User Interface Expert for Configurators

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Abstract

A user interface (UI) expert for configurators is a specialist who focuses on designing and optimizing the interfaces of configurator systems. Configurators are tools that allow users to customize or personalize products or services according to their specific preferences and requirements. The role of a UI expert in enabling users to perform such customization processes is therefore crucial in today's digital landscape. As technology continues to advance and user expectations grow, user interfaces become an essential component of any product or service, with regard to the product/service itself or in its selling. A UI expert provides specialized knowledge and skills to create intuitive and user-friendly interfaces that enhance the overall user experience. Therefore, companies that want to implement or already use configurators benefit from understanding and applying the specific competencies of UI experts for configurators. The present paper sheds light on the tasks, individual competencies, and training requirements of the UI expert for configurators in an industrial context. In addition, the profile is also compared with European standard descriptors.

Keywords

Mass customization, configuration, configurator, user interface expert, professional profile, individual competencies

1. Introduction

Configurators can be observed as an interface between companies and their customers. They allow the customization or personalization of products or services according to the customers' specific preferences and requirements. The user interface (UI) plays a critical role in this context, because, as pointed out in Carroll [1]: "The interface connects the technical system and the user, and it therefore has a potentially big impact on the success and failure of the *human-machine system* as a whole" [1: p. 55]. Well-designed UIs are of specific importance in product configurators [2], as they are increasingly used by companies to initially consult clients to save scarce human resources. Challenges related to bad UIs are frequently reported [e.g. 3, 4]. For example, an un-user-friendly interface is the most cited cause of difficulties in using product configurators in the survey of Zhang and Helo [3] and lack of usability is among the worst defects of online configurators in the survey of Leclercq et al. [4]. Therefore, the role of an expert responsible for the UI of configurators has become essential in recent years because of the spread of configurators guiding customers and supporting company personnel through the customization process (besides desktop environments also on mobile devices, digital kiosk systems, etc.), in the product/service itself or in its selling. A central task of UI experts is to bridge the gap between technology and users [5]. They understand the needs, behaviors, and preferences of the target audience and translate them into design decisions. This goes beyond the characteristics of the interface alone and covers all relevant aspects of user experience (UX) [6]. By, for example, conducting user research, applying user-centered design processes (UCD), and related methods (e.g. prototyping, usability testing) [7], UI experts ensure that the interface meets the users' requirements and expectations and fits in the context of use. UI experts bring specialized knowledge and skills to create intuitive and easy-to-use interfaces, for example, by making it easier for users to navigate and interact with the system on different digital platforms (desktop, web, mobile). By taking into account related standards, guidelines, and interaction patterns it is possible to flatten the learning curve, improve efficiency, and minimize errors, all of them resulting in increased user satisfaction. A positive UX leads to greater user engagement, customer loyalty, and ultimately business growth [8, 9].

User interface experts for configurators pay specific attention to the mechanisms of configuration, for instance, the complexities involved in configuring products and translate that understanding into an interface that supports the specific needs of customers in this context (e.g. enhanced navigation aids in the form of wizards, corresponding overview / detail

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visualizations, etc.). The professional portfolio of the UI expert involves layout definition activities, graphic and dialog design, and customization activities in product configuration systems [10]. In addition, it includes the evaluation of user interaction and experience and derives suggestions for improvements. Thus, the UI expert for configurators analyzes all important aspects of human-machine interaction, as well as the users' perceptions of system characteristics, covered in the specifications of usability engineering [11] and UX [12]. Besides the skills related to the characteristics of the UI and interaction, the UI expert for configurators possesses the appropriate soft skills to work in an interdisciplinary team and to communicate with users, involve them in development processes, understand and satisfy their different requirements and needs. In addition to knowledge and skills in ICT, they must understand human aspects that can influence interaction with a configuration system.

