

# Teleconsultation for Knowledge Exchange between Doctors – Formulating a Success Model

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**Abstract**— *The last decade has witnessed the arrival of teleconsultation in healthcare where doctors are offered a platform for online consultation with their colleagues. While the advantages of teleconsultation are well discussed, the issues of lukewarm acceptance among doctors are known to be the stumbling blocks for the success of its implementation. Looking at it from the perspectives of knowledge management, the opportunity for knowledge rich activities that could have been leveraged on through the knowledge exchange in teleconsultation is now at stake. This research studied the reasons behind teleconsultation underutilization and established that the inhibitors can be categorized into organizational, social, individual and systems factors. These factors are then aligned with constructs from relevant theories to propose a teleconsultation success model for knowledge exchange between doctors. The outcome is hoped to pave ways for further studies on the successful implementation of teleconsultation among doctors especially from the perspectives of knowledge management.*

**Keywords**— *Teleconsultation; healthcare; knowledge exchange; success model; knowledge management.*

## I. INTRODUCTION

The advent of teleconsultation in healthcare arena has brought along technological advancement to global healthcare. The discussion of its benefits was initially and still is to a great extent revolving around its ability to extend medical care to those residing in remote geographical location where access to medical care is limited. From the viewpoints of knowledge management (KM), teleconsultation offers a platform for knowledge exchange between doctors, presenting favorable circumstances for development of skills and expertise among doctors.

Teleconsultation in healthcare generally is divided into two categories, one is where the consultation is taking place between doctors and patients, and the other one is between doctors. This study will focus on the later one as this is where the opportunities for knowledge exchange and skills development among doctors are concentrated, and in line with the foundation of this research.

Despite the many positive opinions about teleconsultation, studies have shown that there have been many situations where doctors reject the ideas of utilizing teleconsultation in their daily medical consultation routines resulting in poor utilization of the system and consequently halting the knowledge rich activities that could have taken place.

The inhibitors for the underutilization of teleconsultation among doctors are identified from the study of literatures. Relevant theories are referred to in identifying the constructs

for the success model to be formulated. The constructs identified for the model are categorized into four factors namely, organizational, systems, social and individual. This paper will deliberate the development of Teleconsultation Success Model for Knowledge Exchange among doctors.

## II. LITERATURE REVIEW

The benefits of Teleconsultation in healthcare industry has been widely acknowledged in various literatures. [1], [2], [3], [4], [5]. Looking into the process involved in teleconsultation between doctors, it is apparent that there is a prominent presence of knowledge rich scenario taking place when doctors consult one another using the system. [6], [3], [1]. When a doctor request for opinion from another doctor, an exchange of knowledge from tacit to explicit will take place where the requesting doctor will document details on the case he needs consultation for. The knowledge is then conveyed via the system to the specialist being referred to and the specialist will go through the explicit knowledge presented and provide his/her opinion about the case in a form of verbal and a written report; at this stage executing a tacit to explicit knowledge exchange.

The above description of teleconsultation process between doctors have been found to match well with the KM activities that have been explained in well-known KM studies such as by Nonaka [7] and Wiig [8]. Hence it is apt to conclude that Teleconsultation system is a knowledge management system and research pertaining to Teleconsultation system can indeed be conducted from the viewpoints of KM [9] rather than the usual technology acceptance study.

While the Teleconsultation advantages are well recognized, the acceptance and adoption of the system may not be indicating an overall positive outlook. World Health Organization reported very little increase of healthcare organization involvement in Teleconsultation worldwide from 20% of telemedicine evaluation conducted in 2010 [10] to 24% in 2016. [11]. A study on telemedicine in Senegal reported many telemedicine initiatives have ended prematurely during the last two decades leaving only a few currently being used at public healthcare centers. [12]. In Brazil, there have been a report on teleconsultation underutilization which have shown a reduced number of usage from 1600/month to 700/month in a space of 2 years. [13]. Khan et al. [14] reported only one implementation of telemedicine for every 1100 cases in the USA based on the medical claim reports. These findings suggested that a sizeable

percentage of healthcare industries worldwide may not be regarding telemedicine as very important, hence resulting in poor utilization of the system among doctors. In return, this situation will lead to health care industries missing out in leveraging on the potential of Teleconsultation as KM.

