The Use of Electronic Medical Record System on Dynamic Capabilities and Physician Productivity

Ewilly J. Y. Liew
Monash University, Malaysia, ewilly.liew@monash.edu

Yeh-Han Poh
University Malaya Medical Centre, Malaysia, pohyh@ummc.edu.my

Sharon G. M. Koh
Monash University, Malaysia, koh.geokmay@monash.edu

Juliana A. French
Monash University, Malaysia, juliana.french@monash.edu

Pei-Lee Teh
Monash University,Malaysia, teh.pei.lee@monash.edu

Liew, E.J.Y., Poh, Y.H., Koh, S.G.M., French, J.A., & Teh, P.L. (2018). The use of electronic medical record system on dynamic capabilities and physician productivity. In *Proceedings of The 18th International Conference on Electronic Business* (pp. 673-681). ICEB, Guilin, China, December 2-6.

The Use of Electronic Medical Record System on Dynamic Capabilities and Physician Productivity

(Full Paper)

Ewilly J.Y. Liew *, Monash University, Malaysia, ewilly.liew@monash.edu
Yeh-Han Poh, University Malaya Medical Centre, Malaysia, pohyh@ummc.edu.my
Sharon G.M. Koh, Monash University, Malaysia, koh.geokmay@monash.edu
Juliana A. French, Monash University, Malaysia, juliana.french@monash.edu
Pei-Lee Teh, Monash University, Malaysia, teh.pei.lee@monash.edu

ABSTRACT

Transiting from manual to electronic medical record (EMR) system is a managerial concern due to human resistance to change and potential interruption to the existing workflow operation. Using PLS-SEM, findings show that doctors' perceived usefulness and ease of using the EMR system can be leveraged to enhance their dynamic capabilities for knowledge acquisition and deployment, thus having a positive impact on physician productivity. The study contributes towards policies and strategies that can enhance doctors' dynamic capabilities to leverage the implementation of the EMR system towards improving physician productivity from a developing country perspective.

Keywords: Electronic medical record, intensive care unit, information systems, dynamic capabilities, physician productivity, developing country.

* Corresponding Author

INTRODUCTION

The United Nations' Sustainable Development Goal for "good health and wellbeing" calls for better health coverage to promote wellbeing by 2030. In response to the call, countries are investing in healthcare services to ensure healthier lives to promote wellbeing. As such, the information technology platform is identified and utilized by health care providers to improve patient care and safety while ensuring universal health coverage. Studies often relate quality healthcare with patient mortality and readmission rates, patients' satisfaction with quality care or physical health, infrastructure, and availability of preventative care (Legatum Prosperity Index, 2017). The prevalence of data and extensive use of information systems in developed countries has urged the implementation of electronic medical record (EMR) system in the developing countries for public healthcare development. The EMR system has radically transformed the healthcare sector in developed countries and evidence points towards savings of an estimated USD $81 billion in United States alone (Hillestad et al, 2005). Subsequently, the adoption of EMR systems can lead to improved patient care, reduced medical errors among medical practitioners, and improved transmission of laboratory tests. In addition, the EMR has also benefited day-to-day operations through efficient admission and billing charges.

The EMR system being a component of the available healthcare information systems is being implemented in stages by hospitals in developing countries. As the EMR system moves healthcare information and knowledge resources towards an integrated interface, an effective use of the system would improve staff efficiency, accountability, and error reduction in hospitals as it systematically manages patients' clinical data. Physicians are human and not infallible hence they are unable to be the authority in every medical discipline even within their own specialty, they cannot claim to 'know everything'. The use of EMR reduces human error and improves medical diagnostics as physicians do not work in silos and are able to make better patient care decisions based on available information. In this age of rapid medical advancement, doctors have to rely on reliable systems to ensure real-time access to information and enable regular communication between teams of multidisciplinary specialists involved in the care of a patient. In addition, little is known about physicians' belief about the usage of the EMR to aid decision-making from a developing country perspective and the drivers of IT use behavior in the context of healthcare delivery. Empirical support on the use of EMR system has so far been varied and Western-centric. The high costs associated with the implementation of the EMR is another deterrent from the institution's perspective. Unlike a profit-making firm, many hospitals struggle to measure the return on investment (ROI) from IT applications. Berner, Detmer, and Simborg (2005) further illustrates that in the early years EMR adoption, hospitals struggle with "technology immaturity, health administrator focus on financial systems, application "unfriendliness," and physician resistance". However, changes in government policies, computer literacy and physicians' attitudes have led to better acceptance of the EMR in the United States. From a developing country's perspective, the costs associated with healthcare technology investment has not been uniformly justified, often leading to slow adoption of the EMR. Currently, countries in Southeast Asia spend between 3-5% of GDP on health expenditure (Health, Nutrition and Population Statistics, 2018).

