DEVELOPMENT, VALIDATION OF COMPETENCY QUESTIONNAIRE, ANALYSIS OF ITS PREDICTORS AND MEDIATORS FOR THE ADOPTION OF HEALTH INFORMATION SYSTEM AMONGST NURSES IN HOSPITAL UNIVERSITI SAINS MALAYSIA

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DECLARATION

I, Naveen Azizen Aziz, declare that the work presented in this thesis is originally mine. The information that has been derived from other sources is clearly indicated in the thesis.

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Student ID: P-UD 0003/18
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
AIC	Akaike information criterion
APEX	Accelerated Program for Excellence
AVE	Average Variance Extracted
BIC	Bayesian information criterion
CFA	Confirmatory factor analysis
CR	Composite Reliability
CVI	Content validity index
DOF	Degree of freedom
EA	Enterprise Architecture
EFA	Exploratory factor analysis
FVI	Face validity index
HIS	Health Information System
IQR	Interquartile range
I-CVI	Item-Content Validity Index
IT	Information Technology
JEPeM	Research Ethics Committee (Human) University Sains Malaysia
Jr	Jururawat
MI	Modification indices
OUH	Oxford University Hospital
RMSEA	Root Mean Square error of approximation
S-CVI/Ave	Scale-level Content Validity Index/average method
SD	Standard deviation
SR	Standardised residuals
SRMR	Standardised root means square
TOGAF	The Open Group Architecture Framework
TLI	Tucker Lewis Index
USM	University Sains Malaysia
VUCA	Volatility Uncertainty Complexity Ambiguity
WHO	World Health Organisation

ABSTRAK

PEMBANGUNAN, PENGESAHAN SOAL SELIDIK KOMPETENSI, ANALISIS PREDIKTOR DAN PERANTARA UNTUK PENERIMAAN SISTEM MAKLUMAT KESIHATAN DI KALANGAN JURURAWAT DI HOSPITAL UNIVERSITI SAINS MALAYSIA

Pendahuluan: Kajian ini di bina ke atas kepentingan sistem kesihatan yang kukuh dalam menghadapi pandemik dan keperluan untuk peningkatan kesediaan organisasi untuk perubahan, khususnya dalam sektor penjagaan kesihatan Malaysia. Keberkesanan dan kesesuaian instrumen yang digunakan untuk mengukur kesediaan organisasi telah menjadi subjek perbincangan dan pertikaian yang banyak. Walaupun usaha untuk menilai kesediaan organisasi, lebih daripada 70% inisiatif pengurusan perubahan organisasi gagal mencapai matlamat mereka kerana rintangan pekerja dan sokongan yang tidak mencukupi dari pengurusan. Kajian ini tertumpu pada komponen kecekapan kesediaan organisasi untuk perubahan dan kepentingannya dalam memudahkan transformasi kesihatan digital. Kegagalan adopsi kesihatan digital telah didokumentasikan secara meluas di ekonomi maju dan berkembang. Kajian ini meneliti kecekapan kakitangan dan peramal dan mediator yang mempengaruhi kecekapan pekerja yang diperlukan untuk sistem maklumat kesihatan. Objektif pertama adalah untuk membangun dan mengesahkan soal selidik kecekapan, yang merupakan komponen kesediaan organisasi untuk adopsi sistem maklumat kesihatan delam kalangan jururawat dari hospital pengajaran di Kelantan, Malaysia. Diikuti oleh objektif kedua yang menentukan tahap kompetensi semasa dengan menggunakan soal selidik yang dibangunkan dan disahkan. Objektif ketiga adalah untuk mengenal pasti prediktor manakala objektif akhir adalah untuk mengenal pasti faktor-faktor perantara yang berkaitan dengan kompetensi semasa dalam kalangan jururawat.

Kaedah: Selepas menghasilkan beberapa “item”, satu kajian rintis dijalankan dengan 180 jururawat dan analisis faktor eksploratori dijalankan untuk mengurangkan bilangan “item” dan mengenal pasti konstruk tersembunyi, diikuti dengan pengambilan 305 jururawat untuk analisis faktor pengesahan (CFA); menilai keabsahan konstruk. Kemudian, kajian diteruskan dengan pengambilan 420 jururawat dari Hospital USM untuk mengira kecekapan kakitangan semasa untuk adopsi sistem maklumat kesihatan. Regresi linear dijalankan untuk mengenal pasti peramal yang berpotensi mempengaruhi kecekapan. Dua model mediator dianalisis untuk mengenal pasti mediator yang mempengaruhi kecekapan jururawat untuk adopsi sistem maklumat kesihatan.

