Socio - Technical Perspective for Better Design Thinking Process in User Interaction Design Using Light-Weight Why Because Analysis (LWBA)

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Abstract- Over decades, IT provided accessibility for all generations, from youngsters to the elderly, from the cognitively to the physically impaired. User interaction creates engagement between the user and the system, by providing the necessary structure and behaviour of a system to the users. Therefore, designing a User interaction combines cognitive sciences of psychology, computer science, human factors, and engineering, which is not easily addressed in the framework of science and engineering. This paper is presenting a use case of designing a user interaction by taking into account the socio-technical aspect of the clients. Light-weight Why Because Analysis is a semi-formal method intended to identify constraints, both technical and non-technical constraints, of a system based on the causal reasoning. The solution is generated by using the counterfactual of given causal factors. By implementing these approaches, the designed user interaction is able to satisfy the problem, resulting an appropriate delivery time of the final system.

Index Terms- Causal Inference, LWBA, Persona, Socio-technical Approach, User Interaction

I. INTRODUCTION

In recent years, IT has become a broad market both in terms of social and organizational purposes. IT provides accessibility for all generations, from youngsters to the elderly, from the cognitively to the physically impaired. Human Computer Interaction (HCI) is a multidisciplinary field of research which encompasses computer science, cognitive science, and human factor engineering. With the growing technologies, HCI expanded from its initial focus on individual and generic user behavior. The initial concern of HCI has evolved from computers to all forms of information technology products, as today's Information technologies are made available to the widest possible spectrum of human experiences and activities.

User interaction is a sub-domain of human computer interaction (HCI) research which focuses on creating engagement between the users and system. This can be achieved by providing the necessary structure and behaviour of an interactive system to the users. User interaction (IxD) focuses on interactivity and user behavior. Design should concern not only whether users can understand the product, but their responses and how the product reacts on the basis of users' behavior (Jiajing, G., 2017). Therefore, to deliver the objective, one has to comprehend not only the technical aspects, but also the psychology and design theory.
Almost all IT products today are combining the elements of personal computing such as social media, games, productivity application, and personal computer platforms (the operating system, programming languages, hardware). These innovations have made everyone potential users of computers. However, having a big market of potential users means that there will be usability issues arising in regard to the gap of knowledge of the market. The human-factor has made this field of research even more exciting, to include that there are other variables, such as the gender, age, cultures, even religion which might affect the success of an IT product.

This research is presenting a use case of Light-Weight Why Because Analysis (LWBA) to address issues in designing a system, particularly in designing the interaction which later affect the feature design of the system. This paper presents a proof that understanding the socio-technical aspects play an important part in delivering a successful project. The approach taken to address the identified constraint was based upon the LWBA analysis result. LWBA facilitates researchers to have a better understanding of the problem space Hence, having a broader consideration in designing the suitable approach.

II. Literature Study

Action research study is driven by real-world problems faced by researchers. Therefore, an action is performed to address the issues accordingly. These actions enable the researchers to discover new findings to a particular problem. The reason behind this paper was a phenomenon experienced by the researcher in conjunction to IT development projects.

Developing IT product requires not only technical skills but also soft skills such as communication ability. One of the critical challenges is during the requirement phase. According to the IEEE Standards in 1998 (IEEE, 1998b), a requirements are commonly classified as:

> **Functional.** A requirement that specifies an action that a system must be able to perform, without considering physical constraints; a require- ment that specifies input/output behavior of a system.

Non-functional. A requirement that specifies system properties, such as environ- mental and implementation constraints, performance, plat- form dependencies,

maintainability, extensibility, and reliability. Non- functional requirements are often classified into the following categories:

Performance requirements. A requirement that specifies performance character- istics that a system or system component must possess, for example, max. CPU- usage, max. memory footprint.

External interface requirements. A requirement that specifies hardware, software, or database elements with which a system or system, or other factors caused by such an interface.

Design constraints. A requirement that affects or constrains the design of a system or system component, for example, language requirements, physical hardware requirements, software development standards, and software quality assurance standards.

Quality attributes. A requirement that specifies the degree to which a system possesses attributes that affect quality, for example, correctness, reliability, maintainability, portability. It has been extended also to the concept of Hedonic Quality known as User Experience.

These set of requirement definitions play an important role in the success of a software. hence, to be able to correctly understand the users' wants and needs are crucial in IT development projects. Let the quality attribute, user experience, be the case. Many translate User experience (UX) to user interface capability in assisting users' needs. As the consequence, the UX component has a strong dependency on who the audience is. Human action is being controlled by cultural models (Clemmensen, T., & Plocher, T., 2007). Cultural models for humans interacting with computers should therefore be at the heart of the scientific study of human-computer interaction (HCI). The existing practice derived from the West of migrating software from a source culture to a target culture may work in the design and implementation phase, but not in the usability evaluation phase (Clemmensen, T., & Plocher, T., 2007). Moreover, the decission of icons, metaphors, shapes, colors of text and background, frame/text locations on screen, etc. may be employed in system designs by considering the relevance to the culture of origin of the software (Wiryana, 2009). This should be taken into a consideration as some signs or colors may represent the opposite of the intended meaning in other cultures. Therefore, a UX designer should be aware of the social-technical aspects and incorporate these to the designs.