The study integrates theoretical perspectives from the information systems and dynamic capabilities literature to examine the impact of using the EMR system on individual doctors' dynamic capabilities for knowledge acquisition and deployment as well as physician productivity during the switch from manual to electronic workflow operation. Such examination would provide insights on whether the benefit of implementing the EMR system fulfills its potential to curtail the heavy cost of healthcare technology investment. Three research objectives would be addressed as follows:

1. To examine doctors' technology perceptions of using the EMR system on dynamic capabilities enhancement and physician productivity.

2. To examine the effect of doctors' dynamic capabilities enhancement on physician productivity.

3. To examine whether doctors' dynamic capabilities enhancement mediates technology perceptions of using the EMR system on physician productivity.

Results from the study will inform policy implications on using the EMR system for leveraging doctors' dynamic capabilities and physician productivity from a developing country perspective. This is necessary since numerous policy implication can be proposed based on the usage and acceptance of the EMR from the perspective of health care practitioners.

The structure of this paper is as follows. In the following section, we provide a review of current literature on the role of dynamic capabilities to inform the theoretical framework of the study. This is followed by the conceptual framework which presents the hypotheses development of the study. Next, the empirical methodology section outlines the data, sampling design, and methodology employed in the study. The result section presents the measurement and structural models obtained from the multivariate analysis, followed by the discussion section. Finally, the conclusion section summarizes the limitations, future research direction, and concluding remarks of the study.

LITERATURE REVIEW

While rapid technological development presents great potential for healthcare advancement, the actual use of these technologies may be resisted by individual healthcare professionals for fear of changing their work processes, consequently affecting their job performance (Kankanhalli et al., 2016). This may further impair the allocation of technology and knowledge resources that would impact not only patient care but also socioeconomic outcomes for various stakeholders in the community. The literature often views technological infrastructure as a trajectory to effective knowledge management which would have a positive impact on job performance (Easterby-Smith & Prieto, 2008). An emerging aspect of knowledge management is the development of dynamic capabilities.

Dynamic capabilities are the ability of an organization to manage its vast resources in a rapidly changing environment, allowing for improvisations where necessary. The concept, first defined by Teece and Pisano was built on a resource-based view (Barney, 1991) dealing with the evolutionary nature of resources and capabilities in a rapidly evolving environment. However, having resource advantage is necessary but not sufficient for gaining competitive advantage. To achieve competitive advantage, the enhancement of distinctive capabilities is essential to make better use of organizational resources (Wang & Ahmed, 2007).

The development of dynamic capabilities can be understood as an evolving process based on the interaction between daily operation and knowledge-creating activities. It is not a one-off ad-hoc problem-solving mechanism (Zahra et al., 2006). The enhancement of dynamic capabilities is an ongoing process that would redefine the knowledge base of organizations or individuals, which eventually would lead to value creation (Barreto, 2010).

In the healthcare industry, individual healthcare professionals should not only be able to perform their duties (operational capabilities) but comprehend changes in their external environment, seize the opportunity to utilize technology and knowledge resources or competencies to meet new challenges (Teece, 2007) as and when they arise in healthcare industry. The quality of job performed by individual healthcare professionals would directly ensure for the quality of healthcare services provided, which may further impact patient care and socioeconomic outcomes at the macro-level.

Furthermore, individual healthcare professionals often "learn by doing" (Cohen & Levinthal, 1990) and are called to provide accurate diagnosis involving life-and-death decisions. Learning is central to developing dynamic capabilities (Cohen & Levinthal, 1990). It is as they learn by accessing explicit patient data and assessing these data based on tacit medical knowledge that they are able to articulate sound diagnosis on patients. Trial and error, improvisation, and imitation (Zahra et al., 2006) may also be useful in the process of reconfiguring knowledge resources and competencies to better address the medical conditions at hand. When individual healthcare professionals are actually engaging in such knowledge-creating activities, they are indeed learning and consciously develop their dynamic capabilities for better job performance (Easterby-Smith & Prieto, 2008).

Literature discussed thus far has pointed out that the development of dynamic capabilities will lead to change in operational capabilities and improvement in job performance. This study seeks to address an important literature gap, which is about the possible impact of actual use behavior of healthcare technology on the relationship between dynamic capabilities and job performance. Increasingly, explicit healthcare and patient data are being digitized and migrated to various technological platforms. Individual healthcare professionals are also increasingly required to use technology in their day-to-day operational activities at work. Based on the literature discussed, the use of technology in healthcare may be akin to operational capabilities, which are said to have an impact on individual's performance. However, it is unclear how the quality of their actual use behavior of healthcare technology may affect their individual performance. It is also unclear whether their actual use behavior of these technologies may have a farther impact on patient care and socioeconomic outcomes at the broader level.

