SMART SHOP SERVICES FOR BUILDING CUSTOMER-ORIENTED SCENARIOS

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Abstract: The shops of today mostly support the customer by offering him or her products based on basic relationships between products viewed or ordered by users with similar tastes. This common approach may fail in many cases especially when the user does not have sufficient knowledge about the market, or when he or she wants to build a set of products in more than one shop. New categories of smart shop services are proposed in order to execute such customer-oriented scenarios where recommended products do meet mutual dependencies with products previously ordered by the customer. An attempt is made to collect additional information about the behavior of users (from past and current contexts) and represent it in a targeted graph called the customer-oriented scenario. Four types of such scenarios are distinguished depending on how many shops have been visited by the user before buying the expected products and how many products the user wants to buy. Moreover, the proposed scenario model provides the possibility of showing which services had been used by the user before the selection was made. Customer-oriented scenarios may be created *post factum* based on event data logs or before the user will use the shop, which means that it can be arranged which information, knowledge sources (internal or external), products or categories should be suggested in some context of the user's decision. The possibility of leveraging additional smart services into a traditional trading platform may help users, especially when they want to implement a complex scenario and order many products with mutual dependencies or in a situation when the user wants to understand the market before buying something. Using internal and external services allows creating a network for distributing knowledge focused on the actual customer context in a shop.

Keywords: electronic commerce, categories of shop services, knowledge sources, smart services, customer-oriented scenarios, integrated platforms

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1. Introduction

In recent years the rapidly increasing customer interest in shops operating only online has been observed. One of the reasons for the popularity of this method

of distribution is customer convenience associated with the ability to view and order goods using web services. eCommerce solutions are becoming increasingly popular also due to the development of digital skills of customers and the related lifestyle changes, including the performance of more and more tasks remotely over the Internet or unwillingness to visit traditional shops [1, 2]. Customers of online shops can use their functionality to familiarize themselves with their offer — they can compare selected products, negotiate the terms of purchase, place orders or use an automated order payment process. In addition to providing support for customers, online shops make it easier for entrepreneurs to manage the product range, as well as automate the processes of order placing, billing and forwarding of ordered goods.

However, there are still some groups of products and services that are bought by customers mainly in traditional shops e.g., complex electronic systems, cars, repair equipment, medical services or luxury goods. The most frequent reasons for such behavior of customers are the desire to set oneself apart in case of purchasing luxury goods, lack of confidence in the seller in case of purchasing valuable goods and the lack of sufficient knowledge to choose the product on one's own in case of complex projects. The first two of these causes require personal contact between the customer and the vendor, and therefore cannot be fully eliminated with the use of the additional functionality of an online shop.

In general, customers do not have enough knowledge to independently decide on the purchase of goods. It is particularly true when the range of goods is changing rapidly over time. Standard eCommerce solutions support such customers as regards comparing the attributes of alternative products and presenting lists of the most frequently purchased goods that arouse most interest among the clientele. Such functionality of the shop is often sufficient when the customer has indicated sufficient preconceptions about the product and his or her motivation to make a purchase is high. In other cases, customers are forced to use different types of web sources describing the properties of the needed goods, and often avoid making a purchasing decision. This thesis is confirmed by the low average conversion rate in many of the world's online shops — 2.95% in the fourth quarter of 2016. It indicates, i.e., how many shop visitors were successfully transformed into customers within a specified period of time. In this article a service model of shopping is introduced and the possibilities of supporting it in order to increase the average conversion rate are indicated.

The competition between traditional and electronic shops as regards the extension of the offered functionality can be observed in the market. The advantage of traditional shops is the possibility of consulting the vendor in order to obtain more information, as well a chance to verify the goods before purchase. The most frequently mentioned disadvantages include the limited automation of transactions related to the registration of products selected by the customer, the requirement for personal participation in the purchase process, the dispersion of shops offering a similar range of products, the limited availability of products, as

well as the necessity to organize the transport of purchased goods. Online shops offer their customers a wide range of products and services, automate the ordering process, do not require the customer's arrival at a specified location, support the process of product delivery to the customer and promote customer cooperation by allowing customers to rate the purchased goods and read with reviews of other customers. The disadvantages of online shops include the lack or limited opportunity of consultation with the vendor, inconsistent organization of the product range, incomplete descriptions of the offered goods, and sometimes also the lack of credibility of the online shop.

A significant source of support for customers would be providing them with selective information depending on the current context, their level of knowledge and current needs. So far, the level of customer support provided by eCommerce solutions has often been lower than in the case of traditional shops where customers can often meet assistants explaining the range of products and services or the precise location of the desired products, while helping them to refine their requirements. The existing eCommerce solutions do not provide any effective tools that would support knowledge management [3] and using this knowledge to help customers make choices. As a consequence, the process of selecting products by the customer becomes prolonged. Moreover, with each change of the shop, or the sought range of goods, customers must familiarize themselves with the way in which such range is organized (categories, subcategories), the nomenclature used to describe the products (features and assigned values) and the functionality offered by various user interfaces. This results in prolonging sessions, reducing the number of conversions, increasing the probability of customer fatigue and, as a consequence, lower customer satisfaction.

Additional tools such as i.a. Google Analytics or PIWIK [4, 5] are frequently used to monitor the behavior of online shop customers. They allow logging shop functions used by customers but fail to provide tools for automatic analysis of the collected information and facilitation of the vendor's decision. Due to the lack of automation, the process of analyzing the collected data is lengthy and the time to make changes in the shop, as well as their scope, often fail to meet the needs of many customers. The introduction of an abstract electronic nature of eCommerce solutions will enable the introduction of automation in terms of suggesting to the customer not only products, but also the features available in shops and services of external online providers. It will contribute to the expansion of the process by a stage of customer-friendly education which can also be assisted and supervised by online shops.

