

ANALYSIS OF PRODUCT CONFIGURATORS USED IN THE MASS CUSTOMIZATION PRODUCTION

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Abstract: Nowadays, with the very rapid development of Internet possibilities and a large number of product variations on the market, the interest of shoppers is growing for a product that would meet all the required criteria and parameters. In the past, retailers of various types of products used product catalogues and brochures in printed form to present their portfolios. At present, the Internet is the most widely used primary information medium. Works in the way of product configurators are performing via the Internet. These are tailored to the requirements of customers to meet their needs and wishes. Automobile sellers realize that through product configurators, they can engage a potential customer more effectively and customize the resulting product with their production capabilities. Detailed and detailed product configurators are a step towards the keen interest of shoppers and consumers. An overview of product configurators in different types of use and with other manufacturers is not only necessary for customers, but also manufacturers. For customers, the analysis needs to be able to choose a better configuration offer; for manufacturers, the study is necessary for reasons of competitiveness. This article aims to present an analysis of the use of product configurators of automobiles manufactures operating in the Slovak Republic.

1 Introduction

Thanks to advances on the Internet, e-commerce and mass customization, the demand for product configurators is growing. Today, customers ask sellers for many product configurations options [1].

We define a product configurator as a Computer-Aided Manufacturing (CAM) system that produces its output - a product. The product configurator has evolved into an online guide that guides customers exactly after what they are looking for. A configurator platform is a tool used to create custom applications without custom encoding [2,3].

In the case of mass customization of products, the configuration system - configurator takes over an essential part of communication with the customer [4]. The configurator is an application whose task is to tailor the product to each customer according to his requirements [5]. Execution of a massive number of configurations in combination with excellent product variability cannot realize other than with the support of information technologies [6]. Compared to custom production, for cost reasons, the sale of a product cannot be accompanied by expert consultation at the same level. For this reason, there is a strong trend towards a full application of configuration systems, which using a web browser will help the customer to assemble the desired product interactively [7,8]. The

customer usually works with the configurator in several phases of the sales cycle. In the first phase, it uses the configurator to get acquainted with the product. If the product addresses him, the customer applies the purchase configurator in the second phase. The configurator performs some tasks, such as monitoring the status of order equipment, re-ordering based on reconfiguration, providing support, service and other additional services [9,10].

The configurator should be integrated into the manufacturer information system focused on building a relationship with the customer. The information obtained from contact with the customer should not be forgotten; it should be preserved and reused for further communication with the customer. Current configuration systems often suffer from serious shortcomings that can cause the customer to feel confused, insecure, frustrated, and ultimately discouraged from purchasing [11].

We define the configurator as software with the analytical capabilities to create, maintain and use electronic product models that allow a complete definition of all possible product variants with a minimum of data entry operations and a minimum of services required by system maintenance [9].

The configuration system consists of two primary components, a database and configuration logic. The

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database contains all optional parts of the product. The configuration logic determines which options can be combined [1].

The configuration system can be divided into primary and advanced according to the function. The main thing is that it must allow you to build a configuration. Logically follows the requirement for the validity of the created configuration, i.e. the configurator should include means for verifying component compatibility, for finding and resolving conflicts. The configuration system should provide the customer with at least necessary information about the individual selected components. The customer should be able to deliver the created assembly to the manufacturer [10]. The expanding functions of the configuration system include the assistance of the configurator based on the knowledge database, i.e. specific recommendations and further guidance of the customer through the process of creating the report. This group of functions also includes access to previously created configurations of our own as well as other customers, which provide inspiration based on collective know-how. The configuration system can also be connected to a live operator who can answer complicated atypical questions [11,12].

If the configuration system performs both basic and advanced functions well, it grows from a pure technical means for the one-time recording of components into a comprehensive communication tool for effective, high-quality and long-term contact with the customer [9].

1.1 Product configurator

Building a configuration is often a time-consuming activity in which the customer has to make many decisions. Some decisions can be made immediately, some need to be thought about longer, especially in the case of expensive products such as cars. For some arrangements, the customer needs brief information; for others, he needs very detailed information. Assembling the product can take several minutes, but it can also take hours and, including the customer's decision time, several days [6].

In the case of typically oral communication, this means that the customer comes to the store, the salesperson's employee compiles the configuration with him. If the seller does not have some information available, he will pass it on to the customer later. If the customer cannot make an immediate decision, he must visit the store several times. This process is lengthy and costs a lot of time for both the customer and the seller [8,13].

Internet configurators are a means of avoiding inefficient communication. The customer assembles the product as soon as time allows, he has the whole day available. Directly from the configurator, it can continuously obtain information at precisely the level it requires and gradually assemble the final product until it is delighted with the final product [4,10].

