Exploring the User Engagement Factors in Computer Mediated Communication

Muhamar Lubis, Alfi Khairiansyah, Qadhli Jafar Adrian, Ahmad Almaarif
Telkom University, Telekomunikasi No. 1, Bandung, 40257
International Islamic University Malaysia, 50728 Jalan Gombak, Kuala Lumpur
Universitas Teknokrat Indonesia, Z.A. Pagar Alam No. 9-11, Bandar Lampung, 35142

Email: muharmanlubis@telkomuniversity.ac.id

Abstract. User engagement can be defined as the perception of the user to qualify the experience towards certain application, which focus on the positive aspects of the interaction through Internet in the context of the desire to use it continuously and for longer time. It is fundamental concept in the design of online applications regardless of the platform, driven by the observation that successful applications are not only used but those that work. However, user engagement in the technology advancement is a paradox phenomenon, as they recognize the potentiality but reluctant to adopt or they realize its use to solve problem but prefer the other solution for longer of time. The usual ways to evaluate them can be through self-report measures, observational methods, speech analysis or web analytics. These methods represent different compensations in term of configuration, the size of object and the scale of data to be collected. For example, some study might find detail and deep analysis but they are limited in term of generalizability, while the other might found out resourceful but denies the user reasoning and the context. During this millennial, the diffusion of innovation became the acceptable theory that majority academician and practical expert use to explain the phenomenon of the reason and factor to adopt certain product. Therefore, due to the assumption of several factors such as technology advancement and paradigm shift, this study want to explore current situation in the user engagement factors, which focused to computer mediated communication.

1. Introduction
The social theories and cognitive structures still dominate much researches in interaction design but the emotional dimensions of the user experience have gained increasing interest from researchers. The user engagement become one topic to be evaluated, which emphasizes the response of an individual to a particular type of offer such as a product, service or website. Furthermore, the degree of engagement might be determined directly through the interaction or observation of the user's behaviours. Every day, a potential user sees the application's interface for the first time without knowing the depth of the function and the breadth of feature or even their own objective. Therefore, it is necessary to clarify the simplicity of how the application works, which can help attract and motivate users, at least to begin using the application. Then, let them realize the kind of support of getting help as long as they require it. On the other hand, communicating with users is an excellent way to encourage them to ask questions, experience the functions one by one and move around to other page independently. Typically, users would invest their own time, interest and passion in the process of using the technology to find satisfaction in a pragmatic and consumptive manner. Thus, measurement is an important activity to
assess whether online applications can attract users in their simplest form by offering benefit for their daily activities and maintaining their engagement in long time.

Each product that is worthwhile has characteristics that are not obvious or useful at first glance or initial touch. These types of features can be classified into quick features such as bookmark, reminders, email alerts, third-party integrations, export functions or hotkeys. The only time users are interested in new features or product improvements when they working with the product, so developers can add value in the form of personalization or customization in improving the user engagement. Thus, involving various type of users based on segmentation or classification are particularly useful when launching products in the prototype phase to gain feedbacks and insights. Eventually, requesting the loyal customers or expert users regarding the preview of new product or service to obtain more depth and detail analysis on the user engagements can be done by spreading the invitation through tweets, quotes or blogs. They should be aligned complementary by also offering them the reward or incentive to use the application later on. In addition, it also can ask their participation to perform white box testing to every features or certain functional testing to check the integrity of the system. Because loyal users are more likely to know more about the application and more relevant to verify the quality of the product. Asking them to participate should be done in the earlier phase before the prototype has been finished and incorporate various comments that are frequently heard. Therefore, this study would like to investigate the main factors that influence the decision to engage particular application in the online approach, which is based on the famous adoption theory of diffusion of innovation by Rogers [1, 15].