The proposed solution combines selected advantages of traditional and online shops, enriching them with the opportunity to support the customer in the process of goods selection. The extension of customer support in the process of product selection should include i.a. creating the customer's vision of the product and the need to purchase a specific product. Today, it is primarily the role of marketing departments, which is partly associated with each online

shop. In these considerations, a model of shopping scenario handling based on various types of services offered by online shops or available online on demand to implement new purchasing capabilities will be applied. Thus, the description of the customer's decision-making process is proposed to be expressed in the form of a service purchase scenario which will include services corresponding to the functionalities of traditional online shops (Basic Services) and new smart services (Smart Services), gathering and exploiting the knowledge available in many online shops in order to, e.g. formulate an adequate purchase offer and provide the customer with a more substantive rationale for the product value. The article presents examples of services that support the proposed model and indicate its usefulness in many areas of trade. The research related to the proposed model was carried out in a test environment created by 34 modified online shops offering a product range from different fields, such as construction, medical services, children's articles, bookstores, electronics shops, etc., which enabled the implementation of integrated shopping related to mutually complementary products.

The proposed service model of online shops and categories of shop services is presented in Chapter 2. Then, in Chapter 3, the proposed model is extended by smart services using relevant knowledge, and their potential use is indicated. The customer shopping scenario is discussed in Chapter 4 to clarify the usefulness of the proposed service model. This consists in using different configurations of services depending on the interpreted customer intentions. In Chapter 5, different levels of customer support resulting from the selected varying service configurations are presented. The proposed solution was evaluated on the example of a built test environment consisting of 34 shops. A description of this test environment is provided in Chapter 6 and some results confirming the usefulness of the solution are given. Chapter 7 presents the conclusions and some suggestions for future work.

2. Categories of shop services

The process of selling goods in shops is accomplished through a set of functions that can be grouped by the scope of their use by shop users (customers and vendors):

- Providing product information — presenting a catalogue offer in the form of letters, e.g. categories, products, as well as a collection of information pages detailing the products;
- Customer support related to making decisions as regards the choice of the shop or the product — a set of tools aimed at complementing product descriptions and supporting decision making — including the popularity of rankings of goods, reviews of other customers, mutual comparisons of alternate product values, presenting lists of alternative products, as well as support for processes of order placing and payment;

- Gathering customer information — the possibility to define ratings and comments by customers and monitor customer behavior using external tools such as Google Analytics (GA) or PIWIK.

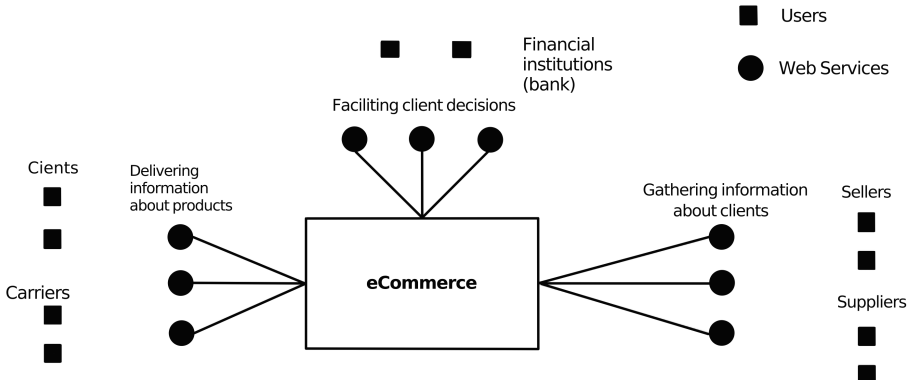

Figure 1. eCommerce solution service model

The above-mentioned functionality can be automated and delivered in the form of services implemented in eCommerce solutions. Such services, implemented in the SOA (Service Oriented Architecture) standard [6] will be hereinafter called called 'Basic Services', as they are available in almost any online shop. It is possible to distinguish system services that support the functioning of the shop and usability services that directly support the customer. Then, a general model describing eCommerce solutions may be presented as a service provider (see Fig. 1) for both the seller and the buyer of goods. eCommerce solutions can vary as regards the selection of categories of services and the way of implementation of individual services from the above-mentioned groups. They can use local services operating within a single shop or a global service integrating several shops. The fixed packages of services offered by the shop will be hereinafter called the 'shop configuration'.

The proposed service model of a shop can also be applied to the modeling of traditional shops — in such cases services represent the actions performed by the customer or the vendor. The category and scope of functionality of these services influence the number of online and traditional shops that behave in a similar way as regards the development of the offer for customers, transaction and customer service after transaction.

One of these new capabilities in traditional shops is increasing sales through appropriate organization of the exhibition of goods in the shop [7, 8] or enabling customers to make purchases without waiting at the checkout [9]. The introduction of such services in an online shop will, on the one hand, increase the satisfaction of its customers, and on the other hand, increase the sales of the entity that offers them. Moreover, such a solution is less costly than in traditional shops.

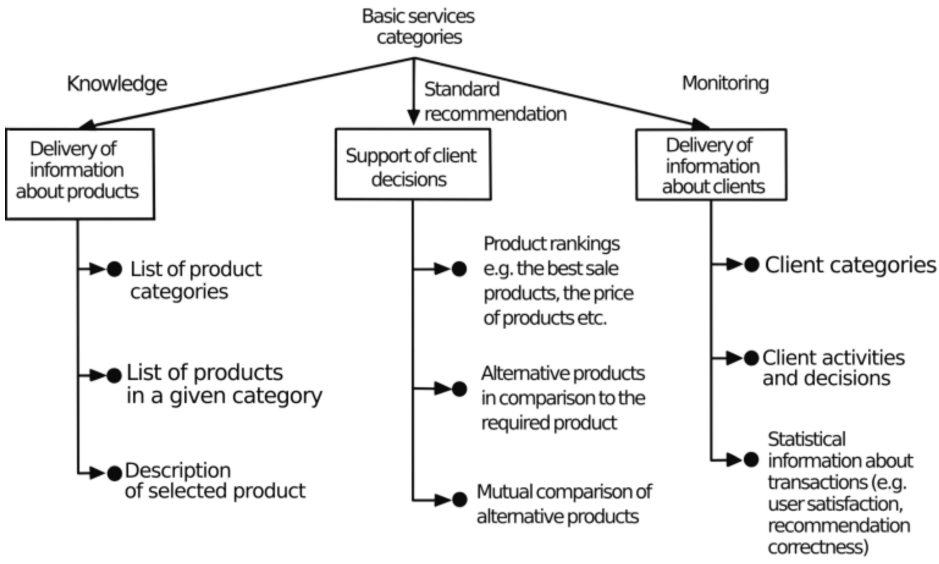

Figure 2. Categories and examples of basic services

Popular eCommerce solutions, like Magento [10] or Prestashop [9], offer a range of basic services, examples of which are shown in Fig. 2. In practice, the existing eCommerce solutions do not offer automated services in relation to e.g., development and presentation of the offer, detection of customer needs, or providing customers with information relevant to their needs.

