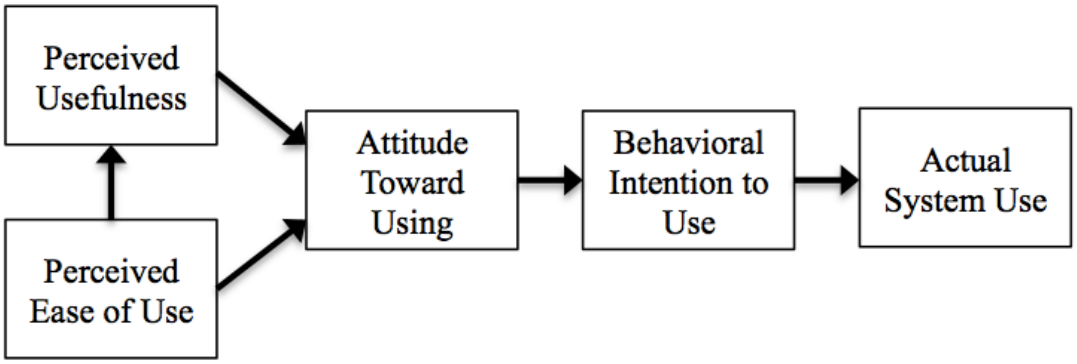

Figure 46: Technology Acceptance Model by Davis [6], © 2013 IEEE.

Usability engineering focuses on the interaction between user and system and keeps the focus on how the system can be presented in a user-friendly way. Nielsen [19] determines attributes that have direct impact on the usability of a system and therefore have to be considered especially in early phases of use. Nielsen describes the term learnability as "The system should be easy to learn so that the user can rapidly start getting some work done with the system" [19, p.26].

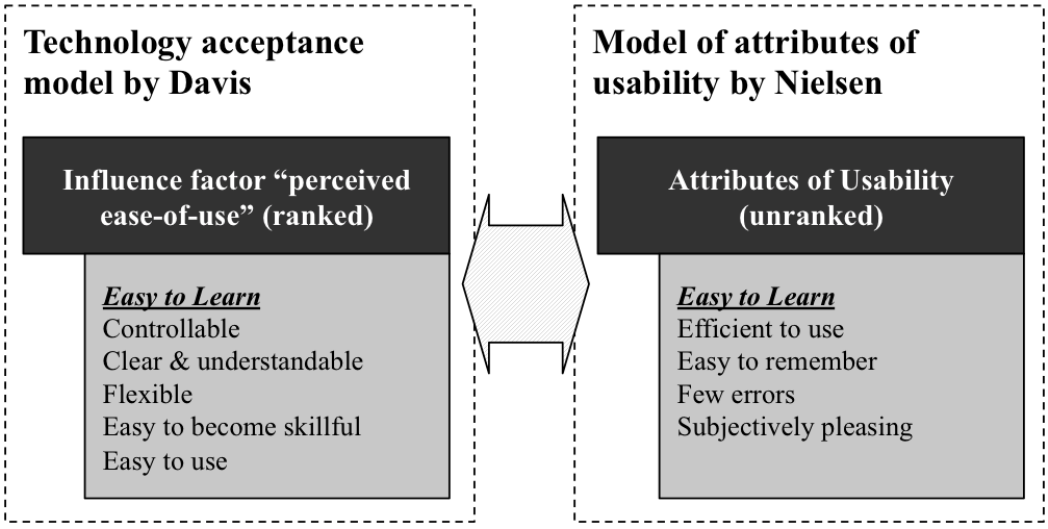

Figure 47: Ease-to-use as factor in TAM by Davis [6] and usability by Nielsen [19], © 2013 IEEE.

Figure 47 shows the interconnection between the attributes of usability engineering by Nielsen [19] and the impact attributes of the influence factor "perceived ease-of-use" in the Technology Acceptance Model by Davis. Similarities for the definition of "easiness to learn" between the model by Davis and Nielsens' description of Usability Engineering can be depicted. Both authors define "easy to learn" as the most important attribute within their models (Davis: "Learnability is in some sense the most fundamental usability attribute" [19, p.27] respectively highest influence factor with .97 on ease of use [2]) where Nielsen also

describes the impact for early adoption phases: “[…] since the first experience most people have with a new system is that of learning to use it” [19, p.27f].

8.3.2 Determining the influencing factors on easy to learn

The learning process for product usage differs by variable factors like age, field of expertise or the usage frequency of the system. Wood [37] shows that the learning behavior is also based on the former experience with similar systems and prior knowledge in the application field. Beside active techniques to gather the required information by simply asking the user, Montgomery and Srinivasan [16] describe passive techniques for further processing in a personalized manner.

Acceptance research and usability research do both describe factors that show influence on positive or negative product experience while usage. Key indicators have to be identified to allow the continuous monitoring of usage behavior and thus support the user by the selection of appropriate techniques for product learning.

8.4 Deriving indicators to monitor

Based on the existing literature in acceptance and usability research, relevant criteria for the monitoring of users’ usage and learning behavior are identified. Subsequently, some given restrictions are mentioned and the indicators are classified according to the literature.

8.4.1 Identifying relevant indicators

Starting from the Technology Acceptance Model by Davis [6] several researchers focused on evaluating factors affecting information system satisfaction and usability. Usability and its importance in the online environment are treated in the field of human-computer interaction (HCI) and information systems (IS). Research in HCI focuses for example on usability as a positive impact on product acceptance. [20] Based on research insights, an overview of indicators that depict the usage and learning behavior of the user is given in Table 16.

Variable name	Description	Author(s)
Transaction Data		
Frequency Visit	Total number of past visits	[5] [15] [29]
Recency Visit	Number of days since last visit	[15] [29]
StdDecRecencyVisit	Standard deviation of the time between site visits	[29]
Mean Recency Visit	Average time between site visits	[29]

Average Visit Time	Total past visit time	[29]
Visit Time	Visit time of the last session	[29]
Total Visit Time	Overall visit time of past visits	[21] [25] [29]
Total Clicks	Total number of clicks in the past	[29]
Number Pages	Total number of viewed pages	[5] [13] [25]
AverageTotalClickTime	Average time per click	[29]
AverageClickTime	Average time per click in last session	[29]
AverageVisitclicks	Average number of clicks in a session	[29]
Hurry	Average time per click in the session is lower than the average	[29]
User Demographics		
Gender	Gender of the user	[13] [21] [29] [32] [35]
Age	Age of visitor	[9] [17] [33]
Language	Used language	[29]
Trust	Supply of phone no. or other private data	[29] [26]
Level of education	Highest education	[34]
Culture	Cultural background	[24]
User satisfaction	Satisfaction with the system	[34]
Experience / Learning	Given experience with a system	[3]

Table 16: List of Indicators, © 2013 IEEE.

8.4.2 Restrictions

There are also statements [18] [30] that tracking users' activities only provide figures at one particular point and time. The identification of users' real information needs, their attitudes toward the system as well as motives for their behavior are sometimes hard to identify.

Restrictions in the tracking of the usage behavior are given when the active usage of the system is interrupted e.g. by a coffee break. Furthermore some users might not log off when leaving the system. Consequently inactivity times will be count as if people are unfamiliar with the system and in the need of help. How is the system supposed to know whether the

user is still using it? Clickstream data does not give any conclusion on the desired activity. A downloaded page can also be generated from an incidental link. These restrictions need to be considered when using the described indicators to monitor the users learning and usage behavior.

8.4.3 Categorization of the indicators

On the basis of Bucklin, et al. [4] the above listed and described factors can be categorized as user-centric and site-centric, whereby the latter are subdivided into the category of variables that relate on past records of user activities, current user records and general features of the information system. User-centric factors consist, inter alia, of demographic data, such as gender, age, level of education, as well as affiliation/experience with and attitude towards the system.