2. Literature Review
Approaches to measuring user engagement can be divided into three main groups, which are self-declared participation, knowledge sharing and online behavioural metrics. The widely used metrics include percentages of clicks, visits to the page, time spent on the site, the frequency with which users return to the site, the number of users and many more. Therefore, the online behavioural measures are limited to collecting data from millions of users, although these metrics cannot explain explicitly why users interact with a service, they act as an agent for users’ online sharing, that is a higher and more frequent use lead to the more interactive the application with the user [2]. On the other hand, the user participation can improves the quality of the application procedure that is being developed, making it more practical and relevant and helps to provide services more effectively and efficiently. It is also a means for the company to maintain its relationship with users by verifying its reputation and popularity. On the other hand, the lack of legal exposure can increase the user’s resistance to the acceptance of the new technology adopted compared to what remains in the traditional way. Meanwhile, it is necessary to provide the opportunities for a variety of suggestions and criticisms that allow user to prioritize within their interest [3]. In addition, the engagement information need to focuses on the user's experience with the content and the expression of particular interaction. At the same time, some other frameworks emphasize the seriousness of the experience and its attractiveness to leave a long lasting impression. However, it makes no more sense for the user experience to be pleasant through complexity and difficulty. In general, there are many characteristics that are important in the measurement of user engagement such as flow, aesthetics, emotional attraction, attention, challenge, feedback, goal-oriented, meaningful, motivating, conscious control, sensory attraction, relevance and impact on the emergence of participation, which are based on an effective approach [4].

The concept of engagement in various areas of scientific and commercial research should be considered carefully. But, there is still considerable volatility, confusion and often, very ambiguity as to exactly what to define the exact term. For example, a number of related concepts, such as interest, constant attention, indulgence and participation, are sometimes used interchangeably which their relationships are often unclear [5]. Furthermore, the researchers observed that the engagement can occur in the context of collective social interaction and at the individual level, which is can be measured effectively an individual behaviours that requires task-oriented activities. Performance is often seen as a measure of outcomes in cognitive tasks and is mediated by emotional dimensions to help explain the role of monetary mediation in the user engagement [6]. Thus, user engagement can be defined as the
emotional, cognitive and behavioural experience of an individual user who own and utilize an existing technological resource, at any time and in any time, in which it differs from the user's experience [7]. The interaction between engagement and motivation can be a feedback loop where the experience in this task can constitute the most similar elements of the state in terms of self-efficacy and motivation, which in turn affect the user's desire to interact again with the application. The ability to comply with one of the treatment conditions will not guarantee that the transaction is fair and legal, in which impartiality and legitimacy must be seen in the separate manner [9].

There is an explanatory relationship between the identity of the community and the user engagement rates, in which community dynamically and constantly update and renew the content of the discussion to be more prevalence to have higher rates of user engagement. Meanwhile, the relationship between engagement and participation is less comprehensive but it is still highly informative, since specialized societies tend to generate focused attention from users at a certain moment, although this does not necessarily translate into long-term retention condition. Thus, to avoid the invasion and misuse of personal data in favour of an institution that provides losses to the owner of the data, legal protection remains an important key to align this progress as well to provide better circumstances in the user engagement [11]. On the other hand, trust also extremely necessary to build and maintain friendships or relationships in any kind of activities. In a given situation, of course, a person cannot automatically deposit confidence without being conscious or without thinking of several factors, such as perceived benefits, privacy concerns, risk management, virtues and values. However, uncertainties, communication channels, time and social order become a major obstacle to the adoption of a particular product innovation, where the clarification of the mechanism and the confirmation of the benefit can limit the impediment [15].

3. Research Methodology
The straightforward way to improve the sensitivity or the power, of a controlled experiment is to increase the amount of the observed statistical data that could be done either by increasing the population of users, participating in the experiment or by conducting the experiment for a sufficient period of time [13]. For this purpose, the researchers distributed the questionnaire to 125 students in International Islamic University Malaysia, then using smartPLS 3 to explore the model of theory [14]. An important characteristic of PLS-SEM is that the model estimates depend on the model under consideration for instance, eliminating or adding certain indicators or constructs, which have an effect on the model estimates in different parts of the model.