Unfortunately, notwithstanding the importance of the UI expert for configurators and their peculiarities in terms of knowledge and skills required, there is no discussion undergoing in the configurator community about this professional profile and how it could be developed in different organizational contexts and through training curricula. The Configuration Workshop is an appropriate place to start a joint academic and practitioner discourse on this professional figure. This is because this is a discussion place where the discussion on UIs for configurator has been on the table for several years [e.g. 6, 13, 14, 15]. This discussion should spread to other places where the characteristics and importance of the UI for configurators has been discussed [e.g. 2, 15, 16-18].

The objective of this paper is to start a scientific discussion on the professional profile of an UI expert for configurators in an industrial context. This paper provides a description of the activities and individual competencies that refer to this professional figure, as well as the contents of an educational concept and training activities required to develop such a professional figure.

The idea presented is based on the personal experiences of the authors in consulting and training, as well as on the experiences of third parties and the information collected by the authors over more than 20 years of activity with configurators in Austria and Italy. This knowledge has been integrated with academic literature and with the descriptions of professional figures taken from recognized frameworks. The results have been discussed in-depth with seven companies (mostly with entrepreneurs), one training and transfer center, and one industrial association of small and medium-sized enterprises (SMEs).

2. Theoretical background

In today's digitalized world, user interfaces play a critical role as they play an essential role in building a bridge between technology and users [5]. The role of UI experts is to ensure that these interfaces meet user requirements and expectations, thus improving aspects of usability, such as making it easier for users to navigate and interact with the system [5, 19]. In particular, UI experts play a vital role in creating interfaces that help users solve complex tasks, such as in the context of configurable products. The central challenge in this regard is to create interfaces that are aesthetically pleasing despite the complexity of the basic tasks they support. According to related models [cf. e.g. 20], UI experts therefore have to have a deep understanding of general interface design principles and specific requirements of different platforms (e.g. desktop, mobile) as well as of psychological aspects related to, for example, color theory, typography, and visual hierarchy. They carefully design layouts, evaluate alignments, spacing, and the selection of visual elements to create an optimal UX based on an interface that is visually appealing and consistent with a corporate's visual and overall identity. A visually pleasing interface can evoke positive emotions, establish trust, and enhance the overall perception of the product or service. To achieve these results, the UI expert has to collaborate intensively with different departments and employees of a company, but specifically with the other members of the development team, such as UX experts, developers, and product managers. The team cooperatively ensures that the UI design is aligned with overall UX requirements, the company-specific strategy, and technical feasibility. The knowledge of UI experts in usability and interaction design helps make informed decisions on different levels, for example, regarding the placement of elements or the utilization of interaction patterns such as responsive design across different devices and platforms.

To be able to assume the described role, the UI expert for configurators typically has a background as a professional interface designer who specializes in configurator environments, responsible for creating UIs of software systems using front-end prototyping tools or integrated development environments (IDEs).

Product configurators represent a special category of human-computer systems and therefore require a deeper understanding and knowledge beyond standard UI development knowledge. Configurators are software applications that not only provide the selection of existing standard products but also support the customization of services and products and the creation of new product variants. Application areas are, for example, sales configuration processes and/or technical configuration processes [e.g. 21, 22]. In the case of sales configuration, product configurators assist a potential customer or a salesperson who interacts with the customer to fully and correctly specify a product solution among all possible solutions offered by the company. In the case of technical configuration, product configurators support the creation of a technical documentation that a company uses to create a desired customer solution.

The market offers a significant number of software packages that allow companies to create their own sales and technical configuration solutions. Alternatively, a company can create its own product configurator from scratch. In either case, the design of UIs that enable interaction between human users and an ICT system in the background is crucial. In contrast to other types of UI, configurators usually consist of a more complex interface architecture because there is a

need to support different actors in different parts of a configuration process. Potential users of these interfaces can be, for example, product specialists, sales professionals, knowledge engineers, designers, installers, system administrators, or end customers.