Site-centric data are tracked visitor activities of previous and current sessions. They include for example what users do when they use a system, where they click, the average time spent on the usage, their purchase behavior and similar insights. Furthermore, design elements of the system, such as the used language, loading time of the page, completeness of content or similar factors have to be considered for an improved usability.

8.4.4 Indicators as basis for personalized actions

The depicted user-centric and site-centric indicators are utilized to monitor the usage and learning behavior of the user. The use of additional indicators to enhance the systems' ability to foster product learning is also conceivable but not evaluated at this point of time. Based on the development of the given indicators, an assessment about the learning process of the user can be made. This assessment normally differs between users, which implies, that different actions should be taken to serve the needs of the user in terms of product learning best. Based on the monitored indicators, our later proposed logic chooses which of the given actions should be performed by the agent.

8.5 Personalization

We depicted, that we monitor the product usage and learning process of the user and derive the needs of the customer for better learning by interpreting the indicators. In this chapter we are giving a short introduction into personalization theory as well as a reasoning why we personalize our actions to enhance product learning.

8.5.1 Types of personalization

Different forms of employed personalization activities are feasible. Web personalization for example intends to adapt web content in regard to the individual needs of users' to maximize business opportunities. [11] This type of personalization "delivers the right content to the right person at the right time" [28, p.867] by a) controlling the content, presentation format and the timing of the individualized information and b) implanting marketing messages into the users' mind. [28] But there are other types as well, which could be relevant when the criterion of "easiness to learn" needs to be raised. Personalization research has developed various classification schemes of personalization activities. [8] [12] [27]

	Implicit	Explicit
Content	Individuated / Categorical	Individuated / Categorical
User Interface	Individuated / Categorical	Individuated / Categorical
Channel / Information Access	Individuated / Categorical	Individuated / Categorical
Functionality	Individuated / Categorical	Individuated / Categorical

Figure 48: Classification scheme of personalization [8], © 2013 IEEE.

We would like to emphasize the model of Fan and Poole [8] (see Figure 48) that divides personalization in three dimensions, which are object (what), target (to whom) and origin (who). Fan and Poole [8] state that the object of personalization includes the content, user interface, channel or information access and functionality. The target of personalization can be divided into two groups, which are namely individuated and classified groups of persons. If individuals are the target of personalization, personalized objectives are communicated to a single person, based on its very unique user profile. If a group of persons in the categorical personalization is addressed, the objective is matched to an average need of a certain group but not to an individual user. Finally the source of personalization is described which they split into implicit or automated personalization, where the personalization is done by a specific system in the background and explicit personalization, where the basic data is provided by the user by e.g. filling in a questionnaire at the platform registration.

Beside these dimensions of personalization, Fan and Poole also provide four ideal types or perspectives on personalization. They divide the types into architectural, instrumental, relational and commercial forms of personalization. While the architectural type "creates a functional and delightful Web environment that is compatible with a sense of personal style",

the instrumental type aims to “increase efficiency and productivity of using the system”. Additionally the relational personalization type tries to “create a common, convenient platform for social interaction that is compatible with the individual’s desired privacy” and finally the commercial type intends to “increase sales and to enhance customer loyalty”. [8, p.190]

8.5.2 Personalization as differentiation

Information systems advanced in terms of functionality and usability in recent years. Corporations took over most of the newly provided innovative technologies and insights into their information systems and developed additional features for their users to specifically fit their needs. However, especially when it comes to Software-as-a-Service, providers of such systems are often interchangeable because basic functionalities are equal between different suppliers. Side factors which are often recognized as negligible are then able to change the outcome of the users’ decision about using a product or not. It is therefore relevant for providers of such systems to employ successful differentiation strategies to gain a competitive advantage over their competitors [22] and as a result, change the outcome of the users’ decision.

There are many possibilities to differentiate the own product or service, ranging from price differentiation to an altered provision of software features or system design. [10] Especially online marketers have adopted several of those differentiation strategies to attract and retain their customers. [28] Personalization activities are one example for popular differentiation strategies in a web and software context. Those activities could be established on various factors and are able to yield additional customer attraction and loyalty. But it could also be supposed that they have the ability to yield a significant influence on “easy to learn”. The personalization activity could then be the crucial point that decides the outcome of the users’ choice.

This is the reason why we suggest the deployment of a special personalization agent and logic to the information system, which takes the specific needs of the user in terms of “easiness to learn” into account and afterwards applies an individually chosen and predefined personalization action on the information system which influences the users’ perception of the system and affects his decision.

8.5.3 Personalization agent

Agents, which are software modules used to generate an individual corporate communication to the customer, are usually perceived as the IT enabler of personalization. [28] Traditionally these intelligent personalization agents are employed to collect and analyze the users’ activities and transactions, create unique customer profiles and finally provide individualized

information to the user. [14] Especially this individualized respectively personalized communication is then qualified to attract customer attention, strengthen customer loyalty [1] and support the attribute “easy to learn” of the information system and hence raise the customer acceptance. For our area of application a split of the general valid model of an IT-agent into the agent itself and a separate logic seems appropriate because the agent needs to be adaptive in regard to the information system whereas the logic is universally applicable. We will describe our model in more detail in the following chapter.

8.6 Hybrid personalization agent and logic

We are now proposing our model “Prototype of a Hybrid Personalization Agent and Logic” which is depicted in Figure 49. Our system improves the users learning process on how to use a certain information system. Although the model is applicable over all phases within the customer lifecycle process, the need for product learning support is especially given in early phases of product adoption. A reasonable supporting system will therefore allow different actions for users with less product experience like additional support in system navigation, and users who have already knowledge and so want to perform tasks more rapidly. Due to personalization methods the supported actions are individually usable and adoptable by the users’ learning progress.

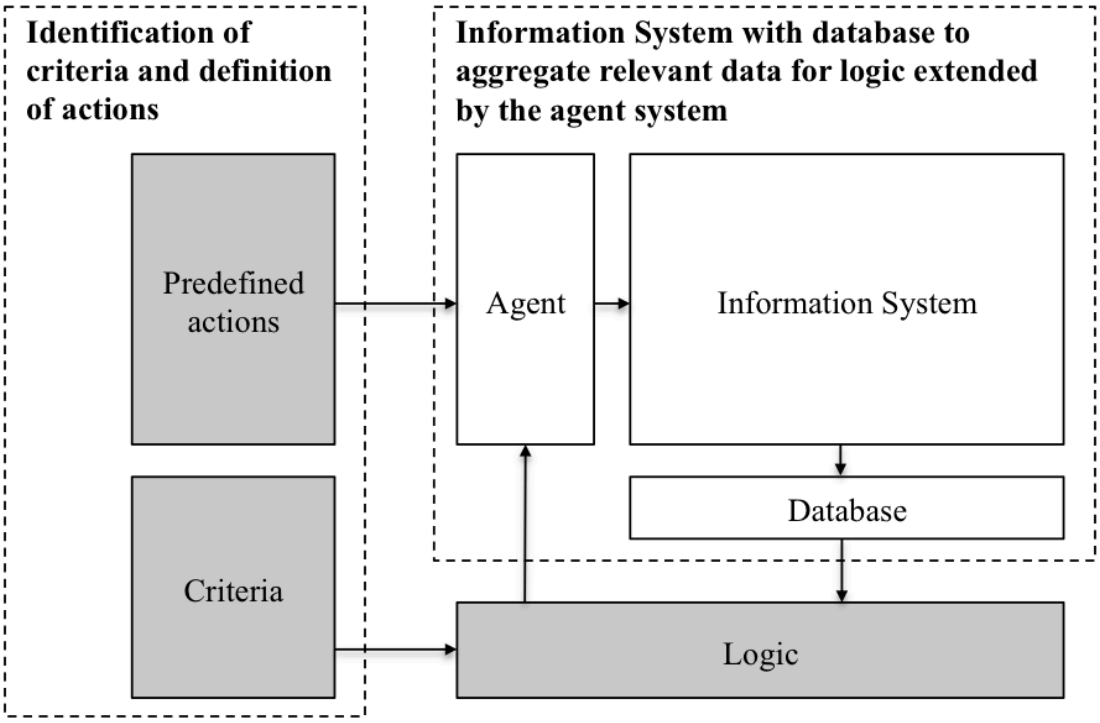

Figure 49: Model prototype of a hybrid personalization agent and logic, © 2013 IEEE.