In the case of a fully integrated configuration system, it can start the execution of the production cycle at the

moment of sending the order, again regardless of whether it is a standard time of sale or not. It saves on sales costs, and shorter order fulfilment times can be achieved [5,13]. The configuration system fulfils only its primary function, i.e. the possibility to assemble a right product from mandatory and optional components. But it can perform a number of other services and become a valuable marketing tool. Ideally, the customer does not need to contact a live seller, and therefore the company only obtains information about the customer through the configuration system [11]. The configuration system can store customer information and use it when repurchasing. If it offers functions that the customer will appreciate even after the completion of the transaction, he continues to visit the configurator, and this opens up the possibility of marketing for the customer. Long-term contact with the company and its configuration system increases customer loyalty and the likelihood of repurchase. A poorly developed configuration system can easily lead to a customer disincentive to purchase [8,9]. In the best case, it leads to a reduction in customer satisfaction during the purchase or to the selection of a product that does not meet its physical needs [11,14,15]. This will be reflected in a decrease in customer loyalty, its transfer to competition and a decline in sales and subsequent profits. Meeting all the requirements for configuration systems is not easy, and most existing configurators fall far short of them [16]. In practice, it is relatively common for the configurator to be at such a level that it directly discourages customers from purchasing. A common reason is a misconception with which the configurator is created, or an attempt to minimize costs [17]. This situation is sometimes exacerbated by the lack of standards, general advice and theoretical support. Properly designed and constructed configuration systems are, therefore, among the key factors in the success of implementing a mass customization strategy [14,18].

2 Methodology

The best known and most used product configurators include automobile configurators. Configurators for automobiles replaced various catalogues and brochures in paper form, which offered different graphical representations of elements and properties of automobiles.

The automobile configuration starts by selecting the type of automobile offered by the manufacturer. The choice of type defines its primary function and use. Subsequently, the configuration is usually divided into fundamental and individual steps in which the various characteristics of the automobile change. The different levels are related to the choice of automobile type. Necessary steps of automobile configuration:

- Step 1 - engine and transmission selection,
- Step 2 - a selection of equipment level,
- Step 3 - choosing the colour of the interior and exterior,
- Step 4 - a selection of additional and additional equipment,
- Step 5 - representation of the final product and breakdown selected elements.

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The configuration of automobile is also offered by automobile manufacturers whose production plants are located on the territory of the Slovak Republic and which have been the subject of research. Automobile manufacturers producing in Slovakia are Volkswagen Slovakia, KIA Motors Slovakia and PSA Peugeot Citroën Slovakia. The configurators of these cars are different. They offer a variety of options for motorization, equipment levels, optional equipment and post-configuration services. The possibilities of graphical display and the speed of its response are also different.

3 Result and discussion

The Volkswagen automobile configurator consists of six individual steps such as Model, Fuel, Variant, Design, Equipment and My Automobile. The first step "The model" consists of choosing the type of automobile from the Volkswagen offer, for example, the Golf Variant. Second step "Fuel" offers a choice of fuel type, transmission and drive. The third step "Variant" provides a selection of equipment levels. Fourth step "The design" provides a range of changing paintwork, wheels and seat covers. Step Five "The equipment" offers a choice of special equipment packages. Sixth and final step "My automobile" displays the ultimate configured automobile and a summary of the individual steps with a detailed listing of the selected equipment and its prices. The configurator offers a graphical display of the final automobile from several exterior and interior views, even in 360-degree rotation. The sixth step also offers additional steps, which are added such as saving the configuration to a profile, printing the shape in pdf, loading the configuration from the pattern, sharing the configuration on Facebook, contacting the seller and arranging a test drive.

The Kia automobile configurator consists of six individual steps such as Model Selection, Version, Colour, Wheels, Equipment and Summary. The first step "Model selection" includes selecting an automobile type from Kia's range, such as the Cee'd Sportswagon. The second step of the version offers a choice of level of equipment and motorization. The third step, "Colours", provides the option of changing the colour of the body. The fourth step, "Wheels", provides the possibility of changing the size and colour of the wheels. Step 5 "The equipment" offers a choice of equipment details, optional interior and exterior material. Sixth and final step "The summary" provides the possibility to print the configuration, save the configuration and buy the vehicle in the selected configuration. The right side of the configurator displays a review of the automobile with the final price, in which it is possible to "click" the details of the selected vehicle elements. The sixth step offers the additional step "Test drive", the possibility of arranging a test drive of the automobile and the option of "Login", for login and review of the configuration.