User interfaces of sales configurators supporting these different types of user, therefore, play a specific role in this context, specifically in the direction of end customers [4]. In contrast to the interfaces addressing experts, end-user interfaces should adequately convey the configuration possibilities without overwhelming the customer, thus significantly influencing the customer's perceived benefits when configuring customized products. The related literature identifies five configurator interface capabilities that are extremely important in improving the customers' perceived benefits of customized products and customization experiences [23-27]: (1) *focused navigation* (to quickly focus a potential customer's search on the solutions in the product space of a company that are most relevant to the customer); (2) *flexible navigation* (to enable users to easily and quickly modify a product configuration they have previously created or are currently creating); (3) *benefit-cost communication* (to effectively communicate the consequences of configuration decisions made by a potential customer in terms of advantages and disadvantages); (4) *user-friendly product space description* (to adapt a company's product space description to the individual characteristics of a potential customer and the situational characteristics of his or her use of the sales configurator); (5) *easy comparison* (to help users compare previously created product configurations).

These sales configurator capabilities increase the benefits perceived by customers when they configure customized products using the sales configurator (benefits of *utilitarian*, *uniqueness*, *self-expressiveness*, *hedonic*, and *creative-achievement*) [24, 26]. Since these capabilities, at least some of them, have a synergistic effect on the benefits perceived by the customer [23], it is important to balance them in the design of a configurator UI.

More recently, customers' need for social interaction during configuration activity has also been recognized as an important aspect to consider when designing a sales configurator [28]. This additionally supports the need of a broad range of related skills emphasized before, which an UI expert for configurators has to have. In addition to technical computer knowledge about software programming, e-commerce, websites, and other applications and tools that interact with the configurator (e.g. social media, chatbots, artificial intelligence-related applications, 3D graphics), this expert must have know-how in marketing, sales, human factors, social and psychological aspects that may influence the effectiveness of the product configurator.

Another peculiar characteristic of configurator UIs is that there are many different solutions for creating configurators' UIs [e.g. 29, 30], therefore, is difficult to identify guidelines [29, 31] and effective unique standards for creating such UIs [29, 32, 33]. Moreover, configurator UIs can change rapidly even from year to year [30]. All these characteristics require to be able to identify the most effective UI design for a particular configuration context and to be ready to continuous redesign and updating of the UI.

In summary, the UI expert for configurators must be able to interact with, understand, and satisfy different types of stakeholders in a development process, specifically users with different requirements, backgrounds, and expectations [4, 34-36].

3. Method

The main objective of this work is to gather and disseminate information on the topic mainly to players in the industrial sector, such as SMEs, who do not have the resources and possibilities to access academic literature and other sources of related information. In comparison to the academic field or large enterprises which have in-company resources to deal with the problem, the presented approach addresses the dearth of prior research focusing on the role of UI expert for product configurators in specific industrial contexts. The empirical knowledge of this attempt is mainly based on the personal knowledge of the authors of this paper, complemented by a theoretical foundation based on the related academic literature.

The authors have between 15 and 24 years of experience in the fields of studying and/or guiding the implementation of configuration systems, collaborating and exchanging experiences with configurator experts, training individuals to design and implement configuration systems, and evaluating and guiding businesses in the eventual implementation of mass customization mechanisms using configuration systems. Additionally, they have researched the effects of online sales configurator capabilities on users' perceived benefits in using those configurators. The authors together developed deep insights into all of the pertinent problems in this area, thanks to the collection of expertise of executors, managers, consultants, trainers, and researchers on these themes. They worked with practitioners mainly in Italy and Austria, although they had multiple occasions to interact across several European countries. They have also conducted research on organizational design and individual competencies for mass customization that helped in identifying relevant activities of the role and the related individual competencies.

The original proposal for UI experts for configurators activities, their individual competencies, and proposed training activities was created jointly by two authors. Subsequently, this proposal underwent a number of revisions where each of the three authors suggested integration or changes. To be able to see the proposal with fresh eyes, we completed three distinct cycles of changes, spaced widely apart from each other. Two specialists, one working for a training and transfer center and the other for an SMEs association, have since conducted final checks.