The literatures reviewed in this study have suggested that Teleconsultation underutilization is largely a result of doctors' hesitation in accepting and implementing the system as part of their routine. [15], [6], [3], [5]. The requirement to operate an additional computer-based system in order to seek and share knowledge among doctors can be cumbersome and will leave doctors with more work in addition to their already hectic schedule [5]. In addition to that, as widely discussed in many technology acceptances studies, users do have their worries about their proficiency level in using a newly introduced computer system [16]. From the perspectives of knowledge exchange some doctors are concerned if their sharing of inputs on the medical case do not come across very comprehensible to the receiving end [17]. From social perspectives, doctors are worried if their peers may think less of them for opting to seek opinions from other doctors [17], [5]. Organization's commitment also played a very important role in ensuring the success of Teleconsultation implementation, where sound technological infrastructures are in place [18] and guidelines are established for the doctors to refer to [19], [20], [14]. This finding is consistent with The World Health Organization's 2016 Global Observatory of E-Health report which has noted that among the barriers for successful implementation of telemedicine is the lack of infrastructure and lack of legislation governing the initiatives, both of which are very much depending on the healthcare management's direction. [11].

### III. MODEL DEVELOPMENT

In order to propose a success model to address the problem statement, relevant constructs need to be established. Literatures on Teleconsultation and issues pertaining to its usage are studied to form a better understanding of the situation that leads to poor utilization of Teleconsultation. This is followed by investigating relevant theories and frameworks

from existing studies that can be referred to in identifying constructs for the development of the model and the hypothesis. The summary of the findings is discussed in the following subsections:

#### A. Issues Affecting Teleconsultation Among Doctors

To summarize the problems affecting the success of Teleconsultation, possible constraints for each stage in a Teleconsultation process is illustrated in Figure 1, in addition, the list of reasons for doctors' unwillingness to use Teleconsultation is compiled in Table I.

Looking at the factors contributing to the poor utilization of teleconsultation in hospitals, it is evident that in guaranteeing successful implementation of teleconsultation, considerations must be put on constructs pertaining to users' willingness to embrace the systems and organization's roles in making it happen.

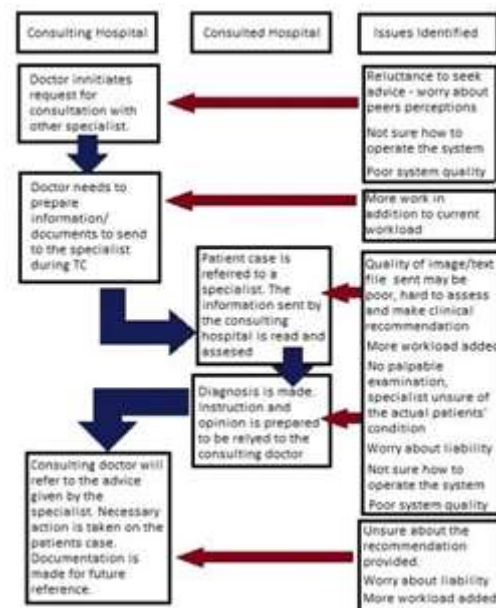


Fig. 1. Issues identified during Teleconsultation process

TABLE I. List of issues for the use of teleconsultation among doctors

Research by	Country	Teleconsultation Type	Reason Teleconsultation being under utilized
Lehoux et al. [17]	Canada	General care	The system does not necessarily support all the consultation activities. Some medical examination cannot be delivered through the system. There is a need for the users of teleconsultation system to be trained to be effective "transmitter to relay information correctly"
Luk [18]	Ghana	General Care	Poor infrastructure and telecommunication network to be able to support smooth exchange of knowledge between consulting doctors
Maarop et al. [19]	Malaysia	Various teleconsultation usage at public hospitals	Lack of guidelines and poor technical support to manage problems with the systems
Esterle et al. [5]	France	Elderly/Geriatric Health Care	Need to establish collaboration between doctors from different hospital – discomfort of the unfamiliar Extra workload in addition to looking after and diagnosing patients' conditions and preparing documentations to be sent through the system during the teleconsultation sessions. Consulted doctors are unable to conduct in person medical examination on patients hence making decision and recommendation can be challenging
Alajmi et al. [20]	Kuwait	Various health care disciplines	Doctors are not keen to use recording and documenting tools during medical consultation
Khan et al. [14]	USA	Various health care disciplines	Concerns over liability and legislation in case wrong diagnosis was given to consulting doctors.