In addition, the functionality of basic services appears to be insufficient due to the low popularity of eCommerce solutions in the case of purchasing certain groups of goods, the choice of which requires additional knowledge from the customer related e.g., to the relationships between certain characteristics that describe the products, the ability to compare the values of such features, the nomenclature used or the methods of classifying goods into distinguished groups. Examples of goods that require some knowledge from the customer during the selection process include Smart Home systems, sets for building the IT infrastructure of an enterprise, or even items needed to repair a bathroom. Services provided to customers in popular eCommerce solutions, such as a list of available categories, a list of products similar to the selected one, a 'wish list' or a comparison of the features of selected products fail to assist the customer in fulfilling an order related to a comprehensive project. The fulfillment of such orders most frequently involves the purchase of many different products at the same time, while taking into account the specific purpose of a particular project.

One of the reasons for the limited usability of the existing eCommerce solutions for the described groups of goods, is the assumption that the customer uses the online shop only to carry out transactions. This implies that a customer using online shops has solid knowledge of his or her expectations, and a list of the products he or she is seeking. The existing way to create the offerings of

online shops by manually defining the division of products into categories and subcategories corresponds to the expectations of only one narrow target group of customers having the appropriate level of knowledge. Based on the average conversion rate described earlier it can be said that most customers (97.05% of online shop sessions) are interested in information about the goods, whereas transactions are rare (2.95% of cases). The conversion rate is the ratio of the number of users carrying out transactions in an online shop (customers) to the total number of visitors using the information presented by this online shop. Before making the decision, customers are most frequently looking for knowledge about products in external sources, such as information portals, social media or search engine advertising. The variety of knowledge levels may depend on many factors, such as product categories, user context, age group, etc. The existing heuristic optimization methods [11] are intended to increase the conversion rate through testing further hypotheses based on well-defined changes in the offer, and the tools for measuring the effects of such modifications. This approach is aimed only at the optimization of the result, and not necessarily, at providing a potential online shop customer with support.

In general, the offers of online shops are static and include a list of goods and their hierarchical description. When buying a single product, such a vertical way of description of goods is sufficient. In the case of a simultaneous purchase of many goods the horizontal organization proves to be superior due to providing faster access to multiple goods and ignoring less important description details.

3. Role of smart services

The personalization of the offerings according to the customer's characteristics is more and more frequently based on recommendation systems [12]. They use a data mining process to extract the relevant knowledge from the information gathered by the shop as regards i.a. customer behavior in the shop, the orders placed, or transactions executed. The recommendation methods are increasingly used by web providers offering various types of products or services, including Netflix [13], clothing shops (Levi [14]), large retail shops (Amazon [14]) or auction sites such as eBay [15, 14].

The popular eCommerce solutions (Magento, Prestashop) provide the possibility to expand the functionality by additional services available for purchase in the eCommerce software developer's shop. Such additional services provide i.a. the ability to detect groups of customers with similar expectations and suggest to them appropriate products from the offering. These services usually cover a limited range of the shop's offering, as they relate to selected items, such as the home page, cart or category, or a list of products recommended based on the product being viewed or the product that has just been purchased. The recommendation methods offered by such solutions most frequently suggest the goods to the users based on their popularity level calculated according to different attributes, such as the shop's most frequently purchased products, the selected category, or the

products from the same brand or purchased together with another product. Such recommendation methods can be effective, but only for a limited set of customers ordering popular products that match the tastes of most buyers. Creating product recommendations at specific points of an online shop based on the popularity of its products is often insufficient: because the customer is still required to have adequate knowledge of the ways to make use of such recommendations. The existing recommendation services usually suggest the products to the users based on their previous behavior rather than on the basis of their current needs. The users of such systems are categorized into certain sets of similar visitors on the basis of a set of decisions that are limited to a single shop. This solution may be insufficient or not very accurate in the case of recommending products that meet the current requirements of the users. Lastly, the recommendations indicated by the recommendation mechanisms may apply only to the offer of a single shop and the behavior of its customers, while disregarding the fact that they browse products in multiple other shops and/or informational websites describing specific products.

The proposed solutions make the eCommerce solutions similar to stationary shops, where suitably trained individuals work in only one, specific, department in order to provide advice on the product range found only in such a department, such as e.g. flooring, glues, wallpapers or furniture. The customer's attempts at finding products that meet their expectations related to their complex project constitute a significant challenge for them. It leads to the need to repeat their requirements to each of the vendors, acquire the knowledge required to complete the order, correct the order on their own, or repeatedly use services of the same entities. Such an approach reduces customer satisfaction because it extends the time needed to complete the order, as well as forcing the customer to make efforts and acquire the necessary knowledge, that is likely to be less helpful when ordering at another shop or buying another product.

The eCommerce solutions that offer products on the Internet can make greater use of the knowledge and services available there, e.g. by presenting marketing information (articles, rankings and videos) on the products being viewed to the customer or offering access to other buyers interested in the currently selected product range. In this way, eCommerce shops can co-create a network for distributing product and customer information, while tailoring such information to the context of customer activity in the chosen online shop. In order to understand the functionality and scope of such services, it is necessary to analyze the possible shopping scenario presented in Fig. 4, and the knowledge required from the customer during the execution of such a scenario (see Chapter 4). Smart Services support the execution of the presented shopping scenario i.a. through extending the user knowledge. A general model of the proposed solution, based on the new type of service called Smart Service, is shown in Figure 3.