Keputusan: Model akhir untuk kecekapan terdiri daripada 18 item, yang menunjukkan penyesuaian model yang baik seperti yang dicadangkan oleh CFA. Soal selidik menunjukkan keabsahan konvergen dan diskriminan yang sangat baik, dengan semua konstruk mempunyai pekali korelasi lebih besar daripada 0.7 untuk item dengan tiga atau lebih. Dalam penilaian domain Individu seperti Pengetahuan, Kemahiran, dan Sikap, nilai purata untuk domain ini adalah 16.8, 11.0, dan 31.0 masing-masing, dengan sisihan piawai yang bersesuaian adalah 3.04, 2.06, dan 5.64. Sama halnya, dalam penilaian domain Pasukan seperti Pengetahuan, Kemahiran, dan Sikap, nilai purata untuk domain ini adalah 15.6, 9.6, dan 8.5 masing-masing, dengan sisihan piawai yang bersesuaian adalah 3.01, 2.08, dan 2.44. Keputusan kompetensi Individu, Pasukan, dan Staf didapati mempunyai skor purata 58.6, 33.8, dan 92.4 masing-masing, dengan sisihan piawai yang bersesuaian adalah 9.50, 6.21, dan 13.9. Dalam analisis regresi, tiada peramal ditemui untuk menjelaskan kecekapan kakitangan semasa. Walau bagaimanapun, melalui analisis mediasi, didapati bahawa gred berfungsi sebagai faktor perantaraan dalam hubungan antara umur dan tahun

pengalaman, memediasi kesan kedua-dua pemboleh ubah pada kecekapan kakitangan, individu, dan pasukan melalui mediasi sebahagian dan persaingan, masing-masing.

Kesimpulan: Soal selidik kecekapan menunjukkan sifat psikometrik yang cemerlang, dengan keabsahan dan kebolehpercayaan yang memadai, dan oleh itu sesuai untuk digunakan dalam sebarang kajian yang berkaitan dengan adopsi sistem maklumat kesihatan dalam kalangan jururawat. Selain itu, kajian ini mengenal pasti gred sebagai mediator potensial, yang menunjukkan kesan mediasi sebahagian dan persaingan melalui umur dan tahun pengalaman, masing-masing, untuk mempengaruhi kecekapan yang berkaitan dengan adopsi sistem maklumat kesihatan.

Kata kunci: Sistem Maklumat Kesihatan, kesediaan organisasi, kecekapan, mediasi, peramal

ABSTRACT

DEVELOPMENT, VALIDATION OF COMPETENCY QUESTIONNAIRE, ANALYSIS OF ITS PREDICTORS AND MEDIATORS FOR THE ADOPTION OF HEALTH INFORMATION SYSTEM AMONGST NURSES IN HOSPITAL UNIVERSITI SAINS MALAYSIA

Introduction: This study builds upon the importance of robust health systems in the wake of a pandemic and the need for increased organisational readiness for change, particularly in the Malaysian healthcare sector. The effectiveness and suitability of instruments employed to gauge organisational readiness have been the subject of considerable discussion and contention. Despite efforts to assess organisational readiness, over 70% of organisational change management initiatives fail to achieve their intended goals because of employee resistance and insufficient support from the management. This study focuses on the competency component of organisational readiness and its significance in facilitating digital health adoption. Digital health adoption failure has been widely documented in developed and developing economies. This study examined staff competencies, the predictors and mediators that influence employees' competencies necessary for health information systems. The first objective was to develop and validate a competency questionnaire that forms a component of organizational readiness for health information system adoption among nurses in Hospital University Sains Malaysia (USM) in Kelantan, Malaysia. Followed by which the second objective determined the current competency level utilising the developed and validated questionnaire. The third objective was to identify the predictors while the final objective was to identify the mediating factors associated with the current competencies amongst nurses.

Methods: After generating the items, a cross sectional study was conducted with 180 nurses, and an exploratory factor analysis was conducted to reduce the number of items and identify the latent constructs, followed by the recruitment of 305 nurses for confirmatory factor analysis (CFA) and evaluation of construct validity. The study continued with the recruitment of 420 nurses from hospital USM to assess the current staff competency for health information system adoption. Linear regression was conducted to identify the potential predictors that influenced competencies. Two mediation models were analysed to identify the mediators that influenced nurses' competencies in the adoption of health information systems.

Results: The final model for competency comprised of 18 items, which demonstrated a good model fit, as suggested by the CFA. The questionnaire displayed excellent convergent and discriminant validity, with all constructs having a correlation coefficient greater than 0.7 for domains with three or more items. The mean values for the Individual domains of Knowledge, Skill, and Attitude are 16.8, 11.0, and 31.0 respectively, with corresponding standard deviations of 3.04, 2.06, and 5.64. Similarly, the mean values for the Team domains of Knowledge, Skill, and Attitude are 15.6, 9.6, and 8.5 respectively, with corresponding standard deviations of 3.01, 2.08, and 2.44. The results for the Individual, Team, and Staff competencies were found to have mean scores of 58.6, 33.8, and 92.4 respectively, with corresponding standard deviations of 9.50, 6.21, and 13.9. In the regression analysis, no predictors were found to explain current staff competency. However, mediation analysis revealed that positional grade served as a mediating factor in the relationship between age and years of experience, mediating the effects of the two variables on staff, individual, and team competencies through competitive mediation classified under partial mediation.