In summary, issues in the implementation of teleconsultation can be concluded to revolve around four main factors; organizational, where a certain direction and policy is expected to come from the management in governing the teleconsultation initiatives; system, where a certain level of functionality and standard is expected from the computer system to be able to support knowledge-based activities; social, reflecting on the doctors' relating and trusting their peers judgement on their act of undertaking Teleconsultation; and individual, reflecting on the doctors' perception of their efficacy level in using the system. [17], [21], [5], [22], [3]

**B. Identifying the Constructs for Model Development**

Models and theories discussing successful implementation of KMS from systems, organizational, social and individual perspectives are studied and the constructs from these models

are mapped to the success and failure accounts established in the review of teleconsultation and telemedicine literatures.

Relevant theories or models with similar constructs were referred to in taking advantage of the fact that these constructs have been previously validated in different scenario to achieve nomological validity of constructs as suggested by Straub et al. [23], stating that theoretically derived constructs that have been tested can be considered valid. Hence in this research, reference is made to pertinent constructs from existing research.

Table II compiles the established issues into categories of factors affecting telemedicine implementation as adopted from a study on teleconsultation acceptance in Brazil by Alkmim et al. [24] and recommends potential theoretical studies to identify suitable constructs for the success model that is to be formulated.

TABLE II. Established constructs and the theoretical theories they originated from

Reasons for Teleconsultation being under utilized	Category of factors affecting telemedicine implementation (adopted from Alkmim et al., 2015)	Relevant Constructs from existing studies
The system does not necessarily support all the consultation activities. Some medical examination cannot be supported and delivered through the use of the Teleconsultation system.	Technical (Usage of the system)	System Quality construct from DeLone & McLean IS Success Model [25] Knowledge Content Quality construct from DeLone & McLean IS Success Model [25]
There is a need for the users of Teleconsultation system to be trained in order to relay information correctly	Socioeconomics (Perception of benefits and usefulness of telemedicine for patients and professionals)	Self-efficacy, originated from Perceived Behavioural Control construct in Ajzen's Theory of Planned Behaviour [26] Leadership construct from Ali KMS Success Model [27]
Poor infrastructure and telecommunication network to be able to support smooth exchange of knowledge between consulting doctors	Technical (Usage of the system)	System Quality construct from DeLone & McLean IS Success Model [25] Knowledge Content Quality construct from DeLone & McLean IS Success Model [25]
Lack of guidelines and poor technical support to manage problems with the systems	Organizational (Organizational structure of the center to develop, implement, and maintain a telehealth service)	Leadership construct from Ali KMS Success Model [27]
Need to establish collaboration between doctors from different hospital – discomfort of the unfamiliar individuals. Worry about perceptions by colleagues about using Teleconsultation	Human (Influence of technology in the human relationships and in the professional role in the society)	Subjective Norm originated from Norm construct in Ajzen's Theory of Planned Behaviour [26]
Extra workload in Teleconsultation may lead to some sense of frustration among the practitioners as they are not able to get to the essence of their job quickly. Consulted doctors are unable to conduct in person medical examination on patients hence making decision and recommendation can be challenging and doctors may not be satisfied with their own diagnosis	Socioeconomics (Perception of benefits and usefulness of telemedicine for patients and professionals)	Perceived Usefulness & User Satisfaction constructs from DeLone & McLean IS Success Model [25] Outcomes expectation originated from Attitudes construct in Ajzen's Theory of Planned Behaviour [26]
Concerns over liability and legislation in the event where erroneous diagnosis was given to consulting doctors. Unsure about the medical recommendation given by unfamiliar colleagues	Socioeconomics (Perception of benefits and usefulness of telemedicine for patients and professionals)	Trust originated from Attitudes construct in Ajzen's Theory of Planned Behaviour [26]
Doctors are not keen to use recording and documenting tools during medical consultation	Socioeconomics (Perception of benefits and usefulness of telemedicine for patients and professionals)	Perceived Usefulness & User Satisfaction constructs from DeLone & McLean IS Success Model [25]

From the above findings, it is apparent that the technical quality of Teleconsultation systems plays an important role to ensure smooth transferring of knowledge between doctors. Clear images and comprehensible information on the medical condition to be consulted are vital for the experts' decision making. These requirements are in line with what had been

discussed in DeLone and McLean IS Success Model [25] through System Quality and Knowledge Content Quality constructs.

The literatures on teleconsultation have also reported doctors concern about finding the system adding more to their work and not getting their job completed as well as they would

have if they were to meet the patients in person. This situation describes the Perceived Usefulness and User Satisfaction constructs, also from DeLone and McLean [25]. The outcome expectancy the doctors are having from using the system can be described from Attitudes construct in Ajzen’s Theory of Planned Behaviour [26].