Smart Services fall under the category of recommendation services and can be globally used in any shop. It is a collection of knowledge-based services that

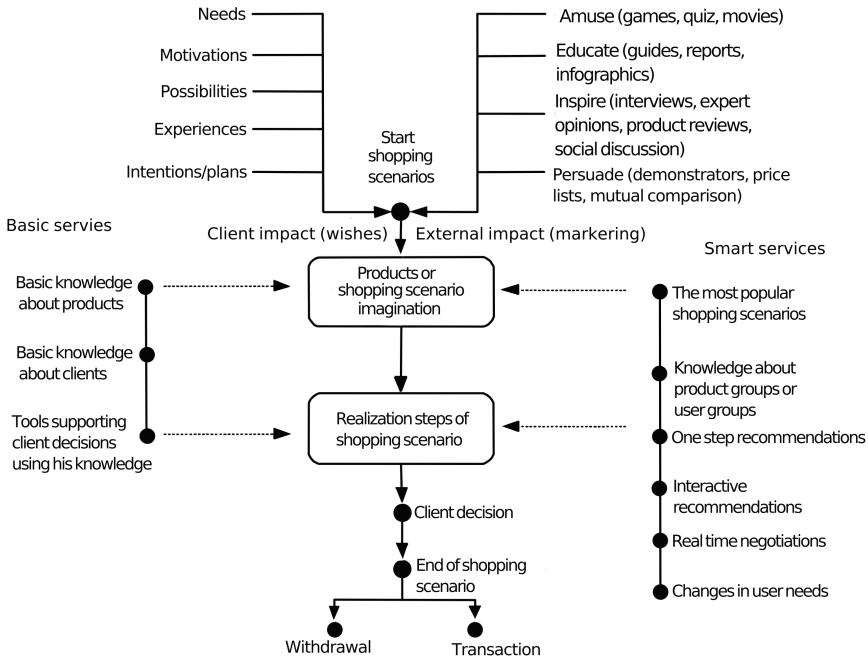

Figure 3. Shopping scenario supported for basic and smart services

allow collecting, processing and using knowledge in order to support the decision-making process executed by the customer and the seller. They provide knowledge by assisting the customer in the execution of complex projects by analyzing the context of the customer's activity and presenting additional information relevant to such context. Smart Services enable automatic enriching of the knowledge of the customer purchasing the goods in the shop. The goal of these services is a global approach to detecting customer needs, suggesting to them adequate information sources, and extending the existing sales process. As a result, this leads to the formation of a new category of shops, i.e. those using automatic Smart Services. Such a solution combines the advantages of traditional shops, and basic online shops, extending them by the possibility to assist the customer in executing a complex project, and likewise the seller in selecting and organizing the product range. On this basis, two types of Smart Services can be distinguished:

- systemic — they assist the vendor in discovering information by indicating e.g., product trends in the market, or shopping trends in the shop, as well as enable the organization and management of knowledge;
- functional — they provide for the development of the user's knowledge and support the executed shopping scenarios.

In order to increase the attractiveness of eCommerce solutions, it is necessary to strive to reduce the number of tasks performed by the customer and limit the requirements towards their product knowledge. The basic services in online shops should complement information on the goods offered in multiple in-

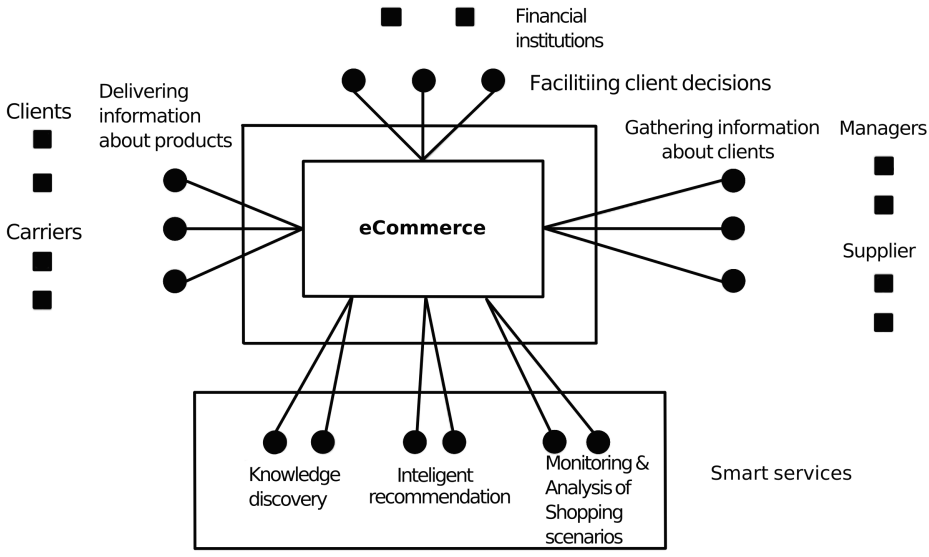

Figure 4. Scheme of the smart shop services

dependent online shops which form a collaborative network (a virtual workgroup). Supporting the exchange of information on the offered goods can have a significant impact on the customer's decisions; by enhancing their knowledge and clarifying the vision of the expected product. The following Smart Service categories are suggested:

- Intelligent product recommendation for the customer using feedback from various customers in the eCommerce network — estimating customer needs by building product or service selection rules based on customer behavior in the eCommerce network and recommending the right products from any of the shops, as long as they match the discovered needs of the customer.
- Extending information on the proposed products using the new capabilities of external web services — providing information relevant to the current customer context based on the knowledge of available web services (e.g. social networking information, information derived from promotional materials, videos) and discussions with other customers considering the purchase of the selected product.
- Monitoring current user context — discovering relevant knowledge based on the information about customer activity (e.g. services used, products selected, requests made), enabling the identification of customer needs and classifying customer behaviors into groups of similar customers based on their level of expertise, inspirations, trends, promotions or goals. The new possibilities can be created by the Internet of Things technology.

Examples of Smart Service functional services for these groups are shown in Fig. 5.

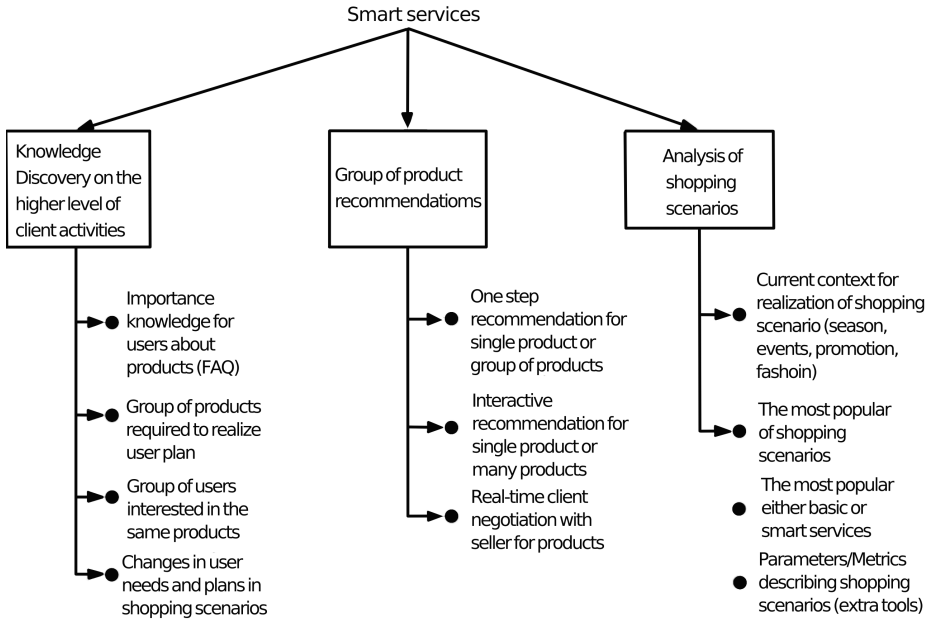

Figure 5. Categories of Smart Services

The proposed change enables the enhancement of the role of online shops with respect to traditional shops, by providing services that automate some of the customer's tasks. Such support can increase the customer's satisfaction by providing them with convincing knowledge in order to facilitate the finalizing of the transaction, e.g. by reinforcing their belief that the purchase of the proposed products is justified. Smart services can support complex purchase scenarios by minimizing e.g. the total cost of purchased goods, or the time required to purchase products needed for the planned project. Moreover, supporting the customer with the proposed services is aimed at reducing the time spent on shopping, by adjusting the displayed information to their expectations. The level of support provided to customers of online shops by the proposed Smart Services depends mainly on software developers working on particular eCommerce solutions. Ultimately, Smart Services offered by different vendors should enable the interoperability of online shops using such services. Exchanging information, by shops offering similar product ranges, will enable the establishment of virtual workgroups of customers interested in similar products, or executing similar projects. Such an approach will allow the dissemination of information about the shops and their customers, facilitating i.a. the consultations during the process of choosing products.

The proposed model of an eCommerce solution using Smart Services facilitates the use of knowledge collected by customer monitoring tools and external web services, such as discussion forums, social networks or information portals. This allows the process of making purchases in an online shop to

be supported by additional knowledge, which is unavailable in the existing eCommerce solutions. The shop networks using Smart Services offer additional opportunities for collaboration, i.a. related to providing consulting to customers watching similar products in different shops or creating virtual consumer groups e.g. to provide discounts or enrich the offering. The level of usage of such services by customers depends i.a. on their knowledge and level of digital competences in particular.

4. Design of customer-oriented scenarios

Each transaction results directly from the customer's needs and motivations, which can be described as a project to execute. The customer's choice depends on his or her initial knowledge and the product preferences resulting from it. The user's knowledge related to the ways of selecting services is most often formed on the basis of marketing information, the decisions made by him or her and the evaluation of these decisions. Each decision of the user is related to the conviction that choosing a certain product or a product group is justified. This is due to the interpretation of the information describing such products, and its similarity to the preferences of the user shaped in the purchase process.

The development of customer knowledge is the result of assimilating some kind of product information, as well as relationships linked to the customer's life. The processed collection of such information is called market knowledge, collected by the customer and the seller during the execution of the purchase process. The knowledge of the customer and the seller can be formalized in paper or electronic form or exist only in their minds as a set of general guidelines that will guide their market decisions. The knowledge required to execute shopping scenarios can be divided into four groups, related respectively to:

- shops / eCommerce network — descriptions of offered products, available alternatives, shop and product rankings, cooperation of online shops within a network of such shops (eCommerce network);
- customers — their favorite activities and real needs, financial capabilities, digital capabilities, groups of similar types of customers, social relations;
- sellers — business claims, favorite promotions, marketing impact and customers, social relations with customers;
- context — technology or innovation trends, marketing audience, essential events having impact on shopping time periods (seasons).

The knowledge of the seller can be distributed among many individuals playing certain roles in the functioning of the shop. Regardless of the form of the collected knowledge, the customer and the seller make certain decisions about their behavior in the shop. On the seller's side, they concern the selection of the offered products, the way of product range organization, or the scope of applied promotions. On the customer side, they are associated with the rules of searching and browsing products, ways of defining orders, or methods of comparing offers and opinions related to the available products.

The development and usage of knowledge by the customer of an online shop can be presented in the form of a shopping scenario describing their activity expressed in terms of the services used by them to make purchases in the web market. A scheme of such a shopping scenario is shown in [[?]] Fig. Figure [[?]]. There are four types of shopping scenarios:

- SPSS (Single product - Single Shop) — refers to ordering a single product by the customer based on the data derived from using one shop;
- SPMS (Single product - Many Shops) — describes the order of a single product based on the information presented by multiple shops;
- MPSS (Many products - Single Shop) — refers to the history of user activity related to ordering multiple products related to a specific project based on the information available in a single shop;
- MPMS (Many products - Many Shops) — refers to the customer's ordering multiple products related to a specific project based on the information available in multiple shops.

