

Conference Paper

The Unified Theory Acceptance and Use of Technology in the Industrial Internet of Things Era: A Conceptual Framework

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Abstract

The purpose of this article is to build a conceptual framework based on literature review that will be tested in future research related to Digital Business. The results of the literature review allow for the construction of hypotheses into a conceptual framework. Furthermore, the study assesses the influence of performance expectations, efforts expectations and social influence on behavioral intention and usage behavior by modifying Hofstede's cultural dimensions. The conceptual framework will be tested among Industrial Internet of Things (IIoT) users for future research in Indonesia.

Keywords: performance expectancy, effort expectancy, social influence, behavioral intention, use behavior, UTAUT, Hofstede's cultural dimensions, Industrial IoT

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1. Introduction

The Government of the Republic of Indonesia is preparing to face the industrial era 4.0 through an Indonesian strategy roadmap, initiated by the Ministry of Industry entitled "Making Indonesia 4.0". The government is striving to revitalize Indonesia's industry as a whole. The road map was officially launched by President Joko Widodo in conjunction with the opening of the "Indonesia Industrial Summit 2018" at the Jakarta Convention Center, Senayan, Central Jakarta, Wednesday, April 4, 2018 (<http://presidenri.go.id>).

For the first time, the Concept of the industrial revolution 4.0 was introduced by Klaus Martin Schwab, an engineer and economist from Germany, better known as the founder and chief executive of the World Economic Forum. In his book *The Fourth Industrial Revolution*, Schwab explains how technology and society coexist, what its effects are and what can be done to get benefits for the common good [26].

The industrial revolution 4.0 became a new era of the use of technology in the industry, such as artificial intelligence (AI) at the core layer, Internet of Things (IoT) at the connectivity layer, wearables, sophisticated robotics, and 3D printing at the

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application layer. Five main sectors launched by the Indonesian government for the initial application of this technology, namely (i) food and beverages, (ii) textiles and clothing, (iii) automotive, (iv) chemistry, (v) electronics.

It is expected that the results of this study can be used as a reference in knowing the development of industrial behavior towards interests or interests using IloT technology and knowing the influence of Hofstede's cultural dimension factors on interests or interests in using IloT technology in the future.

2. Industrial Internet of Things

One of the main components of the industrial revolution 4.0 is IoT (Internet of Things), leading to a paradigm shift for manufacturing companies [24]. IoT can be understood as a global network that helps and provides integration functions to connect the physical world to the virtual world. This is done through the collection, processing and analysis of data generated by IoT sensors in all respects and will be integrated through public communication networks [22]. In another sense, IoT provides a condition and environment, when any object can be connected and can communicate through the network, the object includes machines and other equipment.

3. Unified Theory of Acceptance and Utilization of Technology (UTAUT)

The development of digital technology currently has a wide influence on the daily activities of users. In line with the increase in technology, it makes work easier and lighter. Likewise, its influence on businesses and companies, innovation and creativity in the use of new technology will create differentiation from competitors [11]. From the many studies on individual adoption and acceptance of new technology from the user's perception, the Technology Acceptance Model (TAM) model is often used.

The development of TAM is the Unified Theory of Acceptance and Utilization of Technology (UTAUT). UTAUT was built by Venkatesh, Morris, Davis and Davis [31] as a unified of eight existing acceptance models that have been published as a unified theory of user acceptance of technology, the theories include: (i) Theory of Reason Action (TRA); (ii) Technology Acceptance Model (TAM); (iii) Motivational Model (MM); (iv) Theory of Planned Behavior (TPB); (v) Combined TAM and TPB (C-TAM-TPB); (vi) Model of PC Utilization (MPCU); (vii) Innovation Diffusion Theory (IDT); (viii) Social Cognitive Theory (SCT).

UTAUT has proven to be more successful than the other eight theories in explaining up to 70 percent of the intention variance. From the comparison between the several models, we obtain 4 factors in influencing the acceptance of a system [32]: (1) Performance Expectancy, (2) Effort Expectancy, (3) Social Influence and (4) Facilitating condition. Besides these factors, the UTAUT model has four other factors: gender, age, voluntariness of use and experience that serve as moderators to strengthen the influence of the four main factors on technology acceptance behavior.

4. Hofstede's Cultural Dimensions

During the late 1960s and early 1970s, while working for IBM, Hofstede began surveys of company employees throughout the world. The original purpose of this work was not specifically to study cross-cultural differences. However, in analyzing the results Hofstede began to identify systematic variations in the way groups answered certain questions in different parts of the world. Subsequent follow-up work focused more closely on identifying questions that showed variations between countries. As a result of his research, Hofstede identified four national cultural differences: (1) Power Distance, (2) Individualism/Collectivism, (3) Masculinity / Femininity, (4) Uncertainty Avoidance, (5) Long Term Orientation [15].