Designs may result in a subconscious impact on the emotion perceived by its user. A cognitive scientist and usability engineer Don Norman (Norman,D, 2013) discussed how everyday objects are designed and the powerful effects of the design can affect the emotions and daily lived experience of the user. Don Norman (Norman,D, 2013) gives an example case by presenting the logic of how color screens gain its popularity when it is first introduced. In the early days of the personal computer, all the display screens were black and white. In that period of time, color was primarily used either to highlight text or to add superfluous screen decoration. On that ground, from a cognitive point of view, color added no value that could be provided with the appropriate use of shading. However, the market response showed otherwise. Don Norman is then doing the research by borrowing a color display for himself. He came to the conclusion that, although the logic reasoning at that time concluded that color was unimportant, however, the emotional perspective of human beings responded otherwise. The affect or emotion that humans have is passing judgments, presenting humans with immediate information or response about the world. Affect, therefore, regulates how humans solve problems and perform tasks. Negative affect can make it harder to do even easy tasks; while positive affect can make it easier to do even the most difficult tasks (Norman, D., 2002).

Usability design of a system combines cognitive sciences of psychology, computer science, human factors, and engineering, which is not easily addressed in the framework of science and engineering (Norman, 2002). People learn patterns of thinking and acting from living within a defined social environment, normally typified by national culture (Massey, A.P., et. al, 2001). By definition, it is learned that culture may pre-determine a person's communication preferences and behaviours. Understanding cultural consequences, therefore, contributes to better comprehension of how a system should be built and should behave. To design a sustainable system, the consideration of technical issues alone will not satisfy the problem, as there are other factors that. On this ground It is essential to contemplate the organizational and cultural aspects on which the system is implemented (Wiryana, 2009).

Humans are using computers to perform certain tasks. Humans told the system their needs. Computers enable human beings to communicate with an inanimate object. The platform which provides such ability for humans to interact with the computer is the User interface. Hence, an interface should facilitate users to use their particular communication styles (Massey, A.P., et. al, 2001). Differences across cultures should be considered while determining proper user interface for a system that intended for public use. Consequently, global interfaces need to accommodate a diversity of communication styles to provide support for the cultural diversity of the users (Ford, G., and Kotze, P., 2005). A good quality that is accepted in the related culture can make the users more loyal to the services (Wiryana, 2009).

Simple cause-and-effect questions are the motivation for much research in the social, demographic, and health sciences, even though definitive answers to cause- and-effect questions may not always be possible to formulate given the constraints that we face in collecting data and evaluating alternative explanations (Morgan, S.L., and Winship, C., 2015). Causal analysis is an approach to find the causality reasoning behind an event based upon the cause-and-effect questions. Causal analysis provides the ability to distinguish the root causes of a given problem with its contributory factors and its contextual details. The common view on causation is sometimes called a "causal chain", which suggests one-to-one causal relations between causes and effects. A root causal analysis depends upon a more general view of causality. In this case, the causes that potentially happen in future. Causal analysis provides the ability of presumption of certain factors which may have a significant role in leading an event to failure.

This paper presents a use case of taking into account the socio-technical perspective to design a user interaction. This paper shows a real-world case, on how socio-technical aspects may affect the interaction design of a software product. The Light-weight Why Because Analysis method is carried to capture

both technical and non-technical constraints. By identifying the system, both technical and non-technical, constraints, one is able to have a broader point-of-view in analyzing the problem. Consequently, giving the convenience of what kind of approach that has more potential in addressing the constraints.

III. CASE STUDY

The research was conducted during a web-based software development project. The client name and institution will remain classified. The aim of the website is to deliver necessary information to its users. In terms of human resources, the agency can be regarded as a small-scale government-based agency, as it is only run by 2 to 3 people. One serves as the top-decision maker while others are the administrative staff. Nevertheless, the impact made by the agency to the public is quite strong.

The client already have a prior web application, however, the client lost contact to its former developer. The client would like to have a new web application similar / to replicate the former. As the consequence, we defines the requirement, both functional and non-functional, based upon the late application. This project itself is expected to be finished in 1 month, therefore the Agile Software Development framework was adopted. However, due to major refinements, the project schedule was stretched. In order to cut back the damage, we employ series of approaches and , hence, the final system was able to be delivered in 1.5 months. The series of approaches will be discussed in the subchapters.