Figure 1. PLS for Reflective Adoption Variable
In short, Rogers has developed one of the better-known theoretical approaches to diffusion of innovation. This theoretical framework is useful when determining the adoption of specific clinical behaviours and when deciding which components will require additional effort if diffusion is to occur. It includes a consideration of aspects of the innovation or new technology, style of communication, steps in decision making, and the social context. Using the diffusion of innovations as the theoretical framework to be tested, this study was beneficial for a number of reasons such as for the development of measurement criteria, the design category for application and market analysis. This study focus on five factors in adoption level namely trialability, relative advantage, compatibility, observation and reflection. The higher the R² value, the better the prediction model of the research model. A strong mode is usually done to determine the effect of independent variables on the dependent variable.

Using the diffusion of innovations as the theoretical framework to be tested, this study was beneficial for a number of reasons such as for the development of measurement criteria, the design category for application and market analysis. This study focus on five factors in adoption level namely trialability, relative advantage, compatibility, observation and reflection. The higher the R² value, the better the prediction model of the research model. A strong mode is usually done to determine the effect of independent variables on the dependent variable.

For the degree of freedom, the value is obtained by reducing the total sample (125) with 0.01 (strong). The higher the R² value, the better the prediction model of the research model. A strong mode is usually done to determine the effect of independent variables on the dependent variable.

Critical issues relevant to the application of PLS-SEM, which are the data, model properties, and the PLS-SEM algorithm and also the related model evaluation issues [16, 18]. Furthermore, in the process of testing the coefficient of determination is usually done to determine the effect of independent variables on the dependent variable. The higher the R² value, the better the prediction model of the research model. A strong model is shown with a value of 0.75 while a moderate model is shown with a value of 0.50 and a weak model is shown with a value of 0.25. Using a two tailed test with degree of significant 99%, so the path coefficient will be meaningful if the t-value is greater than 2.57 or p-value smaller than 0.1 (weak), 0.05 (medium) and 0.01 (strong). Therefore, p values can be calculated using excel formula, TDIST (t-value, degree of freedom, tails). For the degree of freedom, the value is obtained by reducing the total sample (125) with 1.

### Table 1. Interrelationship significance of item constructs

| Reflective Constructs | Ref. Indicators | Outer Load. | Path Coe. (β) | t-Values | Sig. level | p-Values |
|-----------------------|-----------------|-------------|---------------|-----------|------------|----------|
| Relative – Adoption   |                 |             | 0.266         | 3.006     | Strong Path |          |
| RA1                   | 0.573           |             | 3.852         | Strong    | 0.000      |          |
| RA2                   | 0.327           |             | 1.582         | No Sig    | 0.116      |          |
| RA3                   | 0.715           |             | 5.178         | Strong    | 0.000      |          |
| RA4                   | 0.562           |             | 3.794         | Strong    | 0.000      |          |
| RA5                   | 0.708           |             | 5.681         | Strong    | 0.000      |          |
| RA6                   | 0.648           |             | 4.612         | Strong    | 0.000      |          |
| RA7                   | 0.732           |             | 5.457         | Strong    | 0.000      |          |
| RA8                   | 0.550           |             | 3.237         | Strong    | 0.002      |          |
| RA9                   | 0.565           |             | 3.218         | Strong    | 0.002      |          |
| Compact – Adoption    |                 | 0.044       | 0.380         | Weak Path |            |          |
| CB1                   | 0.784           |             | 5.076         | Strong    | 0.000      |          |
| CB2                   | 0.893           |             | 5.970         | Strong    | 0.000      |          |
| CB3                   | 0.857           |             | 6.310         | Strong    | 0.000      |          |
| CB4                   | 0.821           |             | 6.370         | Strong    | 0.000      |          |
| Complex – Adoption    |                 | -0.220      | 0.895         | Strong Path | 0.000      |          |
| CP1                   | 0.528           |             | 1.089         | No Sig    | 0.278      |          |
| CP2                   | 0.541           |             | 1.104         | No Sig    | 0.272      |          |
| CP3                   | 0.892           |             | 1.052         | No Sig    | 0.295      |          |
| CP4                   | 0.846           |             | 1.038         | No Sig    | 0.301      |          |
| Trial – Adoption      |                 | 0.209       | 2.215         | Strong Path | 0.000      |          |
| TR1                   | 0.781           |             | 6.905         | Strong    | 0.000      |          |
| TR2                   | 0.735           |             | 5.364         | Strong    | 0.000      |          |
| TR3                   | 0.809           |             | 5.726         | Strong    | 0.000      |          |
| TR4                   | 0.493           |             | 2.791         | Strong    | 0.006      |          |
4. Discussion