Should the actual use of quality technology enhance performance in making informed decisions, this will subsequently influence better patient care which leads to improved wellbeing. This improved performance will encourage other departments to adopt the quality use of healthcare technology in their daily operations. Furthermore, in terms of policy formulation in the healthcare industry, the government may choose to implement the quality use of technology (as part of process flow) as a result of the value that it adds to the industry and society.

CONCEPTUAL FRAMEWORK

Drawing from the information systems and dynamic capabilities literature, the study develops a research model (Figure 1) that examines the relationship between technology perceptions (perceived usefulness and perceived ease of use), dynamic capabilities, and physician productivity. The study focuses on individual doctors who are at the frontline of interactions with the EMR system reviewing patients' information, making decisions, executing treatments, and entering patients' updates into the system (Bhargava & Mishra, 2014).

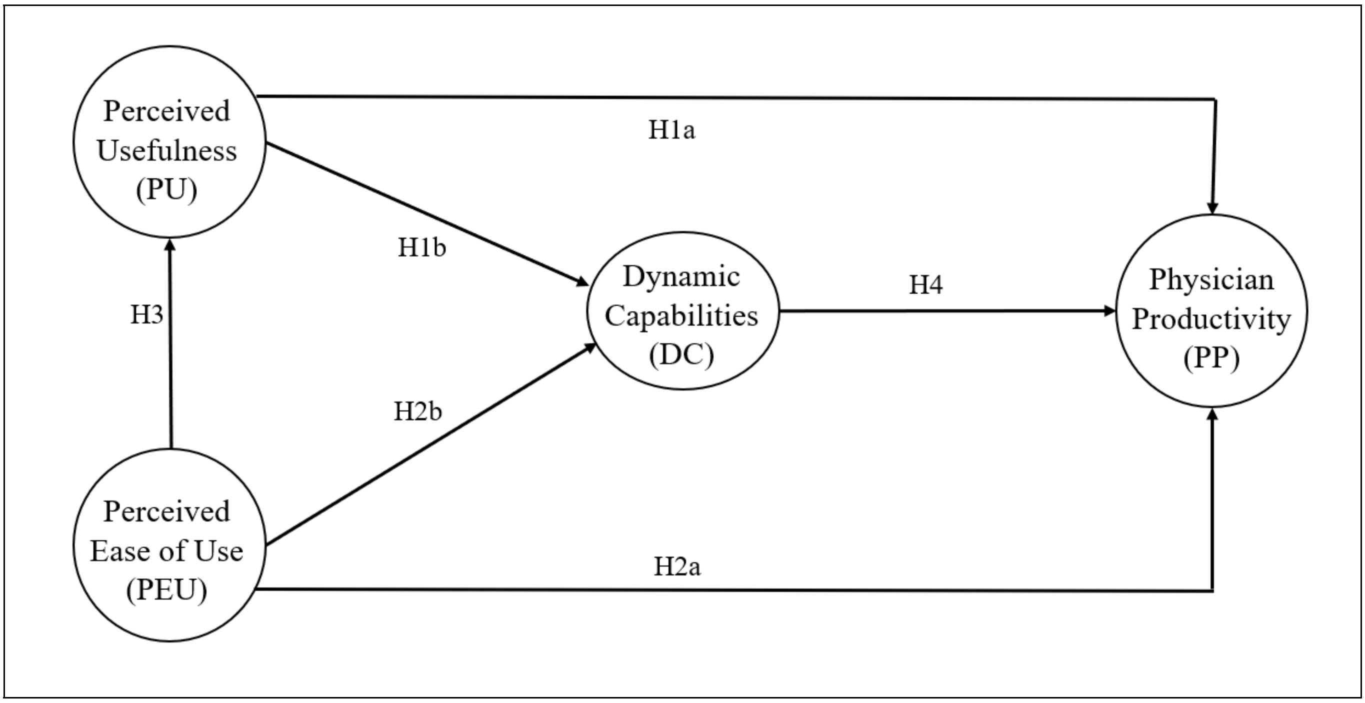


Figure 1: Research Model

The information systems research identifies two technology perceptions that have successfully explained most system use (Venkatesh, Morris, Gordon, & Davis, 2003). Originally developed in Davis' (1989) Technology Acceptance Model (TAM), perceived usefulness (PU) is defined as the degree to which an individual believes that using an EMR system would enhance his or her job performance while perceived ease of use (PEU) is defined as the degree to which an individual believes that using an EMR system would be easy and free from effort. PU has always been the primary determinant of system adoption and use (King & He, 2006; Venkatesh et al., 2003). With an already busy workload, the implementation of EMR system may exacerbate the burden on doctors who show significant concerns over their responsibilities for medical decisions, clinical documentation, patient care, administration issues, and research especially in teaching hospitals (Bhargava & Mishra, 2014; Sykes, Venkatesh, & Rai, 2011). This study postulates that doctors who find it useful to use the EMR system for their operational routine and performance benefits would be likely to use it for enhancing their dynamic capabilities and physician productivity. Thus, hypotheses 1 are as follows:

H1a: Perceived usefulness (PU) has a direct positive effect on using the EMR system for physician productivity.
H1b: Perceived usefulness (PU) has a direct positive effect on using the EMR system for dynamic capabilities enhancement.