Doctors are also facing situations where they are not so sure how to operate the Teleconsultation system, especially when the system is newly introduced. In addition, doctors may feel unsure if the information they have conveyed are comprehensible and the recommendation made about the medical condition being consulted on are accurate. This defines a self-efficacy situation which originates from Perceived Behavioural Control in Ajzen’s Theory of Planned Behaviour [26]. Under the same theory, construct Norm is identified to represent the situation in which doctors’ intention to use the Teleconsultation systems relies on what their colleagues would have thought of them if they were to use the system.

Trust issues are also identified as one of the reasons for Teleconsultation underutilization where doctors may find it hard to trust medical recommendation from colleagues they are unfamiliar with. This is consistent with the Social Capital Theory’s Trust construct which originates from Attitudes construct in Ajzen’s Theory of Planned Behaviour [26]

Directives from the management are also found to be important, as the management is the one with the ultimate mandate to ‘make or break’ the implementation of Teleconsultation in hospitals. Ali’s description of Leadership construct in their KM Success Model [27] will be used in the development of the research model.

From the above findings, the theoretical foundations that are going to be referred to in identifying the constructs for the formulation of the research model in this study are summarized in Table III:

TABLE III. theoretical foundations this study will be referring to

Factors	Constructs	Constructs Origin
Systems	Knowledge Content Quality	DeLone & McLean IS Success Model (2003)
	Systems Quality	
	Perceived Usefulness	
	User Satisfaction	
Organizational	Leadership	Ali KMS Success Model (2017)
	Outcome Expectancy	Ajzen’s Theory of Planned Behaviour (1985)
Social	Subjective Norms	Ajzen’s Theory of Planned Behaviour (1985)
	Trust	
Individual	Self-Efficacy	Ajzen’s Theory of Planned Behaviour (1985)

C. Formulation of Teleconsultation Success Model

Nine constructs are identified to have influenced the use of Teleconsultation system for knowledge exchange namely, knowledge content quality, systems quality, perceived usefulness, user satisfaction, leadership, outcomes expectancy, subjective norms and trust.

Figure 2 shows the Teleconsultation Success Model which has been formulated based on the input established from the literatures. In establishing the relationship between the identified constructs and developing the hypothesis for each construct, Teleconsultation and Telemedicine scenario from the existing literatures are referred to. The list of hypotheses to represent the model is established as follows:

- H1 Knowledge Content Quality will lead to Perceived Usefulness of Teleconsultation system.
- H2 Knowledge Content Quality will lead to user satisfaction