The Peugeot automobile configurator consists of six individual steps such as Select Version, Select Engine, Select Colour, Select Interior, Select Optional Equipment and Summary. Before starting the configuration, you have to first select a model from the Peugeot range, for example, 308 SW. Only after choosing the Peugeot vehicle model is it possible to create a configuration. The first step, "Select version", consists of selecting the equipment level. The equipment has a choice of Access, Active, Style, Allure and GT. After choosing an equipment such as Style, the configurator displays the critical material and different elements from the lower material. Click on Show key equipment to view all equipment elements Comfort, Design, Safety, Audio and on-board systems. From the first step, the configurator offers a graphical display of the automobile in the selected exterior and interior equipment in several views with the possibility of zooming in. From the first step, a summary of the configuration and the current final price of the automobile are displayed on the right side of the configurator, with the option of displaying details and technical parameters. The Second step is to select engine menu to select the choice of the engine according to the type of fuel. The third step, Choose the colour, offers the option of changing the body colour. The fourth step, "Choose interior", provides the option of changing the colour of the seat fabric and choosing additional equipment, like an audio and on-board systems such as CD player, a navigation system, navigation system + CD player. Fifth step Select option offers the option to select safety features such as reversing camera, front and rear parking assist, alarm, super lock, front and rear parking assist. Sixth and final step "The summary" provides information on the selected engine, exterior elements, interior and optional equipment with the possibility to change the specified details. The configurator offers the configuration Save as Pdf., Save, Print, Send to a friend. In the last step, the configurator creates a graphical display of the final configuration in the form of a video presentation.

Citroën automobile configurator starts by selecting an automobile model from the Citroën range, such as the C4 Picasso. The configurator consists of three individual steps such as Technique, Style and Optional Equipment. On the left side of the configurator, the current price of the vehicle is displayed from the beginning of the configuration, at which it is possible to save, open the previous setting or change the automobile model. The first step "The technique" consists of selecting the level of equipment and motorization. The equipment offers Live, Feel and Shine equipment. Engines are divided according to the type of fuel into gasoline and diesel with appropriate transmissions, either manual or automatic. The second step of the Style offers a choice of changing the colour of the car, upholstery and wheels. Third and final step "Optional equipment" provides a selection of optional equipment elements that the selected equipment level does not contain, such as LED taillights, a panoramic roof glass, xenon headlights, a keyless system and much more.

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Throughout the configuration, the configurator offers the Show my Citroën option after selecting the required elements, providing Automobile Summary, Equipment and technical characteristics and a graphical display in several different exteriors and interior views.

Every year the use of product configurators increases, therefore the sellers offer the possibility to customize - to adapt the product to their requirements. Most vendors have individually created configurators, which differ in technical perfection and functions provided, which makes them diverse. The configuration options adapt to the possibilities of mass and automated production in the company. Configurators help users to get acquainted with the range of product features through a graphical display, to adapt the product to their ideas and to facilitate shopping.

In summary, it displays the base price of the automobile, the final cost of the configured vehicle, and the amount of each configuration step. The configurator offers the option to set save and download in Pdf format, or to book a test drive, receive an offer and receive a catalogue. When the Equipment and technical characteristics are displayed, it displays the individual equipment elements and the technical parameters of the engine.

The selected configurators used by our research of the Volkswagen, Kia, Peugeot and Citroën automobiles are different and differ in the configuration options on offer (Table 1). The configurators in the individual configuration steps offer various options for filtering, comparing, searching, selecting, displaying and the like. The configurator with several configuration options offers the potential customer easier to configure, more thoroughly display and adapt the car to his ideas and requirements. The table shows the offered summary of different options of all manufacturers, including and not containing the possibilities of the individual manufacturers being compared.

We consider the configurator, which provides the most significant sum of lively options, to be more thorough and sophisticated. According to the number of positive values, we can rank the configurators from best to worst

(Figure 1). We consider the configurator of the Volkswagen automobile maker to be the best configurator, the configurator of the Peugeot automobile maker is in the second place, the configurator of the Citroën carmaker in the third place and the configurator of the Kia automobilemaker as the worst and least sophisticated configurator.