Essential individual competencies were determined considering the processes and related activities and returning to the authors' experiences on that topic. Individual competencies were grouped into (i) knowledge, (ii) skills, and (iii) transversal skills and competences. These categories are aligned to European reference frameworks, such as ESCO

(European Skills, Competences, Qualifications and Occupations), where they have the same meaning as in the present paper. In this paper, the term knowledge - "is composed of the facts and figures, concepts, ideas and theories which are already established and support the understanding of a certain area or subject" [37: p. 7] and the skills "are defined as the ability and capacity to carry out processes and use the existing knowledge to achieve results" [37: p. 7]. Transversal skills and competences (TSCs) are understood as "learned and proven abilities which are commonly seen as necessary or valuable for effective action in virtually any kind of work, learning or life activity. They are considered/labelled 'transversal' because they are not exclusively related to any particular context (job, occupation, academic discipline, civic or community engagement, occupational sector, group of occupational sectors, etc.)" [38: p. 5].

The reason for choosing this approach is to allow starting a discussion not only among academics but also with training centers and practitioners. This categorization has been utilized to preserve a language widely used in the organizations where we operate while still preserving comparability to past research and international and European classifications. Finally, standard descriptors were used to characterize the figure of the UI expert for configurators. The use of standard descriptors aims to make it easier to recognize competencies across different regions and systems.

To strengthen the validity of our findings, the profile was tested with top managers and entrepreneurs of SMEs. Five of these assessments were supervised by non-academics working for an SME association, and two were guided by one of the authors. These validity checks allowed external control by informed persons who were not affiliated with the authors. The evaluations sought to determine whether the professional figure's description was understandable and meaningful, whether this figure is useful in companies that have to develop configurators and respective UIs, and whether the proposed training paths are relevant and flexible enough to adapt to different contexts.

4. Activities of the UI expert for configurators

The main activities of the UI expert for configurators can be grouped into four parts with the following focal points; (a) understanding of user needs, (b) development of information architecture, (c) development of wireframes and prototypes, and (d) detailed visual interface design.

Understanding of user needs covers the understanding of the user requirements and needs (applying user research and workflow analysis) in order to ensure usability and overall UX.

Development of information architecture deals with the organization of information in an understandable way, translating the requirements into a structure, for example, on the basis of style guides, design systems, design patterns, and attractive UI elements.

Development of wireframes and prototypes involves the initial development, the testing, and iterative further development and refinement of wireframes and prototypes.

Visual interface design consists of four subsets of activities. The first one is UI development planning covering the content to be conveyed, utilized controls, visual design aspects, branding, appropriate navigation aids, benefit-cost communication, user-friendly description of the product space, and the support of easy comparison. The second subset covers the proper application of visual principles: aesthetics in UI, gestalt principles (similarity, proximity, etc.), grouping and organization, hierarchy. The third one deals with the identification of design problems, taking into account the characteristics and presentation of the product from a business, technical, production, or management perspective, as well as the configurator's interdependencies with other business processes and systems, business requirements, and the development of workable solutions. The fourth subset involves stakeholders in the presentation of content and design solutions for configurators and incorporates their feedback into the new design.

5. Individual competencies of the UI expert for configurators

To help the reader to understand which specific individual competencies are needed, the presentation of these competencies of the UI expert for configurators is exposed by the fundamental activities. For each activity, we should have reported the transversal skills and competences too; however, since these skills and competences tend to be common across multiple activities, we reported them separately in Subsection 5.5.

5.1. Understanding user needs to improve usability and overall UX

Understanding user needs to improve usability and overall UX requires the ability to refer to user research from different disciplines and the ability to conduct empirical evaluations on requirements and actual ICT use. Specific knowledge and skills are needed to perform this task well.

Knowledge. The required knowledge includes: (a) interdisciplinary Design Sciences Research perspectives; (b) UX research methods, such as: usability tests; interviews; card sorting (for categorization and hierarchy); eye-tracking and click tests; multivariate and A/B testing; desirability studies; expert/heuristic reviews; surveys; diary studies (recording behaviors or thoughts); personas; participatory design workshops, focus groups, social media listening, interviews; (c) customer research on, for example, benefits, needs and requirements in the sales configuration process; (d) specific requirements of product configurator users (company-internal / external).

Skills. The required skills include: (a) designing a User Centered Design Process (UCD), for example, involving the activities of designing, planning, and conducting UX and usability studies; (b) defining and planning of accompanying activities of empirical social research, such as communication activities; (c) involvement of different stakeholders (company representatives, industrial partners, funding organizations, public authorities); (d) integrating end customers on the basis of an UCD-process, e.g. for requirements and needs elicitation or as participants of usability studies; (e) analyzing the results of usability studies and proposing findings; (f) communicating methodological approaches and results through engaging presentations; (g) initially developing and refining design solutions (wireframes / paper prototypes) based on research activities.

5.2. Information architecture

Information architecture requires one to allocate the contents and procedures of the configurator and organize them according patterns of hierarchy or taxonomy, defining the basic concepts for navigating the website.

Knowledge. The required knowledge includes: (a) organizational schemes and structures; (c) labeling systems; (d) navigation systems; (e) search systems; (f) platform capabilities and specifics (e.g. mobile [iOs, Android], desktop [Windows, MacOs, Linux]).

Skills. The required skills include: (a) analyze the configuration process and its dependencies on other business processes and systems; (b) organize content into taxonomies and hierarchies of information based on content strategy; (c) communicate conceptual overviews and overall website organization to the design team and clients; (d) research and design the fundamental concepts of website navigation; (e) define standards and specifications for the handling of semantic HTML markup, as well as for the format and handling of textual content; and (f) design and implementation of search optimization standards and strategies.

5.3. Development of wireframes and prototypes

Development of wireframes and prototypes requires developing, testing, and iterating to refine the wireframe.

Knowledge. The required knowledge includes: (a) characteristics and representation of the product from: a commercial point of view, a technical point of view, the production point of view, the management control's point of view; and (b) characteristics and representation of the production process.

Skills. The required skills include: (a) translating concepts into wireframes; (b) defining technical requirements; (c) developing creative ideas; (d) drawing design sketches; (e) translate requirements into a visual design; (f) create storyboards to generate ideas for solutions to user requirements; (g) propose and outline a set of visual concepts both on paper and using prototyping software applications (e.g. Figma, Adobe XD); (h) create wireframes on paper and in digital format; (i) create paper prototypes to develop interactive designs; (j) design low- and high-fidelity prototypes; (k)design sketches of user flows.

5.4. Visual interface design

Visual interface design requires the development of the UI, the proper application of visual principles, the identification of design problems, and the participation of stakeholders in the presentation and incorporation of their feedback.

Knowledge. The required knowledge includes: (a) competitor solutions (standards) for the configuration process; (b) customer benefits, needs, and requirements for the sales configuration process; (c) user requirements for the product configurator; (d) internal and external user requirements for a configuration system; (e) configurator software programming; (f) web programming; (g) application usability; (h) graphic design editing software; (i) human-computer interaction foundations; (j) software UI design patterns; (k) software interaction design.

Skills. The required skills include: (a) work on cross-platform applications to develop UXs for mobile phones, tablets, and computers; (b) collaborate with other designers, product design and development teams, business analysts, engineers, and project managers; (c) collaborate regularly with clients to ensure that projects meet their requirements and key business objectives; (d) attend meetings to discuss and review project progress.

5.5. Transversal skills and competences

An UI expert for configurators also needs the following transversal skills and competences, which are not exclusively related to any particular activity but are useful in multiple areas of his or her work: customer orientation; problem solving; teamwork: working in a results-oriented group; attention to order and quality.

6. Description of the profile and reference areas with standard descriptors

Competences, knowledge, and skills related to the profile of the UI expert for configurators are found, organized by category, in ESCO (European Skills, Competences, Qualifications and Occupations) [39], the multilingual European classification of skills, competences and occupations. ESCO functions as a dictionary, describing, identifying, and classifying occupations and occupational skills relevant to the EU labor market, education, and training.

Standard descriptors that are most close to this new profile are identified in Table 1 in the Appendix. Table 1, reports the correspondence between the ESCO profiles, the NUP ISTAT profiles [40] and the areas of activities (ADA) of the "Atlante del Lavoro" (atlas of labor) [41] associated with these ISTAT profiles,

emphasizing the relationship with the UI expert for configurators. For the sake of completeness and precision, Table 1 contains hyperlinks to the ESCO standard terms used and the web pages where these terms are defined.

6.1. Description using ESCO profiles

The three ESCO profiles closest to the UI expert for configurators are the UI designer, the UI developer, and the UX analyst. The descriptions of these three profiles are given below.

User interface designer. Code: 2513.3. Description: User interface designers are in charge of designing user interfaces for applications and systems. They perform layout, graphics and dialogues design activities as well as adaptation activities.

User interface developer. Code: 2512.5. Description: User interface developers implement, code, document and maintain the interface of a software system by using front-end development technologies.

User experience analyst. Code: 2511.19. Description: User experience analysts assess client interaction and experience and analyze users' behaviors, attitudes, and emotions about the usage of a particular product, system or service. They make proposals for the improvement of the interface and usability of products, systems or services. In doing so, they take into consideration the practical, experiential, affective, meaningful and valuable aspects of human–computer interaction and product ownership, as well as the person's perceptions of system aspects such as utility, ease of use and efficiency, and user experience dynamics.

Other profiles that may have some similarities with the UI expert for configurators, though less than the first three, are the information and communications technology user support technicians, the webmaster, and the product and services manager.

7. Training activities

Training should be tailored depending on whether one or more companies are involved, whether knowledge of mass customization and product configurators is limited or advanced, whether a professional configurator is available or not, whether all possible interfaces are considered or only a subset, etc.

Training should also include learning in which the learner plays an active role, possibly both in evaluating and creating specific product configuration interfaces. This can obviously significantly increase the time required for training. It might be useful, especially for small companies, to analyze configuration websites, evaluate actual UIs, and create UIs.

From the above, a benchmark training course will last between 60 and 120 hours. Note that the minimum duration of the training course may be sufficient for companies that already have UX and UI design skills and need specialization in the specific features of a product configurator. Furthermore, the duration of the accompanying training course may also be significantly longer than the maximum reference duration if the involved persons do not have comprehensive UX and UI design skills.

For the profile of UI expert for configurator, the proposed training includes the following content.

7.1. Mass customization and configurational approach

The training on mass customization and the configurational approach includes: (a) variety, customization, and mass customization strategies; (b) degree of product customization; (c) configurational approach and efficient customization; (d) standard, configurable, and special products.

7.2. Product configuration and its digitization

The training on product configuration and its digitization includes: (a) activities in the product configuration process; (b) relationships between organizational context and configuration activities; (c) digitization and automation of the configuration process.

7.3. Product configuration systems

The training on product configuration systems includes: (a) architecture of configuration systems; (b) degree of automation of the configuration process; (c) IT solutions for the configuration process; (d) product models used in the configuration process; (e) configurators and connection/integration with other enterprise information systems (CRM, PDM / PLM, PIM, MPCS, Social Software, etc.).

7.4. Users of a configuration system and their needs

The training on characteristics of users of a configuration system and their needs includes: (a) perspectives of users and designers (conceptual models), overview of methods to involve users in a development process, such as usability testing, interviews, surveys; (b) different types of research to determine users' characteristics and needs: quantitative and qualitative, behavioral and attitudinal; (c) data analysis and result presentation.

7.5. Visual characteristics of configurator UIs

The visual characteristics of configurator UIs include, for example: aesthetics; gestalt principles; grouping and organization; hierarchy; grid and information density; typography and readability; icons; colors; illustration; presentation of data in configurators.

7.6. Designing the UX

Designing the UX includes analyzing UX aspects that go beyond actual interaction (e.g. platform preference

(iOS, Android), peer group identification, social network, etc.) based on the following activities: (a) evaluating user data; (b) creating personas; (c) working with scenarios and storyboards; (d) creating paper prototypes; (e) implementation planning and support.

7.7. Features and functionalities of configurator UIs

The features and functionalities of the configurator UI include: (a) how the features of sales configurators improve the customer's perceived value in configuring a custom product; (b) how the features of a technical configurator enhance the customer's understanding of technical feasibility (and limitations); (c) how specific desires and requirements that deviate from the standard can have a direct impact on pricing; and (d) how customers themselves can manipulate the price/functionality ratio of the product.

8. Discussion and conclusion

Individual competency research for employees working in mass customization situations is very limited ([42], [43], [44]). Despite the fact that previous work provides examples and considerations for a better understanding of the issue of individual competencies in a customization environment, they do not consider professional figures specifically designed for the mass customization context with the only, very recent, exception of the configuration manager [44]. In particular, previous studies do not consider a professional figure such as the UI expert for configurators, which is crucial when mass customization is realized with the use of configurators. This paper contributes to the effort of investigating individual competencies for mass customization by introducing the UI expert for configurators as a professional figure.

More precisely, we describe the activities in which this expert participates and has to perform in a leading position. We then gave suggestions for the knowledge, soft skills, and technical skills that this expert should possess. We compare the figure with current competency classification systems at the national and European levels, and we utilize these systems' standard descriptors to characterize the UI expert for configurators.

The evaluation of this figure with entrepreneurs, managers, a SMEs association, and a training and transfer center managers showed that all companies engaged in customization revealed a company's need for the listed individual competencies. This is an important empirical result. It shows that the need for these competencies is perceived by the target audience/industry. As a consequence, research on this professional figure would be welcomed by practitioners, since it corresponds to their needs.

Equally interesting is to see what the seven SMEs said when they contrasted our proposal with their specific organization design situation. A company recognized the presence of an employee with the competencies listed above, even though his position was not specified with a name that reminds the UI expert for configurators. Other companies, less advanced in mass customization, thought that this professional figure includes so many competencies that it becomes very difficult to find adequate personnel immediately employable for an SME. However, they recognize the possibility to hire an external person with adequate knowledge and skills to make him/her productive in a reasonable amount of time in an SME environment. Other companies said that because of their small size it was difficult for them to get the required competencies from outside and that they have to develop them internally. Other companies said that they have two or more employees that together have the competencies covered by this figure. A company with a considerable amount of variety but not so high to justify the adoption of a configurator underlined that, in situations similar to theirs, a similar figure is needed, but without the specific knowledge of configurators. Hence, the practical world in the considered SMEs presents a highly differentiated situation with respect to building up of the needed competencies and their distribution across employees.

Therefore, our confrontation with seven SMEs, an industry association of SMEs and a training and transfer center provided a strong message, i.e. the essential need for the listed competencies, although their development and implementation pose a highly complex challenge, a challenge that depends on the context. This result constitutes an extensive opportunity and area for future research, which will be even more important in the future given the trend towards a greater digitalization.

With this paper, we started a conversation about the UI expert for configurators in businesses of various sizes, and we think this issue is relevant both scientifically and practically. To complement this paper, future studies might examine the effects of various training methods in developing certain professional figure competencies. Another research opportunity may be to examine how certain individual competencies improve a company's capability of mass customization or lessen the difficulties associated with configurator development.

Even though the activities and the competencies of the professional figure of the UI expert for configurators have been exposed to external scrutiny of industry experts and entrepreneurs, this scrutiny has to be considered as a preliminary one. More extensive scrutiny is needed to strengthen the results obtained and to link them to different company contexts and company performances. We have seen how the company size availability of human resources may influence the development of such a figure or split its competence across different employees. Further empirical evidence based on case studies as well as on surveys would be beneficial. Finally, lab experiments could be conducted to assess different teaching strategies to build the identified competencies.

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Appendix

Table 1
Placement of the "user interface expert for configurators" among the ESCO profiles, the NUP ISTAT profiles, and areas of activities of the "Atlante del Lavoro"

ESCO Profile[a] (in English, German, Italian)	NUP ISTAT (ISTAT CP2011) profiles [b]	"Aree di Attività" (ADA) from "Atlante del Lavoro" [c] (Relevant activities for the UI expert for configurators)
2513.3 - User interface designer - Multimedia-Designer/Multimedia-Designerin - Progettista di interfacce utente 2512.5 - User interface developer - Entwickler von Benutzeroberflächen/Entwicklerin von Benutzeroberflächen - Sviluppatore di interfacce utente 2511.19 - User experience analyst - User Experience Analyst - Analista della user experience	2.7.1.1.1 - Analisti e progettisti di software 2.7.1.1.2 - Analisti di sistema 2.7.1.1.3 - Analisti e progettisti di applicazioni web	ADA.14.01.01 (ex ADA.16.237.773) - Definizione e implementazione della strategia organizzativa nell'ICT ADA.14.01.02 (ex ADA.16.237.775) - Identificazione e definizione delle proposte per lo sviluppo dei servizi IT ADA.14.01.03 (ex ADA.16.238.776) - Gestione del processo di sviluppo del business in ambito Information Technology ADA.14.01.04 (ex ADA.16.238.777) - Allineamento tra strategie di business e sviluppo tecnologico ADA.14.01.05 (ex ADA.16.238.778) - Ideazione e definizione della specifica soluzione ICT ADA.14.01.06 (ex ADA.16.238.779) - Supporto al cliente per l'innovazione nell'ICT ADA.14.01.12 (ex ADA.16.239.785) - Progettazione e realizzazione di applicativi software multi-tier ADA.14.01.14 (ex ADA.16.239.787) - Progettazione e realizzazione dell'interfaccia utente ADA.14.01.16 (ex ADA.16.239.789) - Deployment, integrazione e verifica della soluzione ICT
3512 - Information and communications technology user support technicians - Techniker für die Anwenderbetreuung in der Informations- und Kommunikationstechnologie - Tecnici per l'assistenza agli utenti della tecnologia dell'informazione e della comunicazione 3514.1 - Webmaster - Webmaster/Webmasterin - Webmaster	3.1.2.2.0 - Tecnici esperti in applicazioni 3.1.2.3.0 - Tecnici web	ADA.14.01.06 (ex ADA.16.238.779) - Supporto al cliente per l'innovazione nell'ICT ADA.14.01.12 (ex ADA.16.239.785) - Progettazione e realizzazione di applicativi software multi-tier ADA.14.01.14 (ex ADA.16.239.787) - Progettazione e realizzazione dell'interfaccia utente ADA.14.01.16 (ex ADA.16.239.789) - Deployment, integrazione e verifica della soluzione ICT
2431.15 - Product and services manager - Produkt- und Dienstleistungsmanager/Produkt- und Dienstleistungsmanagerin - Responsabile beni e servizi	2.5.1.5.2 - Specialisti nella commercializzazione di beni e servizi (escluso il settore ICT) 2.5.1.5.3 - Specialisti nella commercializzazione nel settore delle tecnologie dell'informazione e della comunicazione	ADA.14.01.01 (ex ADA.16.237.773) - Definizione e implementazione della strategia organizzativa nell'ICT

[a] URL: https://esco.ec.europa.eu/en
[b] URL: https://professioni.istat.it/sistemainformativoprofessioni/cp2011/
[c] URL: https://atlantelavoro.inapp.org/atlante_lavoro.php