Through bootstrapping process for estimating t-values of item (factor loading) of outer model and path coefficient and establishing a number of subsamples to be created (500) by randomly select the cases that is drawn with a probability of the data set. It was found that 6 out of 30 items in the outer model shown no significant to the inner model which have t-value smaller than 2.64 and p-value more than 0.1. Meanwhile, path coefficient can be used to measure the strength of the relationship between variables with the weights closest to absolute 1 (more than 0.1) reflect the strongest path while the weights closes to 0 indicate the weakest path, which positive and negative value determine its direction (vary from 1 to -1) [17]. The result showed that the interrelationship of Observed - Adoption ($\beta=0.405$) become the strongest path among the other variables, while Relative - Adoption also fall under positive direction and strong path ($\beta=0.266$) so did with the relation of Trial - Adoption ($\beta=0.209$). Furthermore, the relation of Compact - Adoption indicated weak path ($\beta=0.044$) but positive direction to the hypotheses of the diffusion of innovation theory. On the other hand, the relationship of Complex - Adoption ($\beta=-0.220$) also show strong path but negative direction. Nevertheless, based on t value, the changes of Relative in direct proportion to Adoption with coefficient of 3.006 indicated that a 100 points changes in Relative will bring 300 changes in Adoption positively while the changes of 100 points in Compact only bring 38 changes. Meanwhile, the changes of 100 points in Complex bring at around 90 changes in Adoption negatively and the effect from Trial at around 225 points positively. Meanwhile, the effect of Observed became the biggest among other variables, which bring the effect at around 342 points to the Adoption. The five exogenous constructs in the theory, which are relative, trial, observed, compact and complex together has been explained more than half or 65.8% of the variance of the endogenous construct of adoption ($R^2 = 0.658$), as indicated by the value in the construct circle, while there are left 34.2% of variance by other variables.

Relative advantage is the degree to which innovation is perceived to be better than merely useful while compatibility is the degree to which innovation is steady or consistent with the values applicable to, the experience and needs of those adopting. On the other hand, complexity is the quality of the degree to which innovation is perceived as difficult to understand while trialability is the quality of the degree to which innovation is experimented on a finite ground. Meanwhile, observability is a degree where innovation can be witnessed by others. In general, the major mass communication applications are concerned with new things or values. The conditions of social and technological change in society give birth to a need that can rip out old methods with new methods. From this result, it can be concluded that one variable (compatibility) has been changes dramatically in term of its effect to the adoption phase because several possible reasons such as the shifted of trend in the younger generation or the use of online approach constantly to promote the product and values. Previously, the more compatible of certain product to the environment or relation with other software and hardware, the more people have eagerness to adopt the product in the longer duration. However, people have differ in term of product in the realm of online, which they do not consider the compatibility as the factor in the engagement process. To ensure the process adoption run effectively and efficiently, the knowledge, persuasion, decision and confirmation should take in the proper place and suitable context.

| Observed – Adoption | 0.405 | 3.422 | Weak Path |
|---------------------|-------|-------|-----------|
| OB1                 | 0.829 | 10.222| Strong    | 0.000     |
| OB2                 | 0.761 | 8.432 | Strong    | 0.000     |
| OB3                 | 0.821 | 9.395 | Strong    | 0.000     |
| OB4                 | 0.721 | 7.216 | Strong    | 0.000     |
| Observed (R²) of Adoption | 0.658 |       |           |           |
| CB5                 | 0.544 | 2.785 | Strong    | 0.006     |
| CP5                 | 0.617 | 3.701 | Strong    | 0.000     |
| OB5                 | 0.623 | 4.476 | Strong    | 0.000     |
| RA10                | 0.370 | 2.232 | Moderate  | 0.027     |
| TR5                 | 0.665 | 5.414 | Strong    | 0.000     |
5. Conclusion