8.6.1 Hybrid personalization agent and logic

If we take the model of an IT-agent into account, which should enhance the “easy to learn” criterion, a mixture of different personalization strategies and types could be employed to fit into our theoretical structuring.

First of all, the information system and its interconnected database monitor certain indicators implicitly and in a way that the user does not recognize the automated tracking. But also a short questionnaire during the registration process is imaginable to build a general basis of the specific individual user profile. The collected data is stored in the database of the information system and is assigned to certain user profiles.

Our logic afterwards is able to decide which of the predefined personalization actions should be executed by the agent. This decision is based on the specified and monitored indicators. The logic consists of a processing order to aggregate all generated information to an association of significant data, and a predefined instruction set to allow decision-making. It mainly uses categorical personalization in this part of the process, because for different people the same predefined action could be suitable although they are assessed individually by analyzing their personal user profile.

Depending on the collected data of the observed criteria, the underlying content, user interface and functionality could be altered according to the users’ expectations and needs of the information system. We call these alternations predefined actions, which the agent is able to execute. The agent interacts as a direct interface back to the information system and applies the selected actions. If the user provides his interest implicitly or directly, defined and sorted content could be displayed. Depending on factors like age or gender, the user interface could be altered by e.g. changing the arrangement of areas of the information system. Finally also the functionalities could be enhanced or reduced if the system observes that a simplification for early stage users would be beneficial.

Based on these definitions our agent is related to three different personalization types. First of all the agent aims to increase the efficiency of the usage of the information system, which could be related to an instrumental type of personalization. Due to the reason that the customer respectively user loyalty should also be increased the commercial personalization type is comprised too. But also the architectural type of personalization is represented, because the agent is able to adapt the environment of a user in a way that is compatible with its very own individual needs and preferences.

Based on this structuring, we find that various personalization strategies need to be defined as predefined actions. They cover content, user interface and functionality personalization

and are attributable to the architectural, commercial and instrumental type of personalization. Also suitable indicators need to be defined for each action the logic has to take over. Due to the reason that our agent is part of different research fields and personalization types and forms, we call our model “prototype of a hybrid personalization agent and logic”.

8.6.2 Exemplary use cases

For demonstrating the personalization-based model some exemplary use cases and a possible criteria flow model, shown in Figure 50 and Figure 51, are created. Figure 51is an illustration of an exemplary decision making process where the logic chooses appropriate personalization actions, based on user centric and site centric criteria.

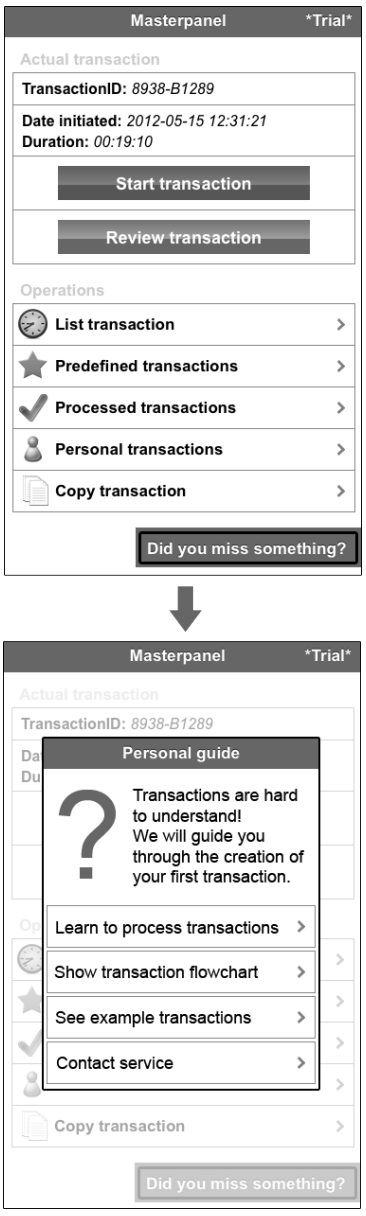

Figure 50: Case 1 – Personal guide to enhance product learning, © 2013 IEEE.

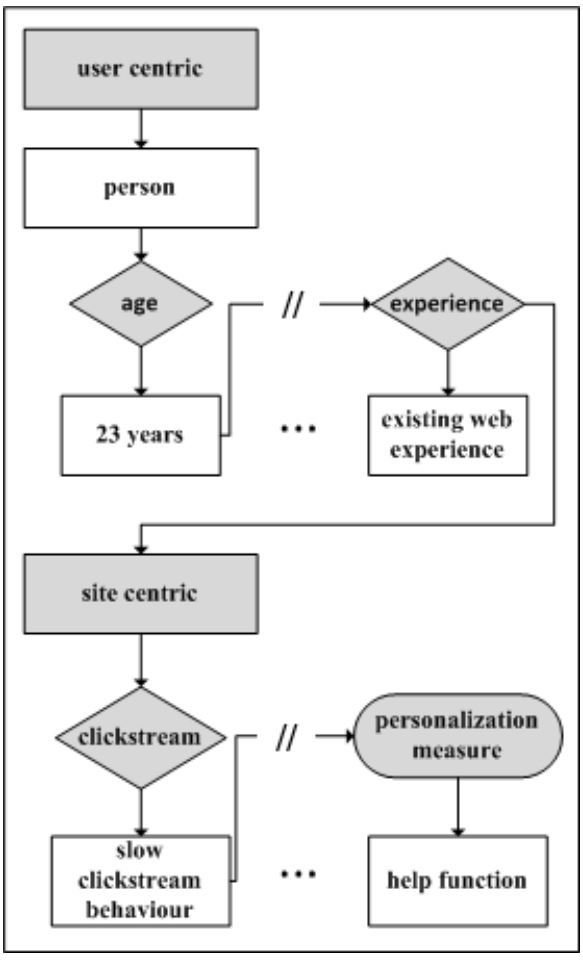

Figure 51: Case 1 criteria flow model, © 2013 IEEE.

Case 1: A male person, aged 23, highly educated, with web experience and unknown culture shows a slow clickstream behavior during his first use of the information system. The monitoring logic recognizes that the indicating level for clickstream behavior is lower than the predefined limit. The logics processing order then selects the most appropriate predefined action. Finally the logic assigns the execution of the specific action to the agent to assist the users early stage usage behavior. In our case the agent enhances the information system by adding an additional help function in the bottom right corner. This feature should assist the user in system learning by showing a help screen when activated (see Figure 50). Thus the attribute “easy to learn” will be positively affected in regard of production adoption.

Case 2: A female person, aged 45, highly educated, with web experience and known culture is already using the information system within a thirty day SaaS-testing period. Although the system provides a wide range of features her usage behavior shows only the execution of very limited functionalities. In our case the tested product is differentiated to other products by this range of features which is therefore one of the products competitive advantages. The more features a customer is using the more likely a positive adoption decision will be made as by only using very specific features other products might provide low-cost alternatives. To show the user other relevant features the logic selects a pop-up as suitable predefined personalization action. This pop-up, which will be executed by the agent, should guide her to other functionalities and therefore allow a deeper understanding on what additional features could be interesting for her and how they work. In this case an indicator would be the amount of used features. Again if this amount falls below a predefined limit the logic recognizes a shortcoming of knowledge in terms of product capabilities. The logic selects instruction manual popups as an appropriate predefined action and therefore assists the user during product learning.