Conclusion: The competency questionnaire demonstrated exceptional psychometric properties with adequate validity and reliability and is thus suitable for use in any study pertaining to the adoption of health information systems among nurses. Additionally, the study identified grade as a potential mediator that exhibits competitive mediation effects through age and years of experience, respectively, to influence competencies related to the adoption of health information systems.

Keywords: Health Information system, organizational readiness, competency, mediators, predictors

CHAPTER 1:
INTRODUCTION

The global health crisis triggered by the recent pandemic has highlighted the critical importance of robust health systems and has prompted a worldwide revival in the post-pandemic era. Before the pandemic, it was not uncommon for health systems worldwide to operate under the assumption of being the best compared to the rest. However, the pandemic has served as a litmus test, pushing every health system to its limits, and in some cases, incapacitating or inundating them to their seams.

In 2019, the World Health Organisation (WHO) emphasised the significance of digital interventions in enhancing health systems worldwide (World Health Organization, 2019). The emphasis on strengthening the competency of healthcare workers through intensive training has been recognised as crucial for addressing future challenges in the healthcare sector, as highlighted by Mokhtar (2017).

The World Health Organisation's (WHO) Global Strategy for Digital Health (2022-2025) emphasises the four fundamental principles outlined in the WHO report from 2021. First, the strategy highlights the necessity for countries to demonstrate commitment and make strategic decisions at the national level to integrate digital health into their healthcare systems, underscoring the importance of decision making and national commitment in implementing digital health initiatives.

Second, the strategy advocates for a comprehensive and integrated approach to digital health, recognising that successful initiatives require consideration of all aspects of the healthcare system.

Third, the strategy stresses the importance of utilising digital technologies appropriately in healthcare, emphasising the need for reasonable and practical use to maximise benefits.

Lastly, the strategy acknowledges the urgent need to address the significant barriers faced by the least-developed countries in implementing digital health technologies, highlighting the need for targeted strategies and interventions to overcome the unique challenges faced by these countries.

These principles serve as a roadmap for countries to navigate the ever-complex landscape of digital health and leverage its potential to strengthen healthcare systems. The adoption of World Health Organisation (WHO) guidelines may significantly influence the future trajectory of hospitals, where top-tier, secure, productive, and result-oriented care is consistently provided by skilled personnel in an advanced technological setting (Mokhtar, 2017).

The current climate presents extraordinary obstacles that necessitate an urgent need to increase organisational readiness, especially in the Malaysian healthcare sector. Although theories of organisational readiness predate the pandemic, this study seeks to revisit and reassess the extant literature on this subject. By synthesising these theories in the context of a healthcare organisation in Malaysia, this research endeavours to transform them into tangible, empirically grounded outcomes. This approach is informed by a desire not only to comprehend the lessons learned from the pandemic but also to employ these insights to bolster the resilience and preparedness of healthcare systems for future challenges. To facilitate this, this research progressed to development and validation of a questionnaire to evaluate the competency for health information system (HIS) adoption.

The significance of organisational readiness for change cannot be overstated, and this research delves into this crucial construct with a particular emphasis on the competency component of the organisational readiness for change framework. This emphasis highlights the pivotal role of competency in facilitating change and attaining organisational readiness, particularly in the context of digital health transformation. The literature has often used the terms readiness and adoption interchangeably; however, in our context, readiness signifies the level of organisational preparation, whereas the adoption of health information systems involves embracing technological advancements to optimize healthcare delivery.

1.1 Organisational readiness for change

The concept of organisational readiness is characterised by the collective psychological state of an organisation's members, encompassing their drive for change and confidence in their capacity to bring about change (Weiner, 2009). This intricate, multifaceted construct is influenced by the individuals that constitute an organisation, which is essentially a collection of individuals with distinct job descriptions and responsibilities, further categorised into departments, teams, and units (Shea et al., 2014).

Considering the intricacy of organisations and the high failure rate in implementing change, it is essential to investigate the factors that shape employee perceptions of readiness. The purpose of organisational readiness assessment is to comprehend and identify potential obstacles that could hinder the critical success factors of an initiative intended to enhance or improve an organisation's performance (Visagie and Steyn, 2011).