Users often have common characteristics, which can interfere with business challenges, the regulatory function and the application they use. Therefore, it is better to provide a platform in the form of a community of friends, blog readers and customers to allow the user engagement become more effective and efficient. The engagement with the customer is essentially about creating as many excellent channels and points of contact as possible. After all, high-paying customers are likely to pay more money, promote more and be more loyal than less active customers who can provide more benefits to the application's exposure to improve their visibility. Our current understanding of patterns of engagement in Internet communities is being reformed through the profiles of several disparate studies that focus on a few individual communities. This work calls attention to the need for a method of systematic expression of similarities and differences between societies. By proposing a way to regulate multicommunity space, not only do we find radically contradictory interaction patterns in different parts of this space, but also that this discrepancy can be explained in part at least by the type of identity that each community supports.

References
[1] Rogers EM. 1995. Diffusion of innovations. The Free Press: New York, 3 Edition.
[2] Lehmann J, Lalmas M, Yom-Tov E and Dupret G. 2012. Models user engagement. Proc. of UMAP, pp. 164-175, Springer.
[3] Lubis M, Kartiwi M and Zulhuda S. 2017. Current state of personal data protection in electronic voting: criteria and indicator for effective implementation. Telkommika, 16(1), February, 290–301.
[4] O’Brien HL and Toms EG. 2008. What is user engagement? A conceptual framework for defining user engagement with technology. J. of the American Society for Inf. Science and Tech, vol. 59(6), 28 Feb.
[5] Peters C, Castellano G and de Freitas S. 2009. An exploration of user engagement in HCI. Proc. AFFFINE.
[6] Wiebe EN, Lamb A, Hardy M and Sharek D. 2014. Measuring engagement in video game-based environments: investigation of the user engagement scale. Computers in Human Behavior 32, pp. 123-132.
[7] Lalmas M and O’Brien HL. 2014. Measuring user engagement. Synthesis Lectures on Information Concepts Retrieval and Services, November.
[8] Sharek D. 2012. Investigating real-time predictors of engagement: implications for adaptive video games and online training. PhD Thesis, North Carolina State University, Raleigh NC.
[9] Lubis M, Kartiwi M and Durachman Y. 2017. Assessing privacy and readiness of electronic voting system in Indonesia. Proc. CITSIM.
[10] Zhang J, Hamilton WL, Danescu-Niculescu-Mizil C, Jurafsky D and Leskovec J. 2017. Community identity and user engagement in a multi-community landscape. Proc. ICWSM.
[11] Drutsa A, Gusev G and Serdyukov P. 2015. Future user engagement prediction and its application to improve the sensitivity of online experiments. ACM Proc. IW3C2.
[12] Ringle CM, Wende S and Becker J-M. 2015. SmartPLS 3. Bonnigstedt: SmartPLS. Retrieved from http://www.smartpls.com
[13] Lubis M and Kartiwi M. 2014. Privacy concern and perceived benefits towards privacy and election in Indonesia. Proc. ICT4M.
[14] Lubis M and Kartiwi M. 2013. Privacy and trust in the Islamic perspective: implication of the digital age. Proc. IEEE ICT4M.
[15] Sahin I. 2006. Detailed review of Rogers’ diffusion of innovation theory and educational technology-related studies based on Rogers’ Theory. The Turkish Online Journal of Educational Technology, 5(2/3).
[16] Hair JF, Hult GT and Ringle CM, Sarstedt M. 2014. A primer on partial least squares structural equation modelling (PLS-SEM). California: SAGE Publication, Inc., pp. 101-149.
[17] Ubrach D and Ahlemann F. 2015. Structural equation modeling in information system research using partial least squares. J. of Information Technology Theory and Application, 11(2), 5-40.
[18] Ahlan A, Lubis M and Lubis AR. 2015. Information Security Awareness at the Knowledge-Based Institution: Its Antecedents and Measures. Procedia Computer Science, 72, 361–373.
[19] Nurdin and Rusli, 2013. Spiritualising new media: the use of social media for da’wah purpose within Indonesian Muslim Scholars. Jurnal Komunikasi Islam, 3(1).