8.7 Conclusion and further research

Product lifecycles of Software-as-a-Service packages often allow potential customers to immediately test the product within a “tryout” phase. Especially in this early product adoption phase the users require additional support to learn about the systems features and functionalities. Personalized actions to enhance product learning allow appropriate possibilities to increase the attribute “easy to use” and therefore enhance positive product adoption. Theory from usability as well as technology acceptance research was taken into consideration to identify relevant indicators for the prediction of the users need for interactive support.

We subsequently developed the conceptual model of a hybrid personalization agent and logic for the assistance of learning processes when using information systems. By executing

specific predefined personalization actions while a user works with an information system, an integrated IT-agent enhances the learning ability of the system. We proposed a logic that is able to match the right predefined personalization action to the specific needs of the user. The logic communicates to the agent which predefined action should be executed to enhance the users product learning and therefore influence the users decisions about a positive adoption. This could lead to a significant advantage for companies over their competitors.

Further research will continuously determine applicable personalization strategies for product learning based on the selected and monitored criteria. Also the decision making process within the logic will gain precision to allow more appropriate selection of predefined actions. Further evaluation will depict which criteria and personalization strategies will be most efficient in various application areas for product learning and positive product adoption.

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9 From manuals towards product embedded interactive learning environments

The following article was authored by Thomas Puchleitner (University of Graz / evolaris next level GmbH) and Otto Petrovic (University of Graz), was presented at the Annual Global Engineering Education Conference 2014 (EDUCON) sponsored by the IEEE Education Society and is a full citation with minor changes in formatting and numbering.[90] After publication the copyright holds the IEEE Global Engineering Education Conference.

9.0 Abstract

"Late developments in information and communication technology show high impact on current implementation of technical documentation. The traditional use of technical documentations was solely defined as technical product information to aid the customer in cases of product learning or handling product malfunctions. Embedding technical documentation into the actual product opens new potentials for consumer learning as well as for various marketing purposes. For private sectors, in form of consumer electronics, and also for business scenarios like testing facilities or manufacturing installations, embedded learning environments enrich the product and open communication channels. By implementing feedback channels, interactive systems can be developed, providing useful information for users and letting businesses gain insights into product usage behaviors at the same time. We identify seven relevant factors for successful implementations of such systems. First implementations for diverse branches to demonstrate the current state-of-the-art in embedded interactive learning environments are depicted. In a critical analysis regarding the selected cases, current limitations and future potentials are highlighted. Finally, we focus on the product engineer's perspective. Utilizing the product as major communication channel expands the engineer's responsibilities, requiring new knowledge in business communication. A paradigm shift in the education of engineers is depicted as consequence of future developments.

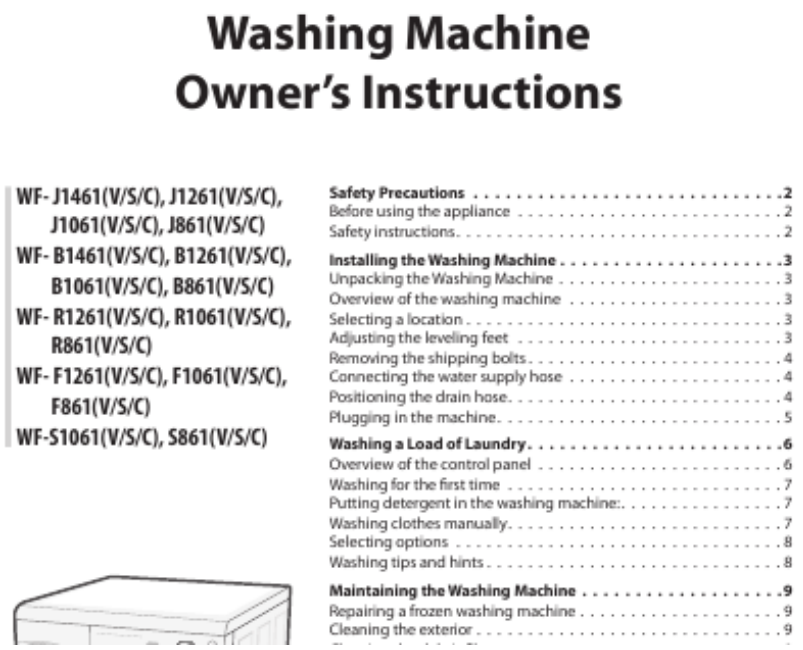
Keywords

embedded learning environments; product learning; engineering education; customer experience

[90] Puchleitner, T./Petrovic, O.: From manuals towards product embedded interactive learning environments. Presented at the Annual Global Engineering Education Conference 2014 (EDUCON) in Istanbul.

9.1 Introduction

Digital media play a major role in daily life routines as they are taking over many brief tasks to relieve our personal life. Further achievements in technological development allow products to extend their field of application but also include more physical- and software-based subsystems. According to study of the Consumer Electronic Association [1] the growth in worldwide revenues for consumer electronics is calculated to five percent in 2012 and three percent in 2013. This steady growth stresses the dealing and handling of consumer goods for customers. Average product lifecycles are shortening, and at the same time products extended functionalities forces consumers to continuously adopt new products. Various studies demonstrate the high relevance of product usability and user experience on positive product adoption [2,3,4]. To ensure the correct usage of these products, manufacturers are required to develop products that are easy to use as well as simple to learn. The enriched functionalities of products on the one hand, and the increase of consumer learning activities on the other hand, demand efficient and effective technical documentations [5]. Besides consumer electronics also factory equipment like testing facilities or manufacturing installations face an increase in complexity. Maintenance and installation not only require an analytical understanding but also adequate support mechanism. Engineers have to utilize various kinds of such systems and therefore continuously require updated information on how to operate them in shortest times. Typically, a variety of manuals like installation or instruction manuals accompany systems to allow rudimentary insights into the installation. Figure 52 shows a typical technical documentation within the consumer electronic sector in form of a manual for a Samsung washing machine.



Washing Machine
Owner's Instructions

WF- J1461(V/S/C), J1261(V/S/C), J1061(V/S/C), J861(V/S/C)
WF- B1461(V/S/C), B1261(V/S/C), B1061(V/S/C), B861(V/S/C)
WF- R1261(V/S/C), R1061(V/S/C), R861(V/S/C)
WF- F1261(V/S/C), F1061(V/S/C), F861(V/S/C)
WF-S1061(V/S/C), S861(V/S/C)

Figure 52: Classic form of technical documentation

Technical documentation belongs to the discipline of translation science as it translates the product or installation into a language the user is expected to understand. Typical forms of technical documents are user and installation manuals or maintenance documents. According to the instructional design approach [6], this is realized by providing simple instructions and steps the user has to follow. Traditional manuals force their readers to adjust their information gatherings according to this provided, static content. However, late research in learning theory depicts that users do not sufficiently adopt such behaviorism methods, but rather learner-centered methods lead to better outcomes and higher motivation [7]. Constructivism and humanism approaches or the design-based paradigm intend to focus on the learner's environment and put these interrelations into the center of attention. Learning results are achieved by applying simulations, on-the-job trainings or by utilizing topic-relevant case studies.

Various factors influence learning outcomes. Studies by Lakshmanan, Lindsey and Krishnan [8], Lakshmanan and Krishnan [9] or Johnson, Bellmann and Lohse [10] highlight such factors in consumer learning. Thus, learning providers have to arrange their documentation according to consumers' demands. The quality of the provided support mechanisms is directly related to the overall impression the customer is experiencing. Research rarely engages in analyzing these marketing affects of product support.

The paper is structured as follows. Section two highlights the role of technical documentation in marketing by identifying the impact of customer touchpoints on customer experience. We then depict seven key factors for the design of embedded interactive

learning environments in section three. Systems have to meet the customer's expectations by providing useful information, as well as the businesses' demand of utilizing usage insights for further marketing purposes. Section four depicts current implementations of embedded learning environments to demonstrate the current state-of-the-art. We finish the case study with a critical analysis on limitations and future potentials. A change in required engineer education to allow the implementation of such systems is discussed in section five, as knowledge on how to communicate a product builds a foundation for future implementations.