A. Personas

Personas is an approach to create a reliable and realistic representations of the system audience . The personas can be used as the segments for reference. By having Personas model, one can discover the expected functionalities, uncover gaps, or highlight new opportunities. During the research, personas profile information is gathered based on qualitative approach which is through interview and discussion with the user group.

There are three persona identified in the case of study:

- Public users - the visitors of the website. This type of user is utilizing the website for discovering information or to contact the agency.
- Management – Decides which content should be put and put down, answer related questions comes to the web, and so on.
- System Administrator - is the people responsible for managing the website content, technically.

However, the uniqueness of this research is there are two personas profile that is assigned to a single person. Though there are three different persona identified, in the midst of the project the people responsible in acting as the system administrator is resigned. Such that, the gap cause by such event should be includes in the system design.

B. Light-weight Why Because Analysis

In the midst of the case study, the schedule of the project is keep being pushed back by the user. Therefore, we know that the time for the project will be longer that what it is scheduled. This problem triggered of this condition is caused by the dissatisfaction, both in the perspective of users' and developers. As we are trying to understand the reason why there is this delay is happening, and how to be back on track as soon as possible. Hence, in this perspective, the root problem is set upon the dissatisfaction of developers' perspective, which is the duration of the project taking longer than expected. However, these reasoning may not be easily understood because there might be information that is not pulled out during the discussion. Hence, the causal interference method is deployed.

To understand more the problem, we utilize an analysis method namely, Light-Weight Why Because Analysis (LWBA) (Wiryana, 2009) a semi-formal method intended to identify constraints of a system. LWBA is based upon Why Because Analysis developed by Peter B. Ladkin in Bielefeld University and has been used for incident analysis (Ladkin, 2001). WBA is employed to perform root causal analysis, by finding the necessary causal factor of the incident.

LWBA is using causal interference between the technical and non-technical constraint as cause-and-effect relation . The common view on causation is sometimes called a "causal chain", which suggests one-to-one causal relations between causes and effects (Wiryana, 2009). The counter-factual test is used to define necessary causal factor (NCF), which further being used to generate the solution to the problem.

The analysis result of LWBA is depicted by a Lightweight-Why-Because Graph (LWBG) in Figure 1.

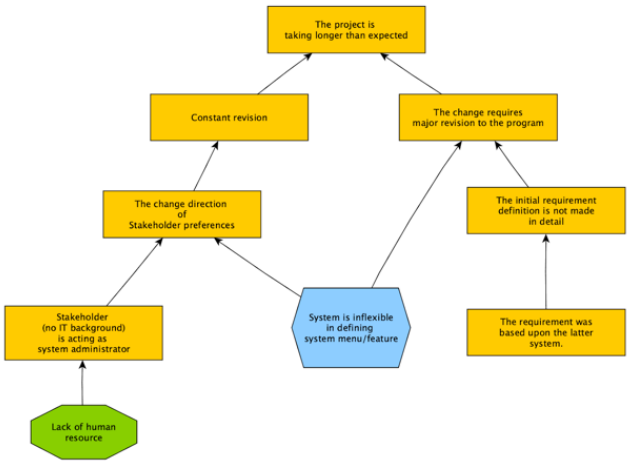

Figure 1. The result of Causal Analysis Using Light-Weight Why Because Analysis

The blue hexagon (Figure 1) is indicating a problem that can be solved using technology, while the green octagon is indicating the problem that can be solved using non-technology solutions. LWBA approach is based upon 'and' relation between the root problem and its causal factors. Accordingly, the solution can be generated by identifying the counter measure the NCF which resulting on form of either technical solution or non-technical solution.

As seen in Figure 1, the inflexibility of the system are the necessary causal factor of two unsatisfactory node. Therefore, by developing the counter measure to the problem one can eliminate the causal factors. In this manner, the counter measure will satisfies the root problem.

IV. FINDINGS & DISCUSSION

Based upon the identified NCF of the LWBG the solution of the problem, to the case problem can be addressed by making the system to be as flexible as possible. This solution may sound simple, however we must take a consideration that there are two different personas that will be assigned to a person. In which, the more power we give to the user, the less we can control the system. This two things is that should be put in balance.

A. Personalized Content Management System

The plan is to give a controlled-freedom to the system administrator personas, by doing categorization of website elements. The freedom is define by giving the ability for users to customized the front application from a content management. The control variable that developer have in order to maintain its original design is by setting a rule for each given customization ability.

There are four categorization of menu available within the website are :

Top menu. Top menu is typical menu that we see at the top of most web application. This type of menu has a predefined number, in this case we set up to 5 menu can be put in. Not only we limit the number of main menu, we also limiting the length of a menu name. The decision is made by taking into consideration in maintain he esthetical perspective to its original design. However, there are no restriction on how many sub-menu and contents for each main menu can be created.