Most EMR systems are designed with multiple screens and rigid navigation options that are not customized for doctors. The initial learning time may put off doctors in transiting from their habitual use of the manual system to the new EMR system. Furthermore, some doctors may perceive that learning to use and master a new EMR system is a bad trade-off as they rather spend their time being more involved in patient care. Although Sykes et al. (2011) find that only PU is a key factor influencing doctors' use of the EMR system, the study also points out the potential association between PEU and physician productivity. This study postulates that doctors who find it easy and comfortable to use the EMR system would be likely to use it for enhancing their dynamic capabilities and physician productivity. Thus, hypotheses 2 are as follows:

H2a: Perceived ease of use (PEU) has a direct positive effect on using the EMR system for physician productivity.
H2b: Perceived ease of use (PEU) has a direct positive effect on using the EMR system for dynamic capabilities enhancement.

Davis (1989) and Venkatesh (Venkatesh, 2000; Venkatesh et al., 2003) discover that PEU can directly impact PU for technology adoption and use, but not otherwise. The positive correlation between PEU and PU is also observed in the use of EMR system (Sykes et al., 2011). This study postulates that doctors who find it easy and comfortable to use the EMR system would be likely to overcome the perceived difficulty in using it and willing to spend time learning to master any useful aspects of the system. Hence, hypothesis 3 is as follows:

H3: Perceived ease of use (PEU) has a direct positive effect on perceived usefulness (PU) of using the EMR system.

An obvious advantage of implementing the EMR system is to move away from information silos among multidisciplinary healthcare professionals towards an integrated interface. Decision making in hospitals and especially in hospital units that require high vigilance such as the Intensive Care Unit (ICU) is a complex process requiring sound medical knowledge from appropriate information sources. Quick and accurate decision may be the difference in preventing deterioration or pulling patients out of life-threatening conditions. As the EMR system helps to facilitate patient information and consolidate multidisciplinary knowledge resources, this study postulates that using the EMR system would be likely to enhance doctors' dynamic capabilities for knowledge acquisition and deployment in practical aspects of patient care, and thus having a positive impact on physician productivity. Hence, hypothesis 4 is as follows:

H4: The use of EMR system positively and directly enhances dynamic capabilities (DC) on physician productivity (PP).

EMPIRICAL METHODOLOGY

Data And Sampling Designs

This study was part of a larger study conducted in the Intensive Care Unit (ICU) of a tertiary government hospital that was implementing an in-house developed EMR system. The ICU is renowned in Malaysia for its medical expertise and excellent patient care. In this study, the ICU was selected because it was the last hospital unit to fully implement the EMR system across all its operations and the implementation has faced much resistance from doctors. A clustered random sampling technique was employed to reach out to all doctors (in the categories of specialists, medical officers, and house officers) involved with patient care in the ICU. The sampling frame contains a list of all doctors who were working in the ICU during the period of our data collection. The doctors were given the option to complete either a paper-based or an online-based questionnaire survey. Our survey questions were part of a larger survey administrated in the hospital. A total of 60 valid responses was obtained, yielding an effective response rate of about 90%.

Content Validity

To ensure for content validity of the multi-item scales used in the study, readily established instruments were adapted from prior research. Instruments measuring perceived ease of use and perceived usefulness of using the EMR system were obtained from Sykes, Venkatesh, & Rai (2011). Instruments measuring dynamic capabilities enhancement were obtained from Sher and Lee (2004). Instruments measuring physician productivity were obtained from Bhargava and Mishra (2014). All items were measured on a 7-point Likert scale.

RESULTS

The empirical results were obtained from a multivariate analysis based on partial least square structural equation modelling technique (PLS-SEM). The SmartPLS 3 software was used to estimate the measurement and structural models (Ringle, Wende, &

Becker, 2015). The PLS-SEM was employed as it allows for exploratory analysis and distribution-free assumptions to be made on small sample size.

Measurement Model

Measurement model was evaluated to ensure for construct reliability and validity, particularly the convergent and discriminant validity of the measurement model. From Table 1, the results show good indicator reliability with most items loadings above 0.708. PU04 was the only nonconforming item with indicator loadings less than 0.60, hence was removed from further analysis. DC08 and PP05 had item loadings between 0.60 and 0.708, but a further test showed that they did not significantly threaten construct reliability and validity, hence was retained for further analysis.