9.2 Technical Documentation in Marketing

Developing products that fulfill customer needs is of tremendous importance for businesses. While engineers traditionally developed products according to specifications and requirements provided by marketers, late developments show that also the handling of products affect customers in buying decisions. Usability aspects are confirmed to influence product adoption [4], which therefore enhanced the scope of engineers too. Besides the solely technical facets of engineering also usability aspects have to be considered. Thus, product usability is only referring to the actual usage phase of products and does not represent the overall customer experience. In research, customer experience is defined as the summary of all received impressions, including the pricing, the brand's image, advertisings and customer support [12]. As the actual product itself does not communicate all these factors, also product-related activities influence the customer experience.

Customer touchpoints are an often-referred term in marketing literature to highlight the importance of every single contact between customer and business [13]. Each touchpoint strengthens a customer's impression of a product or service and thereby automatically represents a marketing activity. Businesses are challenged to identify potential touchpoints and design them according to their marketing goals and the image they intend to establish.

To identify potential customer touchpoints businesses are required to adopt their communication channels according to the users communication behavior. Without doubt, the Internet changed the ways of communication tremendously. Particularly mobile access to the Internet due to the raising popularity of smartphones opened new potentials for information processing. Smartphones are very personal communication items and allow time- and location-independent access to information. Keeping that in mind, the product itself acts as the perfect medium to carry technical support information. Embedding learning environments into the product ensures the availability of information at the right time with the right context. Even for products and installations without integrated displays, communication technologies like NFC or Bluetooth allow an information exchange to external devices. Smartphones or tablets are utilized as output for the provided information stream. Such communication

systems build a future trend for product manuals in form of product embedded interactive learning environments, where the product itself acts as communicator and marketing medium. This movement stresses the responsibilities of engineers, marketers as well as technical writers. Figure 53 shows the typical process for the design of technical documentation, which seems outdated in context of embedded product communications.

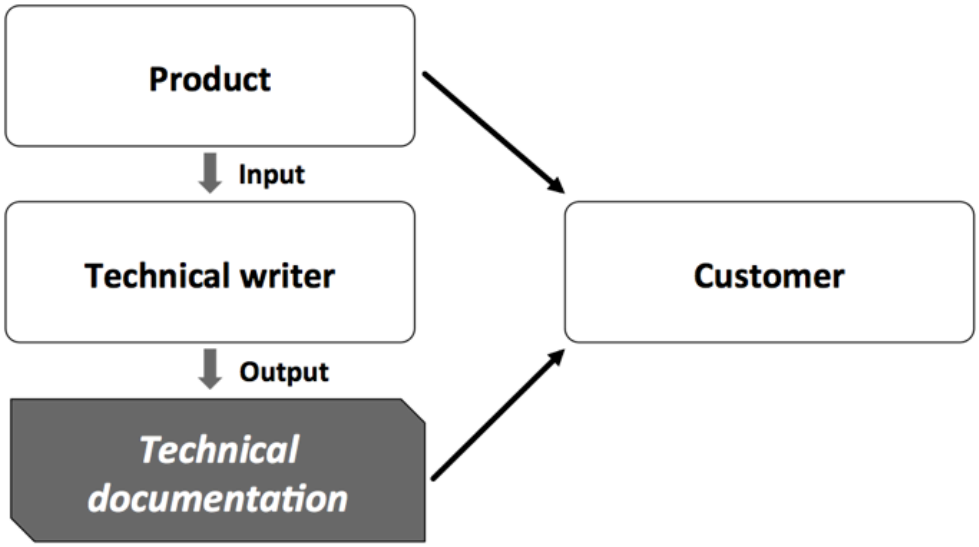


Figure 53: Outdated process for the design of technical documentation [11]

Trends like the increase in product complexity, the integration of consumer learning into the product, and the rising relevance of support for customer experience demands the rethinking of the engineer's role within the communication process. The integration of tasks out of all three domains is required to provide future learning environments. These systems build the basis for further customer relationship management and customer experience optimizations.

9.3 Designing Embedded Interactive Learning Environments as Marketing Touchpoints

The utilization of interactive communication technologies by embedding learning environments into products initiates a paradigm shift in customer care. While for users aspects of support and product learning build the main trigger for using embedded environments, businesses expect deeper insights regarding product usage behaviors. Communication activities, both useful for users as well as value-added for businesses, are applied. Seven relevant aspects for the successful transition from manuals to interactive learning environments can be depicted.

A. Embedding

Manuals are no longer separately created and delivered to the product but are embedded in the product and context-sensitive. They allow on-demand learning. We see an increasing extent in the last 10 years, for example in the online help of software products.

B. Interactivity

Classic forms of manuals follow the traditional sender-receiver model, where product experts transport advises to users. New communication technology and information systems allow the implementation of interactive instructions, simulations, recommender systems as well as a bidirectional communication flow.

C. Traceability

By using interactive learning spaces, users give detailed insights into their product usage behavior. Additionally, interpreting the user's navigation within the environment can also lead to implications for optimizations of the learning environment.

D. Personalization

Traceability allows a personalized design of interactive learning environments as well as product features themselves. Learning environments can be customized regarding the language or existing product configurations. If product users repeatedly make the same mistakes, additional information could be displayed to guide the user through a learning process to handle the situation.

E. Business Intelligence

Traceability also allows the tracking of individual users' behavior while product usage in comparison to other users. By detecting similar malfunctions or an ongoing appearance of problems, design defects of the product can be concluded.

F. Cross channel communication

Personalized information regarding the product can be transmitted via the users' preferred communication channels like tablet, smartphone, the product itself or interactive files. Interactions can also be performed across multiple channels.

G. Useful marketing channel

Certain marketing activities such as the launch of new or improved products, invitations to conferences, or new services can be performed directly within the interactive environment.

Thus, the advertising message is perceived as significantly more useful than promotional materials without any related context to the product usage.

By applying these factors, businesses are able to utilize support systems in various new ways. While written manuals are often an undesired necessity, interactive learning environments show beneficial for users as well as for businesses. Users associate every product-related touchpoint with their personal impression, which contributes to their overall usage experience.

9.4 Critical Analysis on current Implementations

In the first section Figure 52 demonstrated a user manual in its typical form. Research shows the importance of customer touchpoints for the overall customer experience and how this experience affects further buying decisions. The customers trigger for using technical documentation lays in the need for product support and product learning. By bringing together aspects of marketing as wells as consumer learning, adequate learning environments can be implemented.

In this section we analyze current implementations of embedded consumer learning environments by applying a critical case study. We will demonstrate the potentials for marketing communication and the hereby already accomplished improvement in consumer learning. Businesses are advised to get engaged to the topic and widen their view regarding product support.

The depicted cases represent state-of-the-art implementations within the research area. To highlight the wide field of application for embedded interactive learning environments we selected products from diverse branches. Engineers as product designers have to be aware of this ongoing change in product-integrated support. As products begin to directly communicate with the customer and transport marketing messages, engineers are required to understand the impact of new product design for the overall experience. By elaborating the key aspects of already implemented environments, implications for education of product engineers are given.

A. BMW

Late development in information and communication technology already shows their impact on the vehicle market. Integrated onboard systems like navigation software or Internet terminals connect passengers to the digital world. BMW is one of the pioneers when it comes to embedded learning environments in the car market. They introduced ConnectedDrive, a network of applications integrated into the control panel to access various additional

services. One of these apps is designed to guide the driver through all kinds of information regarding the specific vehicle (see Figure 54).