These types of shopping scenarios are currently supported to a varying degree by services and e.g. the customers following:

- the SPSS scenario can use the available services comparing the selected products in a single shop or recommendation services using the database of the shop;
- the SPMS scenario can use the available services comparing the range of products from multiple online shops, and dedicated services for users following the SPSS scenarios;
- the MPSS scenario most frequently uses only a list of product proposals linked to the product added to the cart or proposals of other similar products from the same category, customers also use services supporting other types of scenarios, i.e. SPSS and MPSS;
- the MPMS scenario can use an additional set of services aimed at assisting the customer in addition to those offered for the SPSS, SPMS, MPSS scenarios.

The customer starts to execute his or her shopping scenario with analysis of his or her needs, using the accumulated knowledge from previous experience, awareness of opportunities and motivation to make certain decisions in the form of the acquisition of necessary goods. The moment of making the decision to search for a certain product is most likely to be inspired by the marketing information obtained by the customer from external knowledge sources that influence the way in which the customer is analyzing the situation. Through properly prepared guides, reports and infographics, the customer can gain additional insight into the purchase or use of a specific product. The customer's search for a product may also be inspired by a variety of expert opinions, product reviews or posts in particular community forums. Demonstrators and calculators are designed to convince the customer of the correctness of his or her decision to choose a particular product.

Last but not least, elements such as films, games or contests are intended to provide the customer with emotions that will overwhelm the arguments for postponing a purchase decision. Based on the conducted analysis of the collected information the customer creates an image of the product or a set of products that he or she intends to purchase in order to achieve his or her intended goal. An imaginary product model is not usually described by exact attribute values corresponding to actual customer needs. The selection of a product compatible with the virtual notion can only be made on the basis of information collected in the shop, such as the price, description, pictures or availability of the product. Nevertheless, the customer often uses additional knowledge resources, analyses the opinions of other customers, asks friends from his or her social networks for their opinions, uses product advisory services or is directed by promotions. The customer selects the products intuitively from the collection of products that correspond to his or her imagination, and then compares them with a narrow set of candidates. The decision to purchase a product from this set may be preceded by an analysis of technical information provided by experts in the form of research results and quality rankings. At the same time, the customer may withdraw from the decision to purchase a product if it is not compatible with their imagination or if they are not fully convinced that the purchase will allow them to meet their goals. The actions taken during the implementation of the purchasing scenario can be divided into the following phases:

- Creating a vision of the sought product — the customer is gathering knowledge about his or her needs and the available possibilities of meeting those needs in order to create a vision of the product he or she is are looking for;
- Confronting the product vision with the available opportunities — analyzing the existing product offering in order to verify an imaginary product model and adjust it to different market constraints resulting from the product availability or the customer's financial constraints;
- Product selection — finalizing the shopping scenario by selecting a product from a small group of products that meet the customer's requirements or withdrawing from the transaction and returning to any of the previous steps of the shopping scenario.

The shopping scenario may be supported by basic services at different stages of its execution, which facilitates its implementation. In addition to the basic services, the so-called smart services should be distinguished, providing still more support for the process of increasing the knowledge and selection of the most suitable product. Services of this type use additional sources of information, created on the basis on the history of execution of shopping scenarios by other customers, including those used by web services. Depending on the services chosen for the execution of the shopping scenario, there are three levels of customer support:

- Simple shopping scenarios — using the basic services offered by eCommerce solutions in the field of searching for products offered by a single entity, presenting information supplied by the seller and choosing the product with the use of a website a simple comparison of the product characteristics, wish lists, and shopping carts;
- Expanding the actions supporting the customer's decisions — product selection is further supported by services recommending products based on the opinions of other customers and the services that enhance the decision-making process through integration of customers having similar interests or by recommending discussion forums, individuals and groups in the social network. Information collected through tools such as PIWIK or Google Analytics also proves useful here;
- Expanding the learning process — i.e. expanding and supporting the process of accumulation of the customer's knowledge related to the viewed products through the use of external web services in order to create a need and convince the customer to make a decision to purchase or imagine not merely the sought product but rather a whole set of products needed to implement the customer's purchasing plan related to the executed project. Creating a purchasing need is associated with monitoring the current user context and indicating to the user the potential sources of knowledge coming also from the external information systems.

The services selected to support the purchasing process determine the kinds of market knowledge that can be used or offered to the persons involved in the process. This means that there is a certain mapping of knowledge to a service that allows specifying the set of required services supporting the customer, or the seller, with a selected type of knowledge. The selection of knowledge and services supporting the execution of the shopping scenario will be hereinafter called the 'shop configuration'.

Due to the selected set of support services, the shopping scenario can be executed sequentially, as in the existing eCommerce solutions, or in parallel, helping the customer to gather knowledge and create an imaginary product model while browsing the offerings of shops. In this way, the customer choosing any shop of this type will be able to obtain comprehensive help required to complete the product shopping scenario at the level corresponding to the services used and the knowledge offered (shop configuration). This approach will enhance the customer's ability to control his or her decision-making process through the appropriate selection of web services that are offered by specific entities, or provide specific sets of information.

5. Additional customer requirements

The number of services used by customers in a shopping scenario depends mostly on the level of their digital skills. The first group includes occasional customers who shop on the Internet while following information from traditional

sources, such as the press or friends. They buy a narrow range of products online because their purchasing decisions depend mostly on talking with an assistant in a traditional shop. They are not familiar with the available online services, and use only basic services for simple orders, such as product popularity rankings, finding product groups that are the most frequently viewed during a single user session, or comparing products based on descriptions provided by the seller. Such shopping scenarios will be hereinafter called 'simple'.