Table 1: Measuring Items Loadings

Construct	Item	Description	Loadings
Perceived Usefulness (PU)	PU01	I believe EMR would be useful in my job.	0.913
	PU02	Using EMR will enable me to accomplish tasks more quickly.	0.934
	PU03	Using EMR will increase my productivity.	0.961
Perceived Ease of Use (PEU)	PEU01	My interaction with EMR would be clear and understandable.	0.829
	PEU02	It would be easy for me to become skillful at using EMR.	0.904
	PEU03	I would find EMR to be easy to use.	0.895
	PEU04	Learning to operate EMR would be easy for me.	0.899
Dynamic Capabilities (DC)	DC01	EMR enhances learning effectiveness of new knowledge.	0.721
	DC02	EMR enhances decision quality.	0.906
	DC03	EMR enhances capabilities of communication and coordination.	0.866
	DC04	EMR enhances responsiveness.	0.849
	DC05	EMR enhances integration in hospital practice.	0.829
	DC06	EMR enhances accumulation of knowledge.	0.772
	DC07	EMR enhances capabilities of resource deployment.	0.799
	DC08	EMR enhances patient relationship.	0.699
	DC09	EMR enhances trust with healthcare providers.	0.792
	DC10	EMR enhances unimitability (unique) of strategic knowledge asset.	0.749
Physician Productivity (PP)	PP01	EMR allows me to easily synthesize information from multiple sources.	0.878
	PP02	EMR allows me to make patient treatment decisions efficiently.	0.895
	PP04	I enter a lot of information about patients, which can be helpful to other physicians.	0.708
	PP05	On the balance, I do more information entry than information synthesis using EMR.	0.651

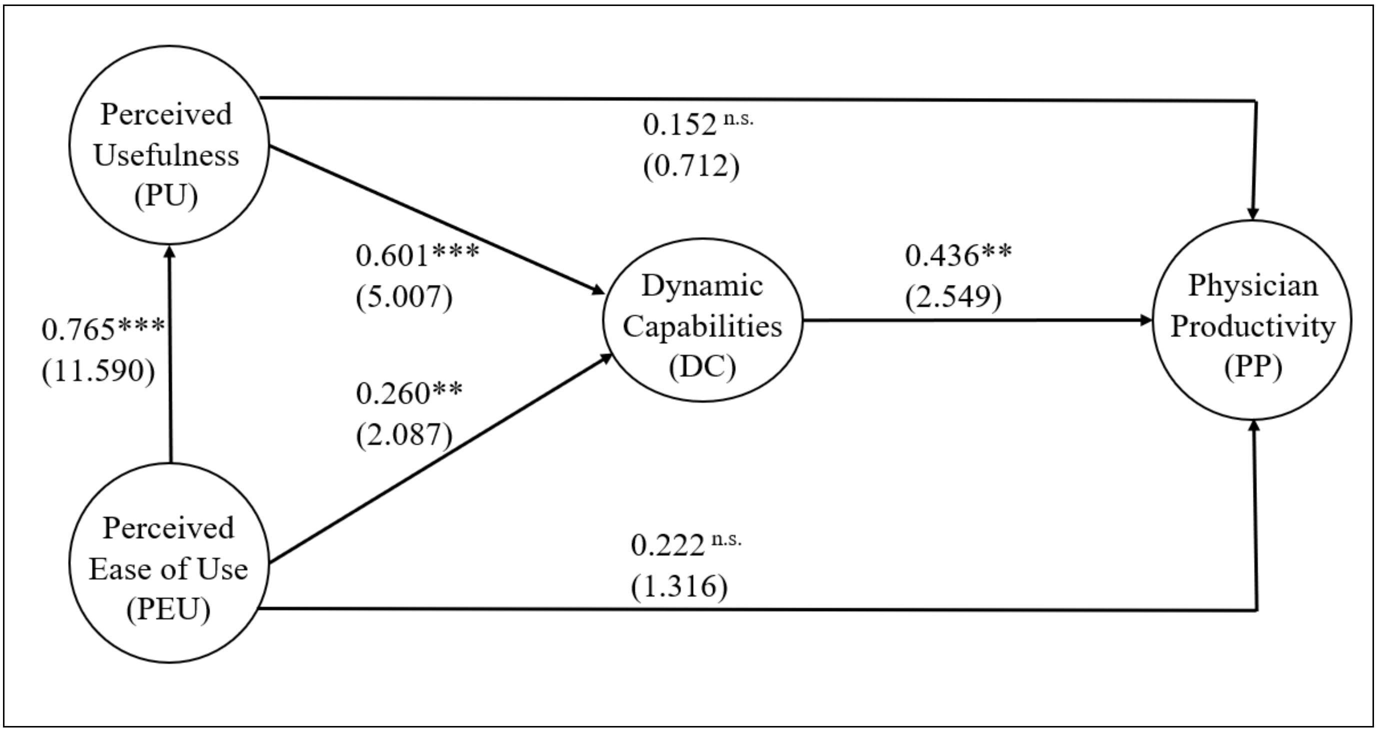
From Table 2, the results show that all multi-item scales had good construct reliability with composite reliability (CR) higher than 0.70 and good construct validity with average variance extracted (AVE) higher than 0.50. Sufficient discriminant validity was also evident based on Henseler, Ringle, and Sarstedt's (2015) heterotrait-monotrait ratio of correlations (HTMT). The HTMT was used as it better evaluates discriminant validity in variance-based PLS-SEM and is more sensitive to detect discriminant validity problem.