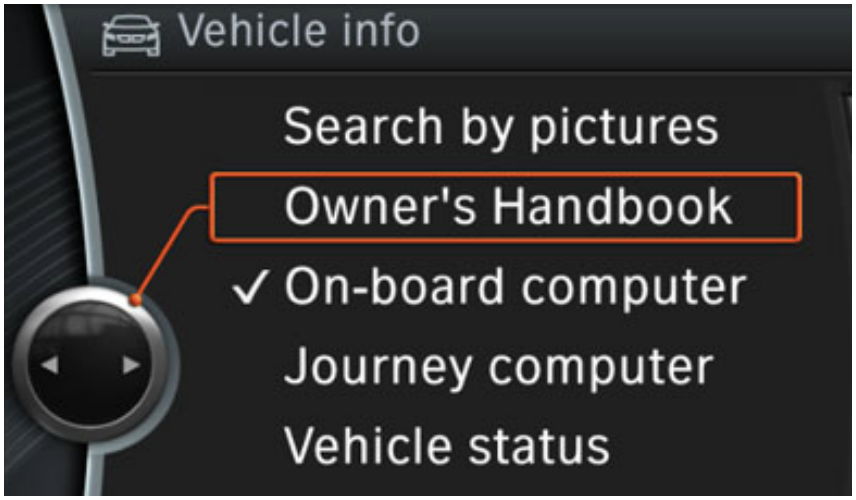


Figure 54: Vehicle-integrated manual by BMW

Services like status updates or a handbook for vehicle-integrated functionalities are available. Additionally, BMW offers service apps to control specific features like an auxiliary heater.

B. Samsung Smart Washer

Samsung is known for its diverse product range. Samsung's line of intelligent household appliances, like the recently introduced Smart Washer, belong to the most referred product ranges for advanced usage scenarios of embedded information systems. Washing and drying machines offer a LCD display (see Figure 55) to give notice regarding the product's status and additionally simplify the handling of complex processes.

Figure 55: Samsung's embedded Smart Washer program

A smartphone application allows remote operations and monitoring. Smart Care performs quick diagnosis on the devices and gets the customer instant access to troubleshooting options.

C. LG Smart TV

For several years products in the television sector were said to be hard to learn. LG, as an example, already integrates the user manual into the television's onscreen menus. Customers are guided through steps to follow in an instructional way. The remote control offers a single help button on the top, which directly links to the learning environment (see Figure 56).

Figure 56: Help button guides to LG's learning environment

D. Amazon Mayday for Kindle

In September 2013 Amazon launched their new product range in the tablet market. The introduced Kindle Fire HDX highlights the embedded support environment as the most important competitive advantage. Regardless the type of problem or question the customer is facing, pressing the Mayday Button directly connects the user to a life person. The support person can remotely draw on the tablet screen to live-demonstrate functionalities and assist the customer. Figure 57 shows the Mayday system in action, where the assistant highlights specific buttons or icons to guide the user through.

Figure 57: Amazon's live support for Kindle tables called Mayday

Amazon produced several TV commercials solely addressing their embedded learning environment. The service is free of charge and available at all times.

E. B2B: EMPOLIS Smart Information Management Systems

At last, we depicted a company developing business-to-business systems for manufacturing and testing branches. Testing facilities or manufacturing installations require control systems to coordinate complex processes. High uptime rates play a major role for such systems, as every downtime causes manufacturing delays and therefore additional costs. Engineers, as users of such systems, are enforced to react rapidly as well as professional on malfunctions. The complexity of machines or malfunctions requires a broad knowledge on very specific topics. Embedded learning environments support the engineer by providing context sensitive learning materials and deeper insights into the functionality of the machine. EMPOLIS as a provider of information management systems supports businesses

by providing embedded learning environments. Their products Smart Documentation and Smart Diagnostics, integrate into monitoring panels to enable support for engineers regarding the current status of an installation. Additionally, an integrated solution with Google Search Appliance (GSA) is available.

Figure 58: Combing search results with Google Search Appliance

GSA (see Figure 58) stands for an integrated hardware and software product for employees and customers of companies to find information in internal and external sources, such as wikis, databases or content management systems. The frontend, where users are searching in, structures the information similar to search results in Google Search.

F. Critical analysis

The depicted cases in consumer electronics vary from simpler solutions like integrated TV manuals to fully integrated support environments like Amazon Mayday. While in private markets standing out implementations are already placed as a competitive advantage in marketing, the B2B market concentrates on improvements in efficiency. We now discuss the cases by a critical analysis regarding the former defined success factors of product embedded learning environments.

All cases conform the trend regarding product embedded environments. Either integrated displays are utilized for aiding the user or external devices are directly connected to the product. Support is not only provided right at the time and place where requested, but also a context is added. Pressing the help button on a TV remote displays support to the currently using features.

Depending on product and support implementation different levels of interactivity can be depicted. Implementations for less complex products keep the traditional sender-receiver communication model, as the documentation is only digitalized and embedded into the product. Amazon's Mayday allows a fully bidirectional communication channel with contact to

a real life person. Especially financial and quality aspects seem doubtful for broader applicability.

Traceability, personalization as well as business intelligence approaches very much relate to the availability of feedback channels. Systems offering communication possibilities are able to learn from usage behaviors and therefore provide adoptions on various levels. All three factors are hard to observe from a user's perspective. Learning environments integrating feedback channels earn important insights regarding their products and their learning environments. Google's search engine is perfect example here, as it collects user data for years now. Google already filters search results individually by the user's determined preferences. Other markets will also benefit from gathered usage data of their products and thereby develop new products that satisfy customer expectations in appropriate ways. In contrary to approaches like open innovation and various forms of crowdsourcing [14], this data-driven approach by in-depth analysis of product usage acts as a passive form of involving customers into product development.

Limitations due to privacy concerns and customer acceptance have to be considered when collecting data. While using data for product development might be a widely accepted assignment, an application for marketing activities depends on intentions and implementation. None of the depicted cases employs the learning environments for direct upselling of features or for offering related products yet. Nevertheless, it can clearly be stated that these channels may be applied for useful marketing activities in the future, as the context of marketing communication appears to be eligible. Also cross channel communication can be established with benefits for businesses as well as customers. The product itself is becoming the most important instrument of marketing as they start to directly communicate to the customers. They do not require classical marketing messages as seen in commercials but enable businesses to place useful messages within a usage contexts. Thereby, marketing activities do not appear as product uncoupled promises but demonstrate the advantages of upsells in a user-centered context. Businesses adopting this marketing channels in appropriate ways will gain competitive advantages by achieving higher upsells as well as by developing products closer to the customers' expectations and needs.

As embedded learning environments are still in early stages, we expect rising research interest in science and practice.

9.5 Implications for the Education of Product Engineers

Figure 53 in section two demonstrates the classic process of composing technical product documentation. In this view technical writers translate product specifications and

functionalities into a language the user is expected to understand. Additionally, marketing communication was separated from this process as these campaigns were transported over other media channels. Engineers developed the product, technical writers translated the product, and marketers generated a demand.

By embedding interactive learning environments into the product, these three fields of responsibilities will lead to more comprehensive processes. Marketing and technical documentation can efficiently be integrated into the product, allowing more accurate and precise activities in form of useful product support as well as optimized marketing campaigns. The product is placed as the central object for business communication. Product engineers are responsible for product development, also including embedded systems. Engineers have to decide which systems to embedded with which kind of functionalities. They thereby directly influence the communication behavior and marketing with impacts on product and brand.

Engineers are required to actively design the product's communication behavior, implying proper education in marketing and business communication. We depict three mindsets of engineering education to respond to the upcoming potentials:

- Knowing what product to develop
- Knowing how to develop the product
- Knowing how to communicate the product

Knowledge on how to develop a product is within the traditional scope of activities of engineering. What to develop was merely within marketers' range of duties as market research is an often-utilized instrument to identify upcoming markets and demands. Late developments already highlighted the impact of technical engineers for new or fast-changing markets, as revolutionary developments rather rely on superb implementations than consumer investigations.

Integrating marketing aspects directly into the product expands the responsibilities of engineers. Knowing how to communicate a product was typical for marketers and technical writers, but will increasingly get relevant for engineers as they embed systems into the product. Engineers require education in relevant communication topics to ensure the implementation of professional systems, which implies a shift in engineer education. Knowledge typically relevant for technical writers and marketers will get into focus for engineers. Other branches already proof this shift and show the relevance for marketing communication education for traditionally non-marketing positions. Exemplary, the Huffington

Post newspaper widened the content producers tasks by allocating half of their writers' time on marketing of their produced articles. The separation between content producers and marketers was abandoned, bringing producers and consumer closer together.