The second group of customers is commonly referred to as Millennials. Their characteristics are described in a Forbes article [16], listing the six main characteristics of this target group:

- diverse — the Millennials as a group constitute the most varied type of customers, from single mothers to middle-class professionals;
- technologically aware — the people from this generation have been brought up in the age of the Internet and easy access to technology: they are using information accumulated on the Internet at any time in their lives;
- following the culture of sharing — they exchange views by means of social networks, which is often a condition for making a purchase decision;
- disliking existing sales methods — the standard sales methods are not accepted by people of this generation and promotional information describing products is not relevant for them; they are directed by the actual value of the product, and the authenticity of the descriptions; they are likely to use rather the opinions of other customers than the recommendations of sellers;
- continually on the move — due to the ability to stay in touch with friends anywhere in the world, the Millennials are the most mobile group of customers, difficult to reach by advertising such as that presented on the television;
- loyal — these customers do not buy products just because they are produced by a well-known company; the products of such a company have to prove their quality and authenticity to make the customer believe in the brand's greatness; building this knowledge among the Millennials is very difficult, but brings enormous benefits to the manufacturer in the form of very loyal customers.

The execution of a shopping scenario can now be monitored using a number of tools developed for this purpose, such as Google Analytics or PIWIK. These tools collect and systematize information describing customer behavior, most often in the area related to a single online shop. They fail to automatically discover the knowledge based on the collected information, so it is impossible to use these tools for dynamic customer support in the shopping scenario. Another problem is related to the lack of knowledge about the impact of the presented offer on the user in the context of using online services offered by external entities (e.g. discussion forums, information portals, etc.). The proposed extension of the existing eCommerce solutions is aimed at supporting the buyers with Smart Services during the execution of the shopping scenario; including

services monitoring the user's context based on his or her activity in a network of interconnected eCommerce solutions and knowledge-based online services. Tools such as Google Analytics or PIWIK track user activity on the pages of an online shop, recording the customer's inquiries and transactions. Their functionality is usually limited to collecting information related to a single online shop. They do not have a defined set of services enabling automatic discovery of knowledge, and provision of recommendations supporting the customer in making decisions. Such functions are offered by the proposed Smart Services, using i.a. information collected by such customer monitoring tools.

The proposed extension of the existing eCommerce solutions, and the creation of a network of such solutions, allows monitoring the shopping scenario executed by the customer in a distributed environment of online shops. Enriching the shopping scenario with additional online services allows creating comprehensive shopping scenarios that present the causality of the customer's choice of services more accurately, as well as describe the moment when the transaction decision is made. The proposed expansion of the shopping scenario by Smart Services may affect the customer in all phases of this scenario (see Figure 3). Selecting the right service for the scenario should be supported by a recommendation system that tailors the list of proposed services to the current context of customer activity. Such a recommendation system should enable monitoring of the activity of customers in multiple collaborating shops in order to precisely define the context and provide opportunities for customer integration. The monitored activity should concern not only the basic information collected nowadays, such as the list of visited pages, or the shopping cart content. It is proposed to extend the set of collected information by data that enable the representation of the customer's behavior in the form of a shopping scenario consisting of services. Such services can be provided both by online shops and by third-party vendors supporting the customer's decision-making process.

In order to provide proper support for the customer executing a complex shopping scenario, the knowledge discovery process should be implemented at a higher level of generality, i.e. above the individual eCommerce solutions. This will allow specifying a single profile of an individual viewing the offerings of multiple shops, as well as detecting the current context associated with the relevant stage of a shopping scenario. A superior role in relation to eCommerce solutions is most frequently played by certain catalogues of online information services, such as e.g. search engines (Google, Bing) or systems comparing the offerings of multiple vendors (Google Shopping, Nextag, PriceGrabber). The role of the catalogue in the proposed solution can be played by a centralized repository of knowledge and Smart Services, collecting and analyzing information from multiple shops at the same time. In this case, the provision of services from such a repository to shop customers results from the implementation of the user interface. With the development of shops and the expansion of support for the purchase process, the number of services used by the repository can determine the choice of an online shop to be used by the customer in order to complete the transaction.

With the development of digital competences of the customers, the tools enabling the automation of the purchase process or searching for goods according to a described scenario, or tools that automatically tailor the offering of the shop to the needs of the customer using the knowledge discovered from the market monitoring tools, can become more and more popular. Such knowledge can be collected by vendors themselves or provided by companies specialized in market analysis and execution of shopping scenarios. Owing to such support, the customer can organize his or her shopping scenarios in real time. The seller can use tools automating the selection of products for their offering, ordering products from suppliers, or shipping products directly from suppliers. The popularity of online shops will most likely lead to the unification of shop offers and, as a result, the competitive advantage of particular entities will be due to the services offered to support the execution of the purchase scenario and the knowledge that is being used and offered.

6. Testing and results

The environment for the execution of the experiments was created using the computing cloud provided by CI TASK[1]. The experiment was divided into four stages:

- creation and implementation of eCommerce solutions offering Basic Services and Smart Services in the cloud;
- implementation of shopping scenarios using Basic and Smart Services;
- analysis of the results obtained in order to evaluate the proposed eCommerce model.

The participants in the experiment were 120 programmers divided into teams of three to five people, each of whom was responsible for developing and managing a single online shop. Each of the shops was created on the basis of the existing eCommerce solutions, i.e. Magento or Prestashop. Each of the created online shops had to offer at least 100 products matching the offering of a selected actual shop. In total, 3911 goods were included in the offering. The created eCommerce solutions were embedded in the computing cloud and integrated with other cloud-based systems, i.e. the global repository (SaaS) of Smart Services, the PIWIK event logging tool and the external Google Analytics tool. The team identified the Smart Services that would be used during the experiment, and defined certain shopping scenarios based on a selected actual shop (e.g. IKEA or MediaMarkt). There were many possible configurations of services and knowledge available to the online shops. During the experiments, specific service configurations that use different types of knowledge were selected. The proposed variety of test environments was purposeful, and intended to show how the proposed approach worked in different contexts of user activity. During

1. **C**enter of **I**nformatics **T**ri-city **A**cademic **S**upercomputer and networ**K**

the experiment, the authors focused on configurations using knowledge related to i.a.:

- offerings of similar shops participating in the eCommerce Network;
- collaboration of virtual customer groups exchanging information through a social network;
- specialized advice, product tests and marketing information.