Table 1 Comparison of product configurators individual automobile

Options	Producer			
Fuel Filtration, gearbox, drive	✓	✗	✗	✗
Unlimited choice of motorization according to equipment level	✓	✗	✓	✓
Comparison of motorizations	✗	✗	✓	✓
Choice of more than one petrol engine	✓	✓	✓	✗
Time-saving equipment	✓	✗	✗	✗
Comparison of equipment levels	✓	✗	✓	✗
Search for optional equipment elements	✓	✗	✗	✗
Choice of more than three trim levels	✓	✓	✓	✗
View the current price and selected elements during all steps	✗	✓	✓	✓
Choice of more than two alloy wheels	✓	✗	✗	✓
Selection of additional exterior elements (ski carrier, bicycles)	✗	✓	✗	✗
View more than two interior views	✓	✗	✓	✓
View more than two exterior views	✓	✗	✓	✓
360 ° rotation of the interior	✓	✗	✓	✓
Display of 360 ° rotation of the exterior	✓	✗	✓	✓
Display a video presentation of the final configuration	✗	✗	✓	✗
SUM OF POSITIVE OPTIONS:	12	4	11	8

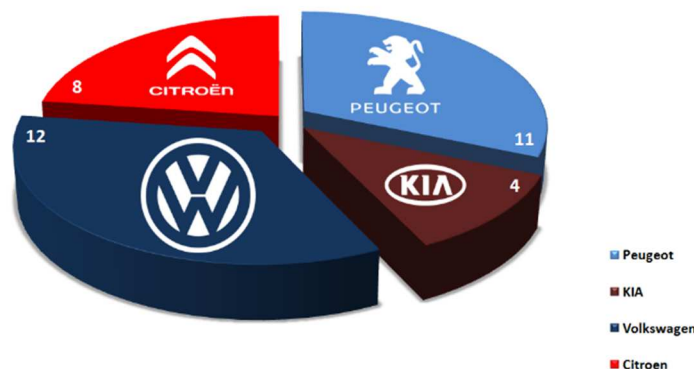


Figure 1 Evaluation of product configurators

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Volkswagen's configurator is the only one to offer fuel, transmission and drive filtration, time-saving equipment and search for optional equipment elements. With the best configurator, we lack the option of choosing additional exterior parts, such as a carrier for skis, snowboards and bicycles.

The Peugeot configurator is the only one to offer the possibility of displaying a video presentation of the final configuration. With the second-best configurator, we lack the opportunity of time-saving equipment.

The Citroën configurator does not offer any specific option. With this configurator, we lack the option of choosing from several petrol engines for given selected equipment.

The Kia configurator is the only one to offer a choice of additional exterior elements such as a ski, snowboard and bicycle carrier. With the worst configurator, we lack several options for displaying the interior and exterior.

After the results, the configurator must observe the following features:

- Simplicity- because compiling a configuration is complicated, it must seem like a simple matter.
- Intelligibility- the information must be provided in a language understandable to the customer.
- Clarity- there must be an easy orientation for the customer at every step and moment, he must know the next configuration step.
- Adequacy of images and information- the customer should see precisely the pictures, views and information he needs in the configurator. If he does not see them, he is frustrated, cannot decide and feels insufficiently informed. If the configurator is full of information, it takes the customer time.
- The logical layout- the layout must be easy to understand, and the individual configuration options should follow each other logically and be grouped into thematic units.
- Standard control- the customer will appreciate more standard than intuitive operation.
- Presentation style- it is necessary to use the appropriate element layout, the number of fonts used, and colour scheme.

4 Conclusions

Product configurators are indeed a fascinating form of implementing mass customization into production and adapting the product to customer requirements. With the growing progress on the Internet, online stores and mass customization, the demand of customers for the possibility of changing the product to their needs, after tailoring the product, is growing. The main goal of this article was to analyse and compare product configurators. In the analysis of configurators, we characterized and compared the configurators of automobiles whose production plants are

located in the Slovak Republic - Volkswagen, Kia, Peugeot and Citroën. In the final evaluation, we took into account the offered, comprehensive, different options of configurators. According to the summary configuration options, we created a detailed report in the form of a table in which we compared the configurator options and assigned to them containing and not containing configuration options. Based on the sum of the positive possibilities, we then ranked the configurators from best to worst and described their specific and missing opportunities. Using a comparison of configurators, we came to the conclusion that the examined configurators can be continuously improved and innovated based on competitors' configurators.

The future direction of our next research will be focused primarily on the customer. Because customer often lacks basic knowledge and the experience required to build a configuration that optimally meets his needs. The product configurator has therefore provided the necessary and available information for decision in text or graphical form. Configurators are most often based on communication with one user and often forget about a person's social behaviour. The simplest way to alleviate this is to save the configuration, recall it, and modify it.

Manual configuration requires a lot of time and effort from the customer, especially if the product is complex. The task of the product configurator is to save time and effort of the customer. In particular, we can that verify the validity of the configuration, automatically generating clear choices and displaying only possible product combinations.

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