9.6 Conclusion

Late developments in information technology clearly depict the advantages and new potentials for product embedded communication. Designing customer touchpoints with respect to customers' needs for product support opens ways for marketing activities. We identify seven factors for successful implementations of embedded interactive learning environments. Considering these factors, businesses build tremendous competitive advantages due to gaining insights into user behavior and recurring product malfunctions. Utilizing environments to transport useful marketing information in various forms improves upsell as well as new product placing. Only few already existing implementations can be highlighted, thus potentials are evident.

Bringing product development, technical documentation as well as marketing closer together leads to a shift of responsibilities and required competences. Knowledge on how to communicate a product with its' features in the right way to support customers on the one hand and cover business targets on the other hand, will become an important asset for engineers. The impact of high product usability on the adoption rate is already verified in various studies. Businesses that acknowledged this trend in early stages built a competitive advantage as customers remark these brands as user friendly. Similar developments are expected in customer support. Again, customers will recognize businesses for their effort in support.

Businesses like Amazon already identified consumer learning as highly relevant for product adoption and user-initiated communication processes. While Amazon's tablet product does not solely differ from competitors in terms of technical specifications, providing live support may be the key feature for specific target groups. The implementation of fully embedded learning environment requires high product knowledge as well as deeper knowledge on professional communication. Knowledge in communication will continue to increase in importance for businesses, and is therefore a future requirement in engineering education.

9.7 References

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10 Results

The overall research question raised in the first section got separated into two main research aims to complete. After an introduction in section 2, sections 3 to 9 answer specific minor questions. Both research aims are discussed now in detail to finally answer the initially raised overall research question.

10.1 Results of first research aim

The first research aim „Identification and analysis of impacts of communication changes on technical documentation“ built the foundation for all further research. An analysis on available literature was performed in section 3, as well as two questions were raised and answered in sections 4 and 5. While the analysis not only gave profound insights into the topic, also the strong relation between Marketing and Information Systems research in technical documentation could be identified.

The first question addresses the change in corporate communication and questioned the validity of traditionally referred sender-receiver models in communication theory. By analysing the change in customer communication due to new technologies, the Communication Space model was highlighted as an appropriate instrument to explain latest phenomenons in communciation. The model describes Communication Systems as technical systems which enable the information exchange by holding Information Units. The Communication Space model explains how customers and businesses realize their separate spaces by choosing their preferred Communication Systems. Exchange of information takes place whenever both parties utlize the same Communication System. Businesses have to realize that customers may interact with other participants on Communication Systems without their control. Thinking in Communication Spaces rather than sender-receiver models allows businesses to adopt their communication and marketing strategies according to changed facts.

Second, generic findings for corporate communication were adapted regarding the special focus of technical documentation. While the first question gives answers on how communication takes place and which components are involved to facilitate an information exchange, the second question addresses the current usage of technical documents. Results are of high interest as they give answers to the adoption and acceptance of product support. To ensure rigor of findings, a multi-method multi-source methodology was performed. Results were manifold and clustered into three groups:

Customers’ view on technical documentation

In most cases, technical documents are provided to translate product features from the language of engineers to customer thinking. This is also approved by the assignment of

technical documentation to the discipline of Translation Science. Depending on the type of product, various forms of technical documents are handed out to customers. Customers on the other side utilize these documents with the solely goal to overcome a problem situation with as little effort as possible. Different mindsets encounter and traditional forms of technical documents do not meet changed customer expectations any more. Furthermore, an often-ignored aspect of these documents is their marketing impact on customers. Product enclosures represent the product as well as the brand and thereby influence the overall customer experience.

Customers' application of technical documentation

The main focus of the study was on customers' application of technical documentation. Results show that media disruption leads to tremendous impacts for businesses as well as customers. Embedding technical support into the product ensures a seamless support process, initiated by context-sensitive information. Two studies in section 8 and 9 relate to challenges and upcoming potentials of embedded support in detail. Aside embedded systems, customers utilize generic search engines rather than studying manuals to overcome problems. The implementation of virtual support services offers relevant content and provides accessible content for search engine indexation. Again, context plays the major role, which starts with the awareness for the correct model type to search assistance for. Second, a successful knowledge exchange has to be ensured. Section 7 deals with learning theories to facilitate this knowledge exchange in detail.

Implications for technical writers

Highlighted aspects influence future applications of product support. Technical writers, who actually produce technical documents, are required to react to the changed needs in support. On this basis, a separate study addressing educational aspects for product engineers to develop customer-orientated support offerings was performed and included in section 9.

Discussed results summarize the findings within the first research aim. Applied methodologies and detailed explanations on findings are discussed in the corresponding publications.

10.2 Results of second research aim and answering the research question

The second research aim was named „Recommendations of business actions for the design and implementation of virtual support environments". It addresses design implications for future implementations of customer support environments to finally answer the initially raised research question:

How does customer support have to be designed to meet customers‘ changed communication behavior?

The first research aim already highlighted the high influence of product support on customer experience. Additionally, it was stated that high customer experience represents a strong competitive advantage. To ensure the design of customer support solutions with high customer experience, focus was set on the customer's perspective. Therefore, a service design methodology, which concentrates on customer expectations, was determined to aid the design process of customer support systems. The developed customer journey map in section 6 demonstrates the support process from the view of the customer. As the consumer electronics market is highly affected by changes in customer support, the map was developed with regard to this specific market. Five major business implications for the design of customer support environments were highlighted and explained in detail in section 6.5. Customer journey phases as well as implications are shown in Figure 59.

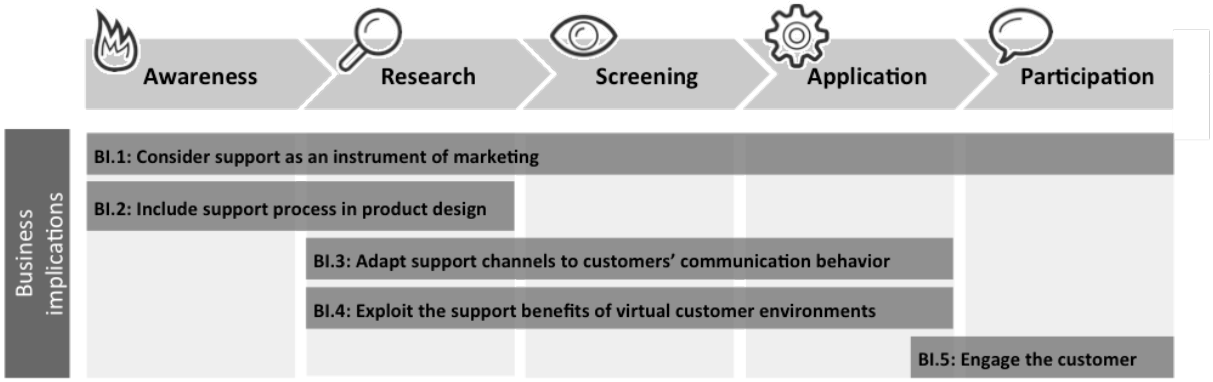

Figure 59: Customer journey map with business implications for the design of support environments in the consumer electronics market.

These five major implications are:

1. Considering support as an instrument of marketing
   Across all phases, businesses have to gain awareness regarding the potentials of support in terms of marketing and influence on customer experience.

2. Including the support process in product design
   Whenever possible, a direct linkage between product and support environment has to be considered. Also, the collection of usage data allows businesses to gain insights in usage behaviors for future improvements or new developments.

3. Adapting support channels to customers' communication behavior
   Customers' preferred Communication Systems within their Communication Space have to be utilized. To support successful information exchange processes, learning theories require attention (see section 7).