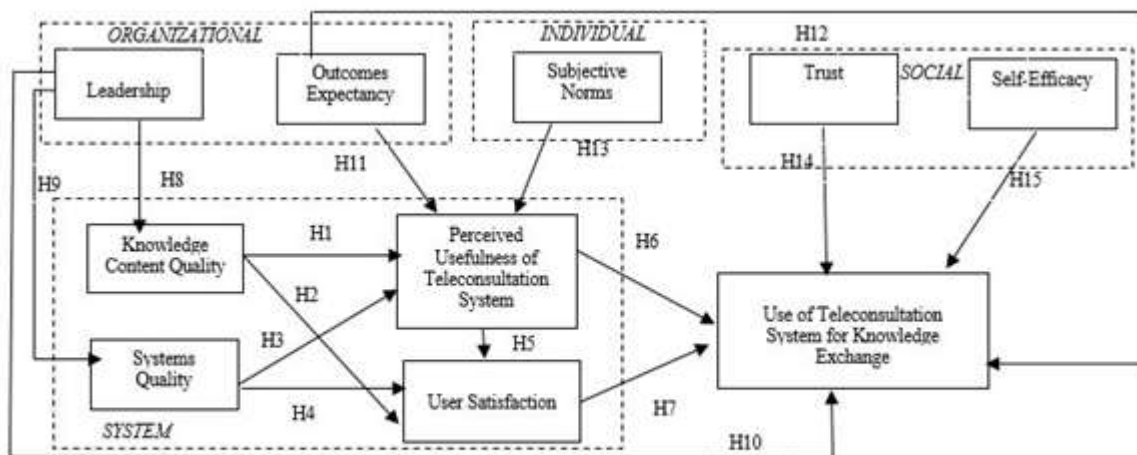


Fig. 2 Proposed Success Model for Knowledge Exchange Between Doctors

H3 System Quality will lead to Perceived Usefulness of Teleconsultation system

H4 System Quality will lead to user satisfaction

- H5 Perceived usefulness of Teleconsultation system will lead to user satisfaction
- H6 Perceived usefulness of Teleconsultation system will lead to Using Teleconsultation for knowledge exchange
- H7 User Satisfaction will lead to Using Teleconsultation for knowledge exchange
- H8 Leadership will lead to Knowledge Content Quality
- H9 Leadership will lead to System Quality
- H10 Leadership will lead to Using Teleconsultation for knowledge exchange
- H11 Outcomes Expectancy will lead to Perceived Usefulness of Teleconsultation system
- H12 Outcomes Expectancy will lead to Using Teleconsultation for knowledge exchange
- H13 Subjective Norms will lead to Perceived Usefulness of Teleconsultation system
- H14 Trust will lead to Using Teleconsultation for knowledge exchange
- H15 Self Efficacy will lead to Using Teleconsultation for knowledge exchange

Items to assess the validity of the above hypothesis will be developed based on the existing research that had used similar constructs. The validation will be done through questionnaires which will be distributed to doctors in Malaysia who are using Teleconsultation systems. The list of hospitals and doctors involved with Teleconsultation initiative will be obtained from Malaysia’s Ministry of Health. There are 40 hospitals with teleconsultation facilities and only certain departments are using the system. Hence the population size for Teleconsultation users nationwide is not large.

Questionnaires will be administered online to approximately 400 samples. A minimum of 100 responses is expected to be obtained for a minimum of 25% response rate. Data collected will be analyzed and the model will be validated and reported separately.

#### IV. CONCLUSION

The outcome for this study at this stage is to establish the issues that have led to poor utilization of Teleconsultation among doctors, map them to the relevant constructs in existing KM and IS studies and propose a success model for Teleconsultation use among doctors for knowledge exchange

Teleconsultation system have been acknowledged to be of type KMS that can be leveraged on by healthcare industries to build medical expertise and preserve medical knowledge among their knowledge workers. However, the initiative may not be very successful if doctors are not buying in the ideas and not very keen in utilizing the system. To realize Teleconsultation’s full potential, it is important that factors affecting the use of Teleconsultation is understood.

In this study, literature review findings on teleconsultation underutilization issues can be categorized into organizational, systems, social and individual, and mapped accordingly to constructs from relevant studies. Given that Teleconsultation has been established to be an Information Systems of type KMS, the mapping of underutilization factors which have been identified from the study of literatures are done against existing KMS and IS theories such as Ali’s KM Success Model and

DeLone and McLean IS Success Model. In studying the reasons for poor acceptance and adoption of Teleconsultation among doctors, the findings have shown that the issues are mainly revolving around doctors’ concerns on trust, outcome expectations, self-efficacy and how their peers’ see and accept the system. These concerns are consistent with the constructs used in Ajzen’s Theory of Planned Behaviour

Nine constructs are identified to have influenced the use of Teleconsultation system for knowledge exchange namely, knowledge content quality, systems quality, perceived usefulness, user satisfaction, leadership, outcomes expectancy, subjective norms and trust. They are integrated into a Teleconsultation Success Model for knowledge exchange between doctors. The model will be validated by medical practitioners from Malaysia’s public hospitals who are currently using teleconsultation system. The result of this model validation will be discussed in a separate publication.