The evaluation of multiple criteria, including job satisfaction, autonomy, and cohesion, assumes that employees perceive these factors positively and that the organisation is prepared to undertake transformation initiatives (Rusly et al., 2015). Despite these efforts, it is regrettable to note that over 70% of organisational change management initiatives fail to achieve their intended goals because of employee resistance and insufficient support from the management (Ewenstein et al., 2015). The theories in question are primarily concerned with employees who are assumed to be competent in the tasks at hand because of their gainful employment, as competence is a prerequisite for employee selection (Westerhuis, 2011; Wong, 2020). However, their competencies have not necessarily been assessed for the specific initiatives in question, nor have the organisation's core competencies been queried (Papula and Volná, 2013; Prahalad and Hamel, 2009). This study examined staff competencies and the factors influencing employees' perceptions of the competencies necessary for health information systems. These competencies are crucial for successfully implementing health information systems in an organisational context.

1.1.1 Existing research on organisational readiness.

The effectiveness and suitability of instruments employed to gauge organisational readiness, particularly in diverse socioeconomic settings, has been the subject of considerable discussion and contention (Miake-Lye et al., 2020). The aim of this study was to gain a more in-depth understanding of the tools currently available and to determine their suitability in different scenarios. The concept of organizational readiness has been widely studied and debated for more than two decades. A comprehensive review of 1370 survey tools reveals that while there are similarities in

the tools used to measure organisational readiness, these tools often lack specificity, a clear direction of change, and a consistent purpose (Gagnon et al., 2014a, 2014b). Additionally, no single tool has emerged as the gold standard (Lehman et al., 2002; Miake-Lye et al., 2020).

These tools must effectively bridge the gap between the theoretical constructs of readiness and factors of interest for implementation (Christl et al., 2010; Smith, 2005). However, tailoring existing tools to specific contexts presents its own set of challenges. Notably, there is a high risk of losing contextual factors, especially considering that most studies have been conducted in developed countries, where constraints differ significantly from those in developing, middle-income, and lower-middle-income nations (Miake-Lye et al., 2020). These findings highlight the need for further research and development in this field. Undoubtedly, one of the primary objectives of conducting organisational readiness assessments is to ensure that employees align themselves with adopting and implementing a particular initiative. However, despite implementing such readiness programs, it is difficult to note that they do not always result in better adoption rates, ultimately leading to failure (Bleich and Jones-Schenk, 2019; Heeks, 2006).

1.1.2 Factors associated with organisational readiness.

The critical factors that determine an organisation's readiness for change include the efficacy of communication regarding changes, the perceived pertinence of the changes to the organisation, and the affective commitment of individuals to the organisation (Burnett et al., 2010; Smith, 2005). These factors have a substantial impact on an

individual's tendency to resist or accept change. (Burnett et al., 2010; McKay et al., 2013).

The adequacy of communication regarding change is a crucial indicator of readiness for change in various respects (Ahmad et al., 2017; McKay et al., 2013). In specific segments of the workforce, especially among non-leaders, the provision of adequate and prompt communication can compensate for the absence of initial involvement in decision-making at the beginning of an organisational transformation. (McKay et al., 2013).

The suitability of organisational change plays a mediating role in the connection between the level of communication adequacy and the inclination to adopt resistant behaviours, which may impact the probability of resistance behaviours being influenced by the quality of communication. (Landaeta et al., 2008; McKay et al., 2013).

Furthermore, an emotional attachment or commitment to the organisation can foster positive perceptions of the value of change (McKay et al., 2013; Visagie and Steyn, 2011). This occurs even if it does not affect other factors related to readiness for change. More importantly, this affective commitment is directly associated with reduced intention to resist change, highlighting its role in facilitating organisational transformation (McKay et al., 2013; Robbins and Galperin, 2010). Based on the definition of organisational readiness, precursors encompass the shared psychological states of members within an organisation. This includes their motivation to change and their beliefs in their capacity to bring about change (Dearing, 2018; Rusly et al., 2015). By placing the organisation's members as drivers of change, we intend to focus on their competency (Mike et al., 2011). The multidimensional nature of capacity has led scholars and researchers to apply this concept to different levels of the organisation.

However, people-centric organisations have experienced more success in implementing changes, as they are the least resistant to change (Dearing, 2018; Nilsen et al., 2020).

The rapid progress of information technology (IT) has led to a growing complexity in IT adoption, presenting hospitals with challenges in interoperability, IT implementation, and the management of heterogeneous clinical data (Damodaran and Olphert, 2000; Purnawan and Surendro, 2016). Despite this complexity, many hospitals have overlooked the importance of interoperability in their development process, often resulting in IT implementation failure (Irani et al., 2023; Lopez and Blobel, 2009). In addition, clinical data are frequently diverse, disconnected, and incomplete, making it difficult to manage information uniformly and utilise it for strategic purposes. Consequently, there is a need to develop improved strategies and systems to address these challenges in the health care sector. Employing a well-defined methodology, such as the enterprise architecture frameworks provided by The Open Group Architecture Framework (TOGAF) and Gartner, would enable us to assