EPiC Series in Computing

Volume 98, 2024, Pages 169–178

Proceedings of 39th International Conference on Computers and Their Applications

Digital Transformation: A Quality Model as a guide to achieve a digital product focused on people

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Abstract

Thinking about the experience that the user will have when interacting with a software, is beginning to understand that, in the interaction process, different factors influence: individual, social, cultural, contextual and those specific to the product in question. Artificial intelligence and process automation, among other technologies, are implemented in companies to increase productivity and improve the experience of customers and suppliers. But how do they impact companies? And how can they improve the user experience? Consumers are more likely to purchase brands that they recognize, remember and provide relevant and personalized offers. Personalized experiences can increase conversion rates by 300% and, precisely, Artificial Intelligence (AI) comes to collaborate to achieve this. In this sense, the objective of this proposal is to provide software development companies with a quality model with a people-centered approach that places them at the center of design-driven development. This mode serves as an instrument, guide or good practices that allow them to position themselves at a highly competitive level in the current market, through the production of quality software based on the user experience. For this purpose, a quality model is proposed, the development of which took into account the structure of the International Standard ISO 13407:1999, the ISO 25000 standard and information collected from the software and computer services industry in the region.

1 Introduction

People and their problems must be at the center of creating digital products. This approach, known as “human-centered,” also plays an important role in moving towards accessibility, because it starts from developing products that address the different needs and capabilities of all people. In the digital age, a huge diversity of people use technology for their daily actions. Organizations have a responsibility to ensure that everyone can navigate by their products. In this sense, a human-centered design approach is vital, facilitating better accessibility for people with disabilities and improving the overall user experience. At the moment, one in ten people in the region has a disability and not designing products for them means losing an enormous opportunity. As accessibility standards become stricter, failing to meet them costs almost three times as much as meeting them. Therefore, building accessibility into product flows from the beginning, in addition to reducing the likelihood of costly adaptation, shapes more inclusive products.

But, what exactly is a human-centered design approach? And how can it be used to advance accessibility efforts? Human-centered design starts with having a full understanding of the people who use the products, specifically what their needs and preferences are. Not having this information means that fundamental research of the user experience (UX) will not be accurate and teams could miss valuable opportunities to improve accessibility and overall products.

So-called "user” persons (imaginary characters created to represent different types of users) are useful in this instance, as they segment audiences based on their needs and context, and highlight what one group of users may need in contrast to another group. User persons also put designers in the users' place, where they can capture their emotions, thoughts, and decision-making. Such empathy encourages designers to think about why a person needs certain features and functionality and allows them to identify product areas where users are not served. Of course, organizations also need to talk to real users, which can be done through surveys, interviews, focus groups, user testing, and data analysis. These conversations should focus on user feedback on their interactions with products, as well as any product changes or new features. Touchpoints with users should be regular to encourage spaces where people can provide honest feedback.

There are a number of tools to assist organizations in their human-centered approach to accessibility. While these resources are helpful, they are parameters, not fixed rules, and organizations should apply them knowing that accessibility is constantly evolving. Some of the most commonly mentioned design guidelines are the Web Content Accessibility Guidelines (WCAG) [1], Apple Human Interface Guidelines [2], and Android Guidelines [3]. In the fast-paced world of technology, applications created in the cloud are giving rise to a new paradigm that is redefining the way organizations dedicated to their development and modernization work. Thus, in order to offer customers high-quality products and services, many IT companies are investing more and more resources in the development of applications through generative artificial intelligence (AI). According to Gartner [4] and IDC [5] projections, by 2025, between 90% and 95% of new applications developed will be cloud-native. This exponential growth of AI has come to consolidate this trend.

The real potential lies in the general workflows where they can be integrated into and the action that can be taken from these models. Based on this, it is proposed to define a quality model focused on the people who use that software as users and with their accessibility limitations to the different frequently used software products.

2 Quality Models

The search for quality in software products dates back a long time, since the models proposed by McCall (1976) [6], where product quality is decomposed into 11 categories or quality factors, grouping

them into three categories: operation, review and product transition; passing through Evans (1987) [7], Deustch (1988) [8], who added new categories and quality factors to those already proposed. These models were developed following quality guidelines that emerged for the improvement of other types of products [9, 10]. Currently, different families of quality standards aimed at software products have also evolved. The ISO/IEC 9126 [11] and ISO/IEC 14598 [12] standards gave rise to the family of standards ISO/IEC 25000 [13], a family of standards also known as SQuaRE (Software Product Quality Requirement and Evaluation) [10]. This is how the 25000 family of standards is organized into five points: requirements, management, model, measurement and evaluation of quality; that corresponding to the quality model -ISO/IEC 25010- is contractually required. The standard also proposes three models: software product quality model, system use quality and data quality model. The development of the ontology is based on what is proposed by the ISO 25010 standard. This standard divides the quality of the software product into 8 characteristics (Figure 1): Functionality, Reliability, Efficiency, Usability, Security, Compatibility, Maintainability and Portability.

For the development of our proposal, we focused on the fourth characteristic: **Usability**. It establishes the capacity of the software product to be understood, learned, used and be attractive to the user, when used under certain conditions [10]. This feature is subdivided into:

- ***Ability to recognize its appropriateness.*** Product capability that allows the user to understand if the software is suitable for their needs.
- ***Learning capacity.*** Product capability that allows the user to learn its application.
- ***Capacity to be used.*** Product capacity that allows the user to operate and control it with ease.
- ***Protection against user errors.*** Ability of the system to protect users from making errors.
- ***User interface aesthetics.*** The ability of the user interface to please and satisfy the interaction with the user.
- ***Accessibility.*** Product capacity that allows it to be used by users with certain characteristics and disabilities [10].

Figure 1: Product quality characteristics ISO 25010 Standard [14]

3 Business Models

Today, B2B (business to business), B2C (business to consumer), B2B2C (business, to business, to consumer) business models are migrating to a D2C in which the contact is *"Directly to Consumer"*. So, they have to integrate the entire value chain and the proposal to speak to those who acquire their products, even if they do not sell them directly. The scenario has been modified. So, developing a digital product without asking ourselves who will use it, for what, from what devices, etc., only distances us from the premise that reigns today, in this digital age: everything for the user.

Often in the software industry we find digital products that are designed and developed by people who are experts in the subject, who find it easy to understand the use of a hamburger menu or who coexist

in everyday life with terms such as scroll, input or form. But what happens if we talk about users who are not experts on the subject? What if we talk about different age groups? From vulnerable communities or those that do not have easy access to technology? How do you feel when you encounter a digital product that was not designed or developed for your situation or context?

Now let's ask ourselves: how could development teams bring a digital product to market with the user in mind if they generally work around the clock? If they often meet the user in the course of development, could they cover the modifications that are requested? To the answers, let's add that the teams are made up of people with different visions, and that they can think of different solutions according to their experience. How could a consensus be achieved? If we take into account that, often, development teams must produce multiplatform software, directly impacting the UX due to the risks inherent to the technologies used [15], could we reach a digital product with which everyone, team and users, did they feel satisfied and identified?

Reflecting on the responses that emerged, the following conclusion was obtained: carrying out the steps of the proposed activity, but from back to front would have facilitated the development and implementation of the menu, optimizing the use of resources (human, economic, material, etc.) and achieving a memorable *user experience*. Based on this reflection, the following steps can be proposed for the design process of a user-centered solution.

1. Understand the diversity and needs of users.
2. Incorporate inclusive design principles and guidelines for accessible products.
3. Accessibility testing and iteration.

To this end, work is being done on defining models, methods, guides, and strategies that allow evaluating the quality of interfaces with a focus on user experiences. In this sense, the tools allow organizations to adapt their showcases based on the browsing behavior of each customer to offer information and products in a personalized way according to the customer's behavior on the website.

In turn, it gives companies the ability to automatically bring personalized recommendations to email marketing campaigns with content and promotions focused on consumers' interests. The goal is to increase conversion rates, profitability and not exhaust potential consumers with irrelevant information.

4 Quality Models for Evaluating the Accessibility of Software Products

Taking advantage of the opportunities that organizations/companies have to reach their customers with personalized and relevant offers will be key when capitalizing on the user's browsing moment. In this way, they will be able to discover the products they want to buy more easily, so that their experience in the showcase leads them to make the purchase decision and that this can then be complemented with cross-selling. To do this, organizations/companies must first know their customers, their online behavior and their particular interests and their limitations or differences in order to appropriate the information on the products that are being offered. Based on the above, the figure 2 show the proposed quality model.

For the development of the proposed model, the following were taken into account:

1. The ISO 25010 Standard [14] in its Usability characteristic and especially in its Accessibility subcharacteristic.
2. The structure of the International Standard ISO 13407:1999 [16] that describes how a User Centered Design process can be implemented to achieve usable systems; and its revision ISO 9241-210:2010 confirmed in 2015 [17].
3. Information collected from the Software and Computer Services Industry in the region.

The objective of our proposal is to provide software development companies with a tool, guide or good practices that allows them to position themselves at a highly competitive level in the current

market, through the production of quality software based on the user experience.

1. **Accessibility**
   1.1. Assistive Technologies
      1.1.1. **Screen Readers**
         1.1.1.1. They read texts
            1.1.1.1.1. Voice Synthesizers
            1.1.1.1.2. Shown in Braille
      1.1.2. **Keyboard Navigation**
      1.1.3. **Adaptive Interfaces**
      1.1.4. **Artificial intelligence**
         1.1.4.1. Interpret Images
         1.1.4.2. Control Devices (without keyboards, mice or screens)
         1.1.4.3. Receive information (without keyboards, mice or screens)
         1.1.4.4. Communicate (without keyboards, mice or screens)

Figure 2: Quality Model

Figure 3 graphically shows how the proposed model is applied within the usability characteristic and its accessibility subcharacteristic.

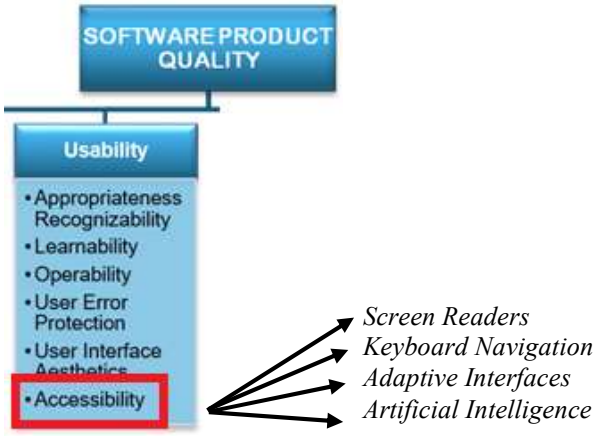

Figure 3. Relationship between the Usability characteristic and the proposed model

4.1 Definition of characteristics and subcharacteristics

Accessibility: Basic accessibility includes assistive technologies.

Screen Readers: Read the text aloud through voice synthesizers or display the text in braille;

Keyboard Navigation: Allows users to move through digital elements using buttons

Adaptive interfaces: Where page designs change according to user behaviors.

Artificial Intelligence: Enables accessible products through voice recognition, where users can control devices, receive information and communicate without depending on keyboards, mice or screens.

4.2 Definition of Metrics and Indicators

To measure the characteristics and subcharacteristics established in the model, a set of metrics and indicators was defined, some of which are described below.

- **Num_App_Bra:** Counts the number of applications that allow translation into Braile language in the implementation of the business processes (BPs) of the company.
- **Num_App_SVoice:** Counts the number of applications that allow voice to be synthesized in the implementation of the business processes of the company.
- **Num_App_with_Keyb:** Counts the number of applications that can be controlled with the keyboard in the implementation of the BPs of the company.
- **Num_Resp_App:** Counts the number of applications with responsive screens in the implementation of the BPs of the company.
- **Num_App_Interp_Imag:** Counts the number of applications that allow images to be interpreted in the implementation of the BPs of the company.
- **Num_App_Cont_Dev:** Counts the number of applications that allow devices to be controlled without the need for mouse, keyboards or screens in the implementation of the company BPs.
- **Num_App_Rec_Inf:** Counts the number of applications that allow receiving information without the need for mouse, keyboards or screens in the implementation of the company BPs.
- **Num_App_Comm:** Counts the number of applications that allow communication without the need for mouse, keyboards or screens in the implementation of the company BPs.

From these direct metrics, derived metrics are defined, such as:

- **Num_App_AI:** Counts the number of applications that allow, through artificial intelligence, to interact with the different users of the implementation of the company BPs. This metric is defined as:

Num_App_AI = Num_App_Interp_Imag + Num_App_Cont_Dev + Num_App_Rec_Inf + Num_App_Comm

- **%_App_Voice:** Represents the percentage of voice management applications through AI included in the implementation of the company BPs.

%_App_Voice = Num_App_SVoice / Num_App_AI

As an example, some of the indicators that were defined to obtain an interpretation of the proposed metrics are presented.

To interpret the **Num App Bra** metric, the elementary indicator is defined:

DUBraile = Degree of Use of Translation Tools into the Braile Language

$$\textbf{DUBraile} = \begin{cases} 0 & \text{Num\_App\_Bra} = 0 \\ 0{,}65 & 0 < \text{Num\_App\_Bra} <= 1 \\ 0{,}80 & 1 < \text{Num\_App\_Bra} <= 3 \\ 1 & \text{Num\_App\_Bra} > 3 \end{cases}$$

Another elementary indicator that was defined is the one used to interpret the %_App_Voice metric:

DUTAIV = Degree of Use of AI Tools for voice work

$$\textbf{DUTAIV} = \begin{cases} 0 & \%\text{\_App\_Voice} = 0 \\ 0{,}2 & 0 < \%\text{\_App\_Voice} < 0.25 \\ 0{,}4 & 0.25 <= \%\text{\_App\_Voice} < 0.5 \\ 0{,}65 & 0.50 <= \%\text{\_App\_Voice} < 0.75 \\ 0{,}8 & 0.75 <= \%\text{\_App\_Voice} < 1 \\ 1 & \%\text{\_App\_Voice} = 1 \end{cases}$$

Broadly speaking, basic accessibility includes assistive technologies such as screen readers, which read text aloud through speech synthesizers or display text in braille; keyboard navigation, which allows users to move through digital elements using buttons; and adaptive interfaces, where page layouts change based on user behaviors. More recently, artificial intelligence (AI) has promoted products accessible through voice recognition, where users can control devices, receive information and communicate without relying on keyboards, mice or screens.

Generative AI helps visually impaired users interpret images, AI-powered sign language is helping hearing-impaired users navigate through digital experiences, and virtual locker rooms help people with mobility restrictions try on clothes. Organizations should always remember that the maximum potential of tools should be the minimum standard for their accessibility efforts.

Accessibility, like any stage of the product creation process, must be continually tested and iterated to confirm that it is having the desired impact. Organizations should have clear, specific accessibility goals and success criteria that direct their accessibility drive and keep them people-centered.

Throughout the product lifecycle, organizations should thoroughly test the product with users to address any accessibility barriers, as well as test with digital tools to detect any technical issues. As far as possible, testing should be carried out by teams that include people with different abilities. The more diverse perspectives placed on a product, the more complete the evaluation of it will be.

Similarly, organizations should be transparent when reporting accessibility results: documents should be shared with internal teams and the user community, expressing what has worked and what hasn't, and what the next steps are planned.

5 Case of Study

For decades, legacy applications have been at the core of business operations, housing crucial processes and data. However, as time progresses, these are becoming a source of productive inefficiency. In fact, research conducted by the IBM Institute for Business Value [18] revealed that 83% of executives consider application modernization critical to business strategies. Despite this consensus, the high complexity of this task has led many organizations to postpone it. In this context, and continuing with the work carried out to achieve the migration to the cloud of the BPs that was carried out in a company in the medium, in which, at the beginning, a first step was achieved in terms of digital transformation [19]. Thus, after moving some of the company's BPs, it was necessary to achieve a platform that allows integrating different technologies such as the cloud, process automation and accessibility to achieve a satisfactory user experience (Figure 4).

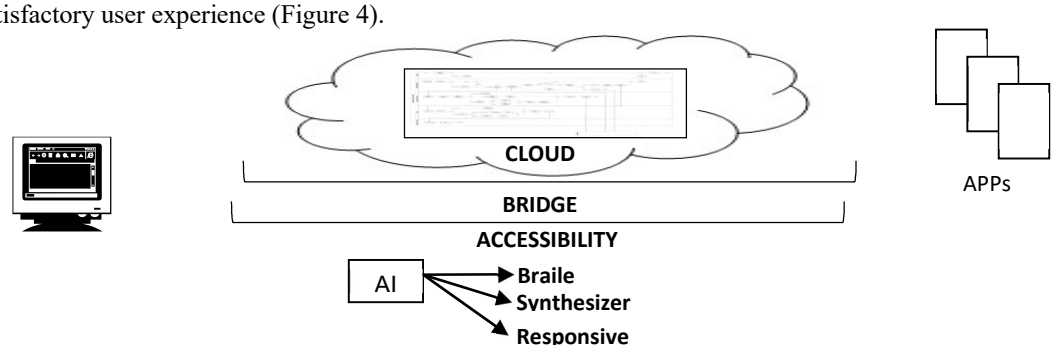

Figure 4. People-Centric Digital Product

The management of company decided to carry out a control over the software and processes involved in the transition or evolution of the company in the new world panorama with regard to BPs in the new paradigms. Nowadays, marketing strategies must be thought of in a real and integrated way,

putting the user at the center (Customer Centric). This means that the consumer must not only be central in a marketing action, but also in all organizational decisions. The user crosses all areas of the companies, so his relevance has to be considered integral. The decision has been made to restructure BPs, adapting them to new technological demands. In this context, as a first step, a cloud internet provider has been contracted. But that brought with it an adaptation problem for the company's work teams. The migration presented a challenge because different requirements were required to be met by the company's software and, in addition, the validation and verification processes had to be adjusted to achieve quality assurance. It was also necessary to control everything related to the external part: the different applications, repositories, etc. that emerged in the new cloud paradigm. For this purpose, the work of the company's human resources was reorganized with the use of a strategy [19] to redesign or condition the interfaces of the web and mobile applications to adapt to the new business paradigms. That is, maintaining a leading position in the market. But it emerged after successive actions in which the usability of the applications was adapted that the number of clients was not increasing. It was necessary to increase the number of clients, therefore it sought to adapt to new technologies.

For the work, the previously defined quality model was used, keeping in mind what refers to ***adaptive keyboard navigation interfaces***, ***screen readers and artificial intelligence***. We focus on those characteristics and their subcharacteristics of interest as they relate to the customer. To achieve this, one of the first activities carried out was the analysis of the data/information available on customer preferences. A study was carried out of the documents that are used to record the results of BPs. To do this, the amount of advertising specifically directed to each client based on their preferences or needs was counted. Purchases, budget requests, traceability was made with their records and advertisements, personalized recommendations that were made. It was found that, through employees, it was possible to have an approximation of customer behavior. But a marked lack was observed with regard to digital information for the same. Table 1 shows a summary of the measurements obtained for the metrics.

Metric	Value
%_App_Interp_Imag	0%
%_App_Cont_Dev	10%
%_App_Rec_Inf	15%
%_App_Com	0%

Table 1. Instantiation of metrics in the implementation prior to the study

Where:

- **%_App_Interp_Imag:** Percentage of applications that allow images to be interpreted in the implementation of the company BPs.
- **%_App_Cont_Dev:** Percentage of applications that allow devices to be controlled without the need for mice, keyboards or screens in the implementation of the company BPs.
- **%_App_Rec_Inf:** Percentage of applications that allow receiving information without the need for mice, keyboards or screens in the implementation of the company BPs.
- **%_App_Com:** Percentage of applications that allow communication without the need for mice, keyboards or screens in the implementation of the company BPs.

As an example, after carrying out an analysis of data and information, it was possible to detect that a percentage of the addresses were already in the database of other clients, children or relatives, who made purchases for their relatives, due to the poor accessibility of the available software applications.

The conversation with the customer becomes more human than ever thanks to AI, although it may seem paradoxical. Let's imagine a client who, faced with any difficulty, does not have to wait for a call to the customer service center, with the infinite decision tree "dial 1, dial 2, dial 5", but in a few seconds he has a response to his commercial query, service improvement, or purchasing a product. It is a revolution that has just begun and all companies already understand the need to incorporate AI into their processes and integrate them into their systems to offer superior and more effective customer service than ever, but even more so if it allows the interpretation of images or the communication of audio. through sign language. After the analysis and implementation by the development group of the company,

and the addition of functionalities appropriate to new technologies, the number of clients increased.

To measure this improvement, the Conversion Rate metric was used. Which is defined as:

- **Conversion rate (CR):** In general, when someone refers to obtaining buyers from an online store, they usually talk about the conversion rate. This metric in ecommerce serves to express as a percentage the number of visitors who were converted to buyers. The conversion rate is one of the main metrics of the success of an ecommerce.

Metric	Indicator	
CR = NVC / NV	100	CR = 1
	75	0,75 < CR < 1
Where:	50	0, 50 < CR <= 0,75
NBV = Number of Buyer Visitors	25	0, 30 < CR <= 0,50
NV = Number of Visitors	0	0 <= CR <= 0,30

After improvements in the application regarding accessibility, an improvement was obtained in terms of the buyer rate.

CR = NBV / NV = 4755 / 7500 = 0,617 – Where: NBV = 4755 Buyers – NV = 7500 Visitors

Which shows an improvement with respect to the values obtained prior to the application of the changes, where the conversion rate gave the following values:

CR = NBV / NV = 4280 / 7250 = 0,590 – Where: NBV = 4280 Buyers – NV = 7250 Visitors

Based on these new values, the proposed quality model was reinstated and with regard to the use of accessibility tools, improvements were obtained with respect to what was previously studied (Table 2).

Metric	Value
%_App_Interp_Imag	30%
%_App_Cont_Dev	30%
%_App_Rec_Inf	25%
%_App_Com	15%

Table 2. Instantiation of metrics in the implementation after the improvement process

6 Conclusions

A people-centered approach places people at the center of design-driven development. Prioritize empathy and the formation of high-quality products that truly serve everyone, for example, generative AI is helping visually impaired users interpret images. Human-centered design thinking goes hand-in-hand with accessibility because it fosters inclusion, bringing more people into the digital world while creating better products for the benefit of all. The number of new use cases and accessibility enabled by generative AI will dramatically increase automation and therefore worker **productivity** across businesses. As leaders consider this future, many come to the same conclusion: the best applications for this technology go beyond model output in isolation. The real potential lies in the **general workflows** they can be integrated into, and the action that can be taken from these models. Generating an email from a notice is great, but automatically generating it from **relevant customer context** and being able to send it with a single click is even better. Thus, after instantiating the quality model proposed in this work, and applying the metrics and indicators, it was possible to conclude that, in the process of optimizing information access to e-commerce visitors and customers, a series of adjustments and transformations are necessary with regard to BPs, since not all users search for the same thing or access it in the same way, nor are they informed in the same way. When the company understands that, according to the journey, there are different consumer profiles at different stages in which they interact with the firm or make decisions, it is important how it goes about understanding what they need. Data plays a key role today because everything is documented and it is important to know how to use it, because it provides the tools so that it can be acted upon when the user needs it to sell a product or service.

In search of being able to reach the client from various sources and ways, it was decided to use AI in

the application to manage the two or three instruments that would begin to be used in the organization, and in this way to be able to reach that user who was excluded. or you were dependent on someone to access the products or services you needed to consume.

As additional benefits of instantiating the quality model, its metrics and indicators and its use in the company, interesting things emerged such as being able to evaluate customer status, sales, orders, etc. at different moments and periods of time. This favored the monitoring of processes through metrics and indicators, and being able to act in a predictive or prescriptive manner for the continuous improvement of the organization's BPs.

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