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#### REFERENCES

- [1] Deldar, K., Bahaadinbeigy, K., & Tara, S. M. (2016). Teleconsultation and clinical decision making: a systematic review. *Acta Informatica Medica*, 24(4), 286
- [2] Som, M. M., Norali, A. N., & Ali, M. M. (2010, October). Telehealth in Malaysia—An overview. In *Industrial Electronics & Applications (ISIEA), 2010 IEEE Symposium on* (pp. 660-664). IEEE.
- [3] Maarop, N., Win, K. T., Masrom, M., Singh, H., & Singh, S. (2011). Exploring factors that affect teleconsultation adoption: In the case of Malaysia.
- [4] Chapman, K. R., & Arunatileka, S. M. (2010, July). Teleconsultation roadmap—the path to telemedicine. In *e-Health Networking Applications and Services (Healthcom), 2010 12th IEEE International Conference on* (pp. 74-80). IEEE
- [5] Esterle, L., & Mathieu-Fritz, A. (2013). Teleconsultation in geriatrics: impact on professional practice. *International journal of medical informatics*, 82(8), 684-695
- [6] Paul, D. L. (2006). Collaborative activities in virtual settings: A knowledge management perspective of telemedicine. *Journal of Management Information Systems*, 22(4), 143-176.
- [7] Nonaka, I (1991). Models of knowledge management in the West and Japan.
- [8] Wiig, K. M. (1993). *Knowledge management foundations: thinking about thinking: how people and organizations create, represent, and use knowledge* (Vol. 1). Arlington, TX: Schema press.
- [9] Ramli, R., & Ali, N. (2018, October). Teleconsultation as Knowledge Management System: Recognizing the Issues Contributing to its Underutilization in Hospitals. In *2018 International Conference on Advanced Computer Science and Information Systems (ICACSIS)* (pp. 277-282). IEEE.
- [10] World Health Organization. (2010). *Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth*. 2010. Global Observatory for eHealth Series.
- [11] World Health Organization. (2016). *Global Observatory for eHealth Publications*
- [12] Ly, B. A., Labonté, R., Bourgeault, I. L., & Niang, M. N. (2017). The individual and contextual determinants of the use of telemedicine: A descriptive study of the perceptions of Senegal's physicians and telemedicine projects managers. *PLoS one*, 12(7), e0181070.
- Pessoa, C., Sousa, L., Ribeiro, A., Oliveira, T., Silva, J. L., Alkmim, M. B., & Marcolino, M. S. (2016). Description of Factors Related to the Use of the Teleconsultation System of a Large Telehealth Service in

- Brazil—the Telehealth Network of Minas Gerais. *Journal of the International Society for Telemedicine and eHealth*, 4, 4-1.
- [13] Khan, F. (2016). The Uberization of Healthcare: The Forthcoming Legal Storm over Mobile Health Technology's Impact on the Medical Profession. *Health Matrix*, 26, 123
- [14] Hu, P. H., Chau, P. Y., Chan, Y. K., & Kwok, J. C. K. (2001, January). Investigating technology implementation in A neurosurgical teleconsultation program: A case study in Hong Kong. In *System Sciences, 2001. Proceedings of the 34th Annual Hawaii International Conference on* (pp. 9-pp). IEEE
- [15] Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of Measure and Initial Test.
- [16] Lehoux, P., Sicotte, C., Denis, J. L., Berg, M., & Lacroix, A. (2002). The theory of use behind telemedicine: how compatible with physicians' clinical routines? *Social science & medicine*, 54(6), 889-904
- [17] Luk, R., Ho, M., & Aoki, P. M. (2008, April). Asynchronous remote medical consultation for Ghana. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 743-752). ACM.
- [18] Maarop, N., Win, K. T. & Singh HS, S. (2014). Understanding demographics influence on Teleconsultation acceptance in hospital: A mixed-method study. *Journal of Advanced Management Science*, 2 (2), 117-122.
- [19] Alajmi, B., Marouf, L., & Chaudhry, A. S. (2015). Knowledge management (KM) practices-a study of KM adoption among doctors in Kuwait. *World Academy of Science, Engineering and Technology, International Journal of Industrial and Manufacturing Engineering*, 2(1).
- [20] Kairy, D., Lehoux, P., & Vincent, C. (2014). Exploring routine use of telemedicine through a case study in rehabilitation. *Revista Panamericana de Salud Pública*, 35, 337-344
- [21] Saliba, V., Legido-Quigley, H., Hallik, R., Aaviksoo, A., Car, J., & McKee, M. (2012). Telemedicine across borders: a systematic review of factors that hinder or support implementation. *International journal of medical informatics*, 81(12), 793-809.
- [22] Straub, D., Boudreau, M. C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information systems*, 13(1), 24.
- [23] Alkmim, M. B., Marcolino, M. S., Figueira, R. M., Sousa, L., Nunes, M. S., Cardoso, C. S., & Ribeiro, A. L. (2015). Factors associated with the use of a teleconsultation system in Brazilian primary care. *Telemedicine and e-Health*, 21(6), 473-483.
- [24] Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of management information systems*, 19(4), 9-30.
- [25] Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11-39). Springer, Berlin, Heidelberg.
- [26] Tretiakov, A., Whiddett, D., & Hunter, I. (2017). Knowledge management systems success in healthcare: Leadership matters. *International journal of medical informatics*, 97, 331-340.