5. Conceptual Framework

Previous research related to the acceptance and adoption of information systems technology initially used the TAM (Technology Acceptance Model) theory and continued to develop until a very prominent and tested theory emerged to be used as a research model namely the UTAUT (Unified Theory Acceptance and Use of Technology) model [32]. Research testing UTAUT has been widely carried out in various countries, including in the UK [6], Spain [20], Thailand [24], China [10], Romania and Germany [21], Korea [19], Malaysia [3], the Netherlands [18], Sweden & Norway [9], Jordan [4], Oman [1]. From these studies, it was found many additional independent variables such as privacy [6, 20], trust [4, 10, 20], cost [4, 9] and several other independent variables such as IT knowledge, mobility, quality innovation, novelty, habit, interest, enjoyment, are variables related to technology technically and in terms of the user's personal condition.

Research using the UTAUT model that uses elements of cultural dimensions is very rare and isolated [21]. Culture has not been prominent in technology acceptance

research, especially in developing countries [27]. Research Huang, Choi and Chengalur-Smith [17], proposed a cultural dimension research model as a modification of the UTAUT model: a case study of the health service context. The same thing is also recommended as further research from the study, using cultural dimensions as independent variables that influence the acceptance of information and communication technology in Indonesia (ICT) [27]. Scarcity and research gap (scarce & research gap) should be filled with a good study and can be used as a reference for subsequent studies. Logical thinking on the use of the cultural dimension moderating the UTAUT model is a new technology created by developed countries that has different cultural dimension values from developing countries. Culture as a pattern of thinking, feeling and acting potential, which has been learned throughout life, and is likely to be used repeatedly and impossible (or difficult) to be changed by individuals, is believed to have an influence on individuals in the context of technology acceptance.

5.1. Behavioral Intention and Use Behavior

Use behavior is defined as the positive or negative feelings of an individual when using a system, while behavioral intention is defined as how far a person has formulated a conscious plan to do or not do some determined future behavior [32]. Post-Purchase Behavior is the stage of the purchase decision process, when consumers take further action after buying, based on their satisfaction or dissatisfaction. The relationship between consumer expectations and perceptions of the performance of the product or system is a factor that stops whether the buyer is satisfied or not. If the product or system fails to fulfill expectations, consumers will be disappointed; if expectations are fulfilled, consumers will be satisfied; if expectations are exceeded, consumers will be very satisfied [7].

H1. Intention to use (behavioral intention) has a positive effect on the intensity of use (use behavior) in the future.

5.2. Performance Expectancy and Behavioral Intention

One of the main reasons for the slow diffusion of IoT technology applications is due to a failure to communicate clear benefits to potential users. According to the diffusion theory of innovation (IDT), users are only willing to accept innovation if the innovation provides a unique advantage compared to existing solutions. IoT technologies should achieve better adoption rates if they can facilitate the daily lives of consumers [10]. In the

IoT context, the perceived benefits show individuals find IoT services useful because they enable them to improve their overall performance in everyday situations [4].

H2. Expectations to improve performance (performance expectancy) have a positive effect on intention to use (behavioral intention).

5.3. Effort Expectancy and Behavioral Intention

Perception ease of use is similar to effort expectancy (UTAUT) and complexity (IDT) [32]. This relates to users who are considered to be making an effort when using IoT technology / services. For users to adopt IoT, they need to feel that IoT is easy to use. Previous studies have stated that perceived ease of use is a significant determinant of behavioral intentions toward technology [10]. Gao and Bai [10] show that perceived ease of use has a significant influence on behavioral intentions to use IoT services in China. Similar research on technology adoption among students, findings show ease of use is one of the factors that influence student behavioral intentions. In a literature review, found ease of use is one of the most important factors for adoption [4].

H3. Expectations to ease of use (effort expectancy) has a positive effect on intention to use (behavioral intention).

5.4. Social Influence and Behavioral Intention

When assessing the acceptance of technological innovation, the social context of decision makers cannot be ignored. The social context plays an important role in the decision-making process. Influence from peers, family, and even media such as television, can influence user intentions to adopt IoT technology and services. Many users have used mobile IoT devices because they are described as a trend by the media. Social influence has received much attention in the field of SI [10]. Furthermore, a study found the social influence of friends and family is a strong factor influencing the adoption of new technologies.

H4. Social influence (social influence) has a positive effect on intention to use (behavioral intention).