The basic eCommerce software was extended to include the capability to log user decisions related i.a. to used services, ordered products and defined ratings. The logged user decisions supported complex shopping scenarios that were recorded in a central database. Based on these scenarios, customers were recommended to purchase products tailored to their needs to use online services supporting identification of the buyer's needs. The sellers were provided with information on the prediction of demand for goods, and the trends observed in the established market of shops. The architecture of the environment corresponded to the proposed Smart Shop network. The role of an intermediary providing access to the offerings of established online shops was played by the Smart Service repository made available for this purpose.

At the next stage, each participant of the experiment was required to execute a shopping scenario based on the received description of the requirements, related i.a. to:

- the shopping scenario description;
- the definition of a user project (a mountain trip, flat renovation, party organization) required for buying some p;
- the list of products for preparation of the user project (5–10 items);
- the maximum user budget for product shopping;
- the maximum time devoted by the user for buying products;
- categories of shopping scenarios: SPSS, MPSS, SPMS, MPMS.

Each of the customers, in order to choose products for their project, used i.a. a global catalogue of online shops, basic services provided by the creators of solutions such as Magento or Prestashop, as well as additional Smart Services. We considered two basic services: Available products and their rankings; Monitoring client behaviors, and three smart services: Understanding customer plans and shopping needs; Coordination of cooperation in eCommerce network; Monitoring shopping scenarios. In addition, they had to execute three shopping scenarios. The customer behavior was monitored by PIWIK (locally running) and Google Analytics (remotely) systems. We concentrated on the analysis of the results and drawing conclusions regarding the usefulness of the proposed service model as regards supporting the purchase process from the point of view of meeting user needs and customer satisfaction.

During the experiment, users executed 340 shopping scenarios that included i.a. using product search services 13,940 times and using services providing information on the selected goods or groups of goods 37,433 times. The average

response time of the services made available was 0.53 seconds. Upon the completion of the experiment, the repository contained 12,873 user evaluations of search services, 9,764 evaluations related to the recommended product and service information, and 8,688 ratings related to the level of customer support offered by the shops. The products, services, shops and search results were evaluated according to a four-level scale: 1 - poor, 2 - acceptable, 3 - good, 4 - excellent. The even number of possible ratings was chosen on purpose in order to prevent the frequent selection of the middle rating in the case of which it is difficult to attribute positive or negative meaning. Two similar experiments were carried out, one concerning the online shop configuration using only Basic Services, and the other using both Basic Services and Smart Services.

The satisfaction with Smart Services offered by the shops was rated at 3.58. In the case of shops offering traditional services to their customers this rating was 2.22. Probably, the satisfaction increased while the shop automatically provided the needed sources of knowledge from e.g., social networks, knowledge bases, etc. The relevance of the recommended information was evaluated as 2.97 on average. With the use of Smart Services, the customer support was extended to include recommendations from external sources of information. In this case, the relevance of the received information was evaluated as 3.84 on average. Offering customer-oriented scenarios allow reducing the number of shops visited by customers while they search for products that satisfy all requirements. The average number of shops visited before running the customer-oriented scenarios was 6 and this number was reduced to only 2 shops after running the smart services models. When the recommendation system was launched, the average session time was reduced to 14 minutes. The conversion rate, i.e. the proportion of sessions ended with a transaction also improved. Prior to launching the recommendation system, it was approximately 10% and, after providing the recommendation system, it ranged from 35% to 60% (47.5% on average) for entities having the offering most suited to the needs of customers and providing all the Smart Services. The average budget utilization rate in the case of individuals using Smart Service support was 89%. This means saving about 11% in comparison with the budget planned by the designer of the requirements. The average time used for ordering decreased to 79% of the time spent while using basic services. Most individuals executing the scenarios chose products faster than anticipated by the designer.

Lastly, the individuals executing shopping scenarios for specific projects used most Smart Services when choosing the first few products (3–5). Subsequent shopping scenarios were executed with minimal support from such services. The shopping scenarios recorded for the same projects indicated high similarity of subsequent selections as regards products chosen and services used.

7. Conclusion

The proposed solution in the form of Smart Services enabled supporting customers in the execution of complex shopping scenarios. Supporting customers

by offering Smart Services made it possible to reduce the time taken to find products meeting customer requirements by almost three times (from 41 minutes to 14 minutes). Enriching the offer of shops with the knowledge provided by external entities resulted in an increase in the number of transactions per started session. This also allowed a reduction in the number of shops that a user had to search to find the right product. The analysis of the customer behavior in the shop network also enabled predicting the demand for products and accelerating the response to inventory shortages.

The service model for the eCommerce solutions described in the article, along with the proposed Smart Service extensions, provides an opportunity to expand customer support by the stage of gathering the knowledge required to initiate a transaction. The service model of an online shop, and supporting shopping scenarios with web services, enable the creation of information hubs that connect information, products and customers in one place. Such an approach provides new development opportunities for eCommerce solutions in the context of appropriate management of information and services provided to potential customers. The presented shopping scenarios can also be described as service models using the BPMN notation [17]. The tools available in the market allow conducting simulations based on such a service scenario. The results of the simulations can be used to determine i.a. the customer behavior in the context of a certain level of service and knowledge support, as well as the impact of the offered range of goods.

The proposed service model, and the use of Smart Services, enable the improvement of the customer service quality in online shops by supporting the executed shopping scenarios with the required knowledge. The observed effects of the proposed change include i.a. shortening of the transaction time and increasing the average conversion rate. Changing the model involves modifying the perception of customers of online shops, and the role of these shops in the global information exchange network. By using Smart Services, online shops can act as nodes linking various information and trade services, thus becoming knowledge-based transactional platforms. It is also important to retain flexibility in designing such shops using the available independently developed basic and Smart Services.

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