Table 2: Construct Reliability and Validity of the Measurement Model

Constructs	CR	AVE	Discriminant Validity		
			PEU	PU	DC
DC	0.947	0.641			
PEU	0.867	0.624			
PU	0.934	0.779	0.830		
DC	0.947	0.641	0.789	0.861	
PP	0.955	0.876	0.754	0.744	0.802

Structural Model

The structural model was analyzed with a bootstrapping procedure of 5000 resamples to prevent inflated test-statistics and increase estimation confidence based on distribution-free sampling method (Hair, Hult, Ringle, & Sarstedt, 2014). The magnitude and significance of all hypothesized path coefficients are presented in the result model below (Figure 2). Inferences were drawn based on the threshold critical value (bootstrapped t-statistics) at the specified significance level.



Note: Significance level: *** p < .01; ** p <.05; * p <.10; n.s. non-significant.

Figure 2: Result Model

Based on the adjusted R-square, the model explained 53.7% of the variance in physician productivity and 66.7% of the variance in dynamic capabilities at 1% significance level. No evidence of multicollinearity between constructs was observed as most VIF values were below 3 and all VIF values were below the threshold cutoff value of 5.

The empirical results show that perceived usefulness (PU) and perceived ease of use (PEU) have no significant direct impact on physician productivity (PP), but dynamic capabilities (DC) have significant direct impact on PP (0.436). With the enhancement of DC, PU and PEU show significant indirect impact on PP (0.262 and 0.433, respectively). While PU has stronger direct effect on DC (0.601) than PEU on DC (0.267), the effect of PEU on PU is even stronger (0.765) thus causing the total effect of PEU on DC (0.727) and PP (0.655) to be more salient and stronger than PU on DC (0.601) and PP (0.414).

Table 3 shows that the direct effects of PU and PEU on PP were not significant, thus not supporting hypotheses H1a and H2a. The positive effect of PEU on PU was significant, thus supporting hypothesis 3. The indirect effects of PU and PEU on PP were significant via DC, thus supporting hypotheses 1b, 2b, and 4. The total effects of PEU, PU, and DC on PP were all significant.

Table 3: Direct, Indirect, and Total Effects

Hypotheses		Direct Effect	Total Indirect Effect	Total Effect
H1a	PU -> PP	0.152 (0.712) n.s.	0.262 (2.052) **	0.414 (2.110) **
H1b	PU -> DC	0.601 (5.007) ***	-	0.601 (5.007) ***
H2a	PEU ->PP	0.222 (1.316) n.s.	0.433 (3.019) ***	0.655 (7.752) ***
H2b	PEU -> DC	0.267 (2.087) **	0.460 (4.019) ***	0.727 (12.518) ***
H3	PEU -> PU	0.765 (11.590) ***	-	0.765 (11.590) ***
H4	DC -> PP	0.436 (2.549) **	-	0.436 (2.549) **

Note: Significance level: *** p < .01; ** p <.05; * p <.10; n.s. non-significant.

DISCUSSION

This study presents findings that investigate the relationship between doctors' technology perceptions on using the EMR system, in terms of perceived usefulness and perceived ease of use, dynamic capabilities enhancement for knowledge acquisition and deployment, and physician productivity in the Intensive Care Unit (ICU) that was newly implementing the EMR system. The empirical results supported four significant hypotheses: (1) doctors' technology perceptions (perceived usefulness and perceived ease of use) do not significantly affect physician productivity; however, (2) doctors' technology perceptions (perceived usefulness and perceived ease of use) significantly enhance their dynamic capabilities for knowledge acquisition and deployment; as a result of which, (3) dynamic capabilities enhancement directly affect physician productivity while technology perceptions (perceived usefulness and ease of use) indirectly affect physician productivity; and finally, (4) although the effect of perceived ease of use on dynamic capabilities is less salient than perceived usefulness, policy makers can leverage on the strong direct positive impact of perceived ease of use on perceived usefulness of the EMR system.