5.5. Uncertainly Avoidance, Performance Expectancy, Effort Expectancy, Social Influence and Behavioral Intention

Uncertainly Avoidance (UA) is the level when people feel threatened by situations and ambiguities that are uncertain and unstructured. The UA dimension relates to the way a society faces the reality that the future will never be known: should we try to control the future or let it happen? The predictions are that UA will have a moderating effect on the relationship between PE, EE & SI on BI, arguing that these factors will help resolve unclear situations and that this information will have a relatively greater influence on the behavior of high UA samples., as a result SI will be more important in a high UA context because the opinion of the reference group provides a useful way for people to reduce the uncertainty associated with the use of new technology [29]. The intention to use technology must be directly influenced by UA or, respectively, by perceived risk, as a result technology user will show less intention to use it in the UA culture [21].

H5. Culture of avoiding uncertainty (uncertainly avoidance) will positively moderate the effect of expectations of increasing performance (performance expectancy) toward intention to use (behavioral intention).

H6. Culture of avoiding uncertainty (uncertainly avoidance) will positively moderate the effect of expectations of ease of use (effort expectancy) toward intention to use (behavioral intention).

H7. Culture of avoiding uncertainty (uncertainly avoidance) will positively moderate the influence of social influences toward intention to use (behavioral intention).

5.6. Long Term Orientation, Performance Expectancy, Effort Expectancy and Behavioral Intention

Long term orientation (LTO) is how far people in a country show a tendency to bring along a long-term perspective, especially emphasizing doing things that enhance the future that are hampered by a short-term perspective, especially emphasizing the present or the success of the country. Loyalty to national traditions is seen as an obstacle in the focus groups of Arab entrepreneurs [14]. The perception of short-term benefits has a more significant effect on intention to use than the perception of long-term benefits in the US sample [5]. A fatalistic orientation towards the future leads to resistance to long-term IT planning in Arab Gulf countries [2].

H8. Long term orientation culture will positively moderate the influence of expectations of increasing performance (performance expectancy) towards intention to use (behavioral intention).

H9. A culture of long-term orientation will positively moderate the influence of expectations of ease of use (effort expectancy) towards intention to use (behavioral intention).

5.7. Power Distance, Social Influence and Behavioral Intention

Power Distance (PD) is the level of strong organizational members accepting that power is distributed unevenly. Indonesia scores high on this dimension (score 78) it means that the following characterize Indonesian style: Being dependent on hierarchy, unequal rights between holders of power and non-holders of power, inaccessible superiors, leaders who have directives, control management and delegation. Power is centralized and managers rely on the compliance of their team members. Employees expect to be told what to do and when. Control is expected and managers are respected for their positions. Based on previous research on the moderating effects of PD, further research is recommended to use PD as a moderating variable for studies related to work characteristics, leadership empowerment, employee participation and job satisfaction [23]. In hierarchical societies, technological change should originate from top management [14]. The methodology of participatory development projects may not be appropriate in high-power long-distance communities such as the Arabian Gulf countries [2]. IT can increase strength among skilled IT workers so as to give them more equality with managers and motivate them [13]. PD positively influences EE and SI on ICT Reception [27].

H10. A culture of power distance will positively moderate social influence on behavioral intention.

5.8. Collectivism, Social Influence and Behavioral Intention

Individualism is the level of society emphasizing the role of the individual. Indonesia, with a low score (14) is a collectivism community. There is a high preference for social frameworks that are highly defined when individuals are expected to adjust to the ideals of society and the groups in which they are located. Some authors have hypothesized that the relationship between SI and BI would be stronger in collectivism cultures more because the views of other group members were considered more important in that culture [29]. Zakour (2007) expects individualism to act as a moderator of social influence

on the ETA model, in individualistic cultures the SI on the ETA model should be weaker [21]. The presence of perceived social applications influences acceptance [28].

H11. Collective culture (collectivism) will positively moderate social influence on behavioral intention

5.9. Femininity, Social Influence and Behavioral Intention

Masculinity is the level of society emphasizing traditional masculine values (such as competitiveness, achievement, and ambition), as opposed to others (such as caring for, helping others, and assessing quality of life). A high score (masculine) on this dimension indicates that society will be caused by competition, achievement and success, with success determined by the winner. A low score (feminine) on the dimension means the dominant values in society are caring for others and quality of life. Those who hold high cultural values of femininity, are characterized as being more oriented towards people than those who have high values of masculinity. For this reason, they are expected to be more influenced by interpersonal contact, therefore some authors have predicted the effect of SI moderation on BI, as a result the relationship will be stronger for a feminine sample [29].

H12. Culture of femininity will positively moderate the influence of social influence on behavioral intention.

Based on these hypotheses, a conceptual framework can be built as in Figure 1.

6. Conclusion and the Future Research

Based on the conceptual framework and the building of hypotheses, the next research will examine the intensity and interest in using IIoT technology as an important part (connectivity layer) of the revolutionary wave phenomenon in the fourth industry, in Indonesia. Previous studies relating to the acceptance and adoption of information technology have been widely discussed, especially those related to IoT technology. However, similar and more specific research into Industrial IoT (IIoT) technology is still difficult to find in Indonesia, as well as research involving cultural dimensions as a factor that moderates the acceptance and adoption of information technology. The author uses performance expectancy, effort expectancy & social influence as factors in influencing behavioral intention and use behavior in the UTAUT model and by adopting Hofstede's cultural dimensions (power distance, individualism / collectivism, masculinity / feminine, uncertainty avoidance & long-term orientation) as variables moderation [16, 32].

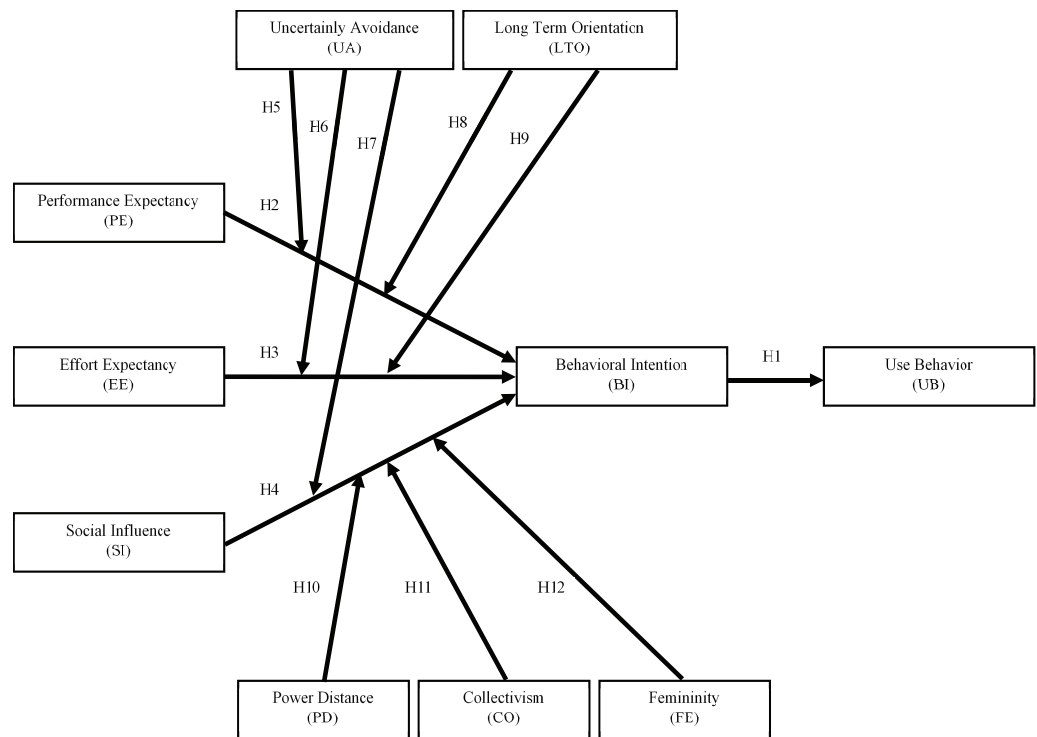


Figure 1: Conceptual Framework

Future research will test: (1) Effect of intention to use (behavioral intention) on intensity of use (use behavior), in the future. (2) Effect of expectations of improving performance (performance expectancy) on intention to use (behavioral intention). (3) Effect of expectations of ease of use (effort expectancy) on intention to use (behavioral intention). (4) The effect of social influence on behavioral intention. (5) The effect of expectations of improving performance (performance expectancy) on intention to use (behavioral intention) is moderated by a culture of avoiding uncertainty (uncertainty avoidance). (6) Effect of expectations of improving performance (performance expectancy) on intention to use (behavioral intention) moderated by long-term orientation culture. (7) Effect of expectations of ease of use (effort expectancy) on intention to use (behavioral intention) moderated by culture of avoiding uncertainty (uncertainty avoidance). (8) Effect of expectations of ease of use (effort expectancy) on intention to use (behavioral intention) moderated by long-term orientation culture. (9) The influence of social influences on intention to use (behavioral intention) is moderated by culture of avoiding uncertainty (uncertainty avoidance). (10). The influence of social influences on intention to use (behavioral intention) is moderated by a power distance culture. (11) The influence of social influences on intention to use (behavioral intention) is moderated by collectivism culture. (12) The influence of social influences on intention to use (behavioral intention) moderated by feminine culture.

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Conflict of Interest

The authors have no conflict of interest to declare.

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