Left menu. Refers as the vertical menu appears on the left-hand side of the web application. We set the number of main menu to 11. However, there are no restriction on how many sub-menu and contents for each main menu can be created.

Topical Issue. This type of menu category used for particular issue. There are no maximum limit in creating such menu. However, the number of menu shown within the homepage of the front website is up to 3 issues, based upon the latest post.

Important Links. Refers as the horizontal menu appears on the bottom of the front web application. We limit the number of main menu to 5.

B. Usability Consideration: Pattern Design Approach

Employing LWBA simplifies the design thinking process and help identifies the solution during the in a short period of time. In redesigning process, we use pattern design approach as our main reference standard in designing the user interaction The design patterns give insight of how other users have been interacting with similar system and how other UX designer have been addressing a particular problem. User Interface Design patterns can also be seen as recurring solutions that solve common design problems.

VI. CONCLUSION

This research is presenting a use case of Light-Weight Why Because Analysis (LWBA) to address issues in design thinking process, particularly in the user interaction design. By identifying the counter measure of the necessary causal factor to the root problem, we are able to design an appropriate solution. As the result, the time delay of the project can be well maintained. The use of other tools such as personas and pattern design helps to save time during the reengineering process.

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REFERENCES

Alsswey, A., & Al-Samarraie, H. (2020). Elderly users' acceptance of mHealth user interface (UI) design-based culture: the moderator role of age. *Journal on Multimodal User Interfaces*, *14*(1), 49-59.

Brejcha, J. (2015). *Cross-cultural human-computer interaction and user experience design: a semiotic perspective*. CRC Press.

Brave, S., & Nass, C. (2007). Emotion in human-computer interaction. In *The human-computer interaction handbook* (pp. 103-118). CRC Press.

Carrara, P., Fogli, D., Fresta, G., & Mussio, P. (2002). Toward overcoming culture, skill and situation hurdles in human-computer interaction. *Universal Access in the Information Society*, *1*(4), 288-304.

Carroll, J.M., The Encyclopedia of Human-Computer Interaction, 2nd Ed.,

Clemmensen, T., & Plocher, T. (2007, July). The cultural usability (CULTUSAB) project: studies of cultural models in psychological usability evaluation methods. In *International Conference on Usability and Internationalization* (pp. 274-280). Springer, Berlin, Heidelberg.

Darmayantie, A. (2017). Requirement Derivation Methodology For Heterogeneous Systems With Socio-Technical Approach That Satisfies The Traceability Of System Requirements. Doctoral Thesis.

Ford, G., & Kotzé, P. (2005, September). Designing usable interfaces with cultural dimensions. In *IFIP Conference on Human-Computer Interaction* (pp. 713-726). Springer, Berlin, Heidelberg.

Hofstede, G.: Culture's consequences (2nd ed.). Sage Publications (2001).

Jiajing, G., Reread the classics, what is IxD, UX, and HCI? A designer's perspective, 8 July 2017 https://medium.com/@jiajingguo/reread-the-classics-what-is-ixd-ux-and-hci-a-designers-perspective-536f4e683fcf

IEEE, 1998a IEEE std 1233. IEEE Guide for Developing System Requirements Specifications.

IEEE, 1998b IEEE std 830. IEEE Recommended Practice for Soft- ware Requirements Specifications.

Wiryana, I. (2009). A sustainable system development method with applications.

Lee, J. J. (2009, July). Culture and co-experience: Cultural variation of user experience in social interaction and its implications for interaction design. In *International Conference on Internationalization, Design and Global Development* (pp. 39-48). Springer, Berlin, Heidelberg.

Montagud, M., Orero, P., & Matamala, A. (2020). Culture 4 all: accessibility-enabled cultural experiences through immersive VR360 content. *Personal and Ubiquitous Computing*, 1-19.

Massey, A.P ., Hung, Y .C., Montoya-Weiss, M., Ramesh, V .: When culture and style aren't about clothes: perceptions of task-technology 'fit' in global virtual teams. In: Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work. ACM Press, New York (2001) 207 – 213.

Morgan, S. L., & Winship, C. (2015). *Counterfactuals and causal inference*. Cambridge University Press.

Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic books.

Norman, D. (2002). Emotion & design: attractive things work better. *interactions*, *9*(4), 36-42.

Okamoto, M., Komatsu, H., Gyobu, I., & Ito, K. (2007, July). Participatory design using scenarios in different cultures. In *International Conference on Human-Computer Interaction* (pp. 223-231). Springer, Berlin, Heidelberg.

Rau, P. L. P., Plocher, T., & Choong, Y. Y. (2012). *Cross-cultural design for IT products and services*. CRC Press.
Sun, H. (2020). *Global Social Media Design: Bridging Differences Across Cultures*. Oxford University Press.

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