4. Exploiting the support benefits of virtual customer environments
   Virtual customer environments act as an online support system, aiding customers to potentially relevant problem solvings. When publicly available, these systems get indexed by generic search engines, which returns control to the VCE provider.

5. Engaging the customer
   The implementation of virtual support environments shows beneficial for customers as well as businesses. Customers may participate in various ways and thereby add the customer's perspective into support and development processes.

By mapping the depicted moments of truth within the customer journey map to current support offerings, businesses gain the chance to determine service mismatchings from customer's perspective.

Depicted implications as well as results from the first research aim indicate the high relevance for the inclusion of learning theory aspects into the design of support environments. A state-of-the-art research was conducted to identify learning approaches adaptable to the requirements of customer assistance. By matching generic theories with terms and challenges of technical support, two design models were depicted to meet requirements. The ARCS model of motivational design by Keller and Kopp[91] as well as the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model[92] are highly adaptable for customer learning environments. Conducted research is described in detail in section 7.

Results show consequences for the product development process as well as for creators of technical documentation. Therefore, further research was conducted as both aspects relate to the design of customer support services. The implementation of software-based systems for support raised the question how aiding mechanisms could be integrated into products to assist the customer right at the time a problem occurs. A personalization-based agent system for early product adoption phases was developed (section 8). By integrating a monitoring system with predefined criterias, logics can be implemented to perform support actions and guide customers through potentially problematic phases. An adaptable agent system visualizes selected actions while usage, ensuring context-sensitive support. The functionality, including the key indicators to monitor, is stated in sections 8.4 and 8.6.

[91] Cf. J.M. Keller and T.W. Kopp, "An Application of the ARCS Model of Motivational Design," in *Instructional theories in action. Lessons illustrating selected theories and models.*, ed. by C. M. Reigeluth (Hillsdale, 1987), pp. 289–320.

[92] Cf. RM Branch, *Instructional Design: The ADDIE Approach*, *Vasa*, 2009.

Embedding support environments not only raises the question on how to design customer support systems, but also personnel questions. Technical writers traditionally act as a translator between product engineers and customers. By bringing support and product closer together, also implications for technical writers arise. A change in education is required in two different ways. First, new marketing aspects lead to the demand for a deeper understanding of business communication and thinking in customer experiences. Second, the strict separation between product and support becomes obsolete. The product is placed as the central object for business communication. Different mindsets are demanded, as final section 9.5 highlights.

11 Summarization

The doctoral thesis covered a wide range of research aspects influencing the progression from simple technical documents to consumer-orientated customer support offerings. Technologies to bridge the virtual with the physical world like Near-Field-Communication (NFC), Bluetooth or various forms of barcodes bring digital support closer to the product triggering the support situation. Embedding support mechanism as an integrated feature opens new potentials in terms of customer experience as wells as marketing communication. Businesses gain the opportunity to keep customers within their communication space, allowing the accompaniment of information exchange.

As the example of Amazon's Mayday for Kindle Fire HDX showed, support offerings already play an important role in marketing and even in advertisings. Amazon uses its support service to distinguish from competitors that offer products with similar technical specifications. Amazon Mayday offers a competitive advantage, especially for target groups not familiar with tablet computers. Nevertheless, it should be mentioned that first evaluations from Amazon already took place. Beside the obvious service benefits in real life scenarios, Amazon also depicted interesting outcomes in terms of brand image. Due to the fact that a real person answers the support case, also smalltalk conversations between manufacturer and customer take place. It seems that people are not used to this direct communication channel any more, as 475 customers asked to speak with the "Amy"-person from the commercial, or even discussed private life matters (35 proposals, about 700 birthday serenades)[93]. Of course this opens risk in terms of an increase in non-financially exploitable personnel expenses, but also gives way for new potential revenue streams. An expandure of the business model to offer further services seems feasible. As an example, Amazon reportes that 109 times customers asked for support to get a pizza delivered[94] – maybe the opportunity for new earnings?

11.1 Implications for businesses

This thesis allows businesses to gain deeper knowledge regarding the increasing importance of technical documentation for marketing communication. Instruments for the transition from simple documents to virtual support environments and potentials of embedding support into products are presented. Due to this research, the need for customer orientation was recognized. The focus on consumer demands and needs will guide businesses through competitive times. The developed customer journey map acts as one important instrument to

[93] Cf. Jochen G. Fuchs, "Amazon Kindle Mayday: Die Top 6 Der Skurrilsten Support-Anfragen Aller Zeiten," *T3N*, 2014 <http://t3n.de/news/amazon-mayday-kindle-539889/> [accessed 20 April 2014].

[94] Cf. Fuchs.

keep the focus on consumers, as their perspective is continuously represented. Utilizing such an instrument throughout phases of planning and realization ensures a permanent customer-orientation. Besides the application of the journey map, also the collection and analysis of various relevant research findings have to be highlighted. Technical documentation involves various research as well as organizational areas. Only by utilizing an instrument like the journey map, diverse research findings out of marketing, information systems and translation science can be put in relation.

The presented map relates to consumer electronic goods, requiring businesses to define and analyze their touchpoints for further actions. The comparision of current touchpoint implementations with the depicted moments of truth shows implementation gaps to overcome. Even if the journey map would look similar for other markets than consumer electronics, adaptations have to be performed.

Businesses will find it difficult to react to facing changes within their organisationals settings. Embedding support environments not only requires new skills for product engineers but also budget considerations. Marketing and product development will get closer together, raising the question which budgets to allocate. Virtual support environments are part of the product, but also show positive impacts on marketing or brand image.

The last implication addresses implementations. Examples from innovation research show that excellence in imlementation plays a crutial role for launching new offerings. When Microsoft introduced the first tablet computer in 2002, customers did not respond to the product. On the contrary, the introduction of the first Apple iPad generation eight years later was a huge success. A superb implementation and environment completed the physical device. In case of support environments, similar rules apply. Testing the acceptance of new offerings with limited functionalities or ressources will lead to distorted assumptions and misleading implications. Implementations will require financial budgets at first place, but excellent implementatios will benefit customer loyality and brand image for winning new customers.

11.2 Implications for research

Implications for research are manifold and yielded in the specific publications. In this section, the opportunity to show implications determined due to doing research in a rather interdisciplinary area is given.

First, the high importance for intense literature analysis has to be highlighted. Interdisciplinary research topics require an analytical proceeding for identifying relevant

literature. The application of a research profiling methodology[95] gives an overview in a very specific field of interest. At the same time, the method ensures the inclusion of highly relevant state-of-the-art research findings. In such a wide research field as the topic of this doctoral thesis, multiple research profiling applications have to be considered.

Second, it can be stated that research in technical documentation and customer support mainly focuses on theoretical studies. Especially in a field with high interest for practitioners, more research could be set on applied topics and research questions. Many research findings showed valid in a very specific context without comprehensions for interdependencies with other studies. Technological aspects will increasingly influence other disciplines in practice as well as science. The transfer of knowledge between different scientific fields demands for openness in research. To ensure high rigor and relevance in applied science, the acceptance for utilized methodologies from different scientific fields is needed.

11.3 Résumé

The goal of this doctoral thesis was to research the impact on customers' change in communication behavior on the specific field of technical documentation. Two research aims were defined, resulting to several research questions to answer. Due to this structuring, a paper-based proceeding was conducted, ensuring a strong and permanent integration into the scientific community.

First, the change in communication behavior was highlighted and impacts on corporate communication were shown. Next, deeper research within the field of technical documentation was conducted. The impact of technical documents on marketing communication, as well as customers' attitudes and usage behaviors of technical documents were analyzed. Additionally, relevant learning theories for the application in support environments were compared to depict concrete implementation methods. Based on these findings, a customer journey map for customer support was developed and research implications for the design of support environments were given. Late developments regarding upcoming potentials for the integration of support systems into products complete the research results.

[95] Porter, Kongthon and Lu.

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