Our findings support earlier study by Agwunobi and Osborne (2016) that hospitals can utilize physician's dynamic capabilities as a source of competitive advantage. The EMR organizes structured clinical data which helps physicians make informed decision to provide accurate diagnosis during their performance in the ICU. Furthermore, the system is often dependent on the collective users of the system. This is because decisions in the ICU require consolidating patient data from various sources to allow doctors a holistic overview of the patient's condition. Huckman and Pisano (2006) examine procedures performed by 203 surgeons in Pennsylvania and find that a portion of surgeon performance is specific to the hospital. Their results suggest that doctor's performance is linked to the familiarity of systems in place and their marginal productivity is not constant across firms.

Doctors involved in the ICU need to make accurate and appropriate medical decisions which usually involve stress and uncertainty when patients have compromised physiological reserve. Bornstein and Emler (2001) discuss the role of biasness when doctors decide on a treatment course after making a definitive diagnosis or the consequences of an wrong diagnosis. The EMR system minimizes such occurrences as doctors will not have to second guess their decision making since all decisions will be made objectively based on the data provided by the EMR. In addition, doctors can access an array of information that would be difficult to present in paper charts. This information includes some of the following (i) longitudinal hemodynamic parameters data, (ii) extensive and frequent blood investigation result patterns (especially in the critically ill), (iii) facilitate risk assessment, and (iv) even provide a means of communication between the different disciplines. This information can then be used by doctors in providing treatment and deciding the best direction of care for patients. The EMR, if used effectively, can remove barriers in healthcare services in terms of quality patient care, improve health services, and communication between healthcare personnel (Noraziani et al, 2013).

As such, the EMR reduces the occurrence of human error. Each healthcare personnel whether doctors, nurses or administrative staff can refer to the same data recorded in the EMR in decision making or providing care. Since EMR stores records online, patient data can be stored for long periods and can be assessed from any point within the hospital vicinity. If the doctor is at one end of the hospital and the patient is located at another end of the hospital. Although studies have found that computerized entry by specialists or physicians may initially slow down physicians' productivity during the transition period (Noraziani et al, 2013), but this was not captured in our findings. Instead doctors find that their productivity increased with the use of EMR. It can be accounted by the heavy usage and familiarity with electronic devices. All these account for the potential advantages of implementing the EMR system and the benefits of the EMR system as an aid for decision making in critical care medicine.

Despite the potential benefits of using the EMR system, certain challenges in using the system have also been highlighted. Doctors have described requiring longer working time learning to use the EMR effectively as most systems have multiple screens and navigation options. With an already heavy workload, doctors would prefer spending their time by the patient's bedside and getting more involved in the practical aspects of patient care. Lack of IT support has also been cited as a barrier to effective use of the EMR system. When probed further, some doctors indicated that there was inadequate assistance when encountering difficulty in navigating the EMR system. Subsequently this can become a deterrent in utilizing the EMR system effectively. Good IT support is therefore imperative for the successful implementation and adoption of the EMR system.

Our study provide implication for practice in that enhancing physician's dynamic capabilities can be leveraged as a source of competitive advantage in environments such as the ICU. The increased use of the EMR will not only increase physician's dynamic capabilities but also their productivity. Specifically, perceived usefulness and perceived ease of using the EMR would determine whether the enhancement of physicians' dynamic capabilities could be a source of their increased productivity. Physicians' productivity is strongly linked to how they utilize the EMR for building and integrating their competencies in daily operations of an intense situation in the ICU.

CONCLUSION

This study is not without limitation. Access to busy doctors who are working in the ICU that demands high attention had been a major challenge during the data collection process. While the questionnaire survey was administered to all doctors working in the ICU, the study could only reach out to doctors on duty during the time of our visit to the ICU. Although the selection of ICU has been justified as the selected cluster for the study, future research should consider extending the study to include a wider sample size that contain doctors from all other units in the hospital. This will be particularly important in units which are fast-paced and high stressed, for example Emergency department. In addition, the study was conducted at a tertiary, not for profit hospital. As such, the generalizability of its culture or organizational structure may indirectly impact our results.

Nonetheless, the ideas we put forward contribute to the wider discussion on the role of dynamic capabilities in the healthcare sector. This study makes new contributions to the literature by examining individual doctors' technology perceptions of using the EMR system on the enhancement of dynamic capabilities for knowledge acquisition and deployment, hence having a positive impact on the physician productivity. Decision making in the ICU may differ from decision making in other departments due to the circumstance of providing critical care to critically ill patients.

The benefits of implementing the EMR system in the ICU are highly skewed towards time consumption and critical decision making on patients involving life-threatening conditions. However, as the EMR system enables doctors to make decisions based on consolidated patient information and multidisciplinary knowledge resources, future research should also extend the current model to examine the use of big data resources embedded in the EMR system for effective decision making in critical care medicine. Studies may also explore the role of shared decision making as a potential model for life threatening diseases for patients in the ICU (Charles, Gafni & Whelan, 1997; Gerber & Eiser, 2001). In response to the UN's Sustainable Development Goal for "Good health and wellbeing", developing countries are fast leveraging on the information technology platform to enhance good decision making and patient care. This study demonstrates how this is being rolled out in a case study of a tertiary hospital.

ACKNOWLEDGEMENT

This work is supported by grant GA-MA-16-L01 of Global Asia in the 21st Century (GA21) Multidisciplinary Funding Platform from Monash University Malaysia.

REFERENCES

[1] Agwunobi, A., & Osborne, P. (2016). Dynamic capabilities and healthcare: a framework for enhancing the competitive advantage of hospitals. *California Management Review*, 58(4), 141-161.
[2] Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
[3] Barreto, I. (2010). Dynamic Capabilities: A Review of Past Research and an Agenda for the Future. *Journal of Management*, 36(1), 256–280. http://doi.org/10.1177/0149206309350776
[4] Berner, E. S., Detmer, D. E., & Simborg, D. (2005). Will the wave finally break? A brief view of the adoption of electronic medical records in the United States. *Journal of the American Medical Informatics Association*, 12(1), 3-7.
[5] Bhargava, H. K., & Mishra, A. N. (2014). Electronic Medical Records and Physician Productivity: Evidence from Panel Data Analysis. *Management Science*, *60*(10), 2543–2562.
[6] Bornstein, B. H., & Emler, A. C. (2001). Rationality in medical decision making: a review of the literature on doctors' decision-making biases. *Journal of evaluation in clinical practice*, 7(2), 97-107.
[7] Charles, C., Gafni, A., & Whelan, T. (1997). Shared decision-making in the medical encounter: what does it mean?(or it takes at least two to tango). *Social science & medicine*, 44(5), 681-692.
[8] Cohen, M. A., & Levinthal, D. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152.
[9] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–339.
[10] Easterby-Smith, M., & Prieto, I. S. (2008). Dynamic capabilities and knowledge management: an integrative role for learning. *British Journal of Management*, 19, 235–249.
[11] Gerber, B. S., & Eiser, A. R. (2001). The patient-physician relationship in the Internet age: future prospects and the research agenda. *Journal of medical Internet research*, 3(2).
[12] Hair, J., F.Jr, Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Thousand Oaks, CA: Sage Publication.
[13] Health, Nutrition and Population Statistics (2018). *Current health expenditure (% of GDP)*. Retrieved from: https://datacatalog.worldbank.org/dataset/health-nutrition-and-population-statistics
[14] Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of Academic of Marketing Science*, *43*(1), 115–135.
[15] Hillestad, R., Bigelow, J., Bower, A., Girosi, F., Meili, R., Scoville, R., & Taylor, R. (2005). Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health affairs*, 24(5), 1103-1117.
[16] Huckman, R. S., & Pisano, G. P. (2006). The firm specificity of individual performance: Evidence from cardiac surgery. *Management Science*, 52(4), 473-488.

[17] Kankanhalli A., Hahn J., Tan S., and Gao G. (2016) Big Data and Analytics in Healthcare: Introduction to the Special Section, *Information Systems Frontier*, 18:233-235.
[18] King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, *43*(6), 740–755.
[19] Legatum Prosperity Index (2017). Retrieved from: https://www.prosperity.com/rankings
[20] Noraziani, K., Nurul'Ain, A., Azhim, M. Z., Ekhab, S., Drak, B., Sharifa Ezat, W. P., & Siti Nurul Akma, A. (2013). An overview of electronic medical record implementation in healthcare system: Lesson to learn. *World Applied Sciences Journal*, 25(2), 323-332. DOI: 10.5829/idosi.wasj.2013.25.02.2537
[21] Ringle, C. M., Wende, S., & Becker, J.-M. (2015). *SmartPLS 3* [Hamburg: SmartPLS]. Retrieved January 5, 2015, from http://www.smartpls.com
[22] Sher, P. J., & Lee, V. C. (2004). Information technology as a facilitator for enhancing dynamic capabilities through knowledge management. *Information & Management*, *41*(8), 933–945.
[23] Sykes, T. A., Venkatesh, V., & Rai, A. (2011). Explaining physicians' use of EMR systems and performance in the shakedown phase. *Journal of the American Medical Informatics Association*, *18*(Feb), 125–130. https://doi.org/10.1136/jamia.2010.009316
[24] Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(8), 1319–1350.
[25] Venkatesh, V. (2000). Determinants of Perceived ease of use: integrating perceived behavioral control. computer anxiety and enjoyment into the technology acceptance model. *Information Systems Research*, *11*(4), 342–365.
[26] Venkatesh, V., Morris, M. G., Gordon, B. D., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425–478.
[27] Wang, C. L., & Ahmed, P. K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews*, 9(1), 31–51. http://doi.org/10.1111/j.1468-2370.2007.00201.x
[28] Zahra, S., Sapienza, H., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: a review, model and research agenda. *Journal of Management Studies*, 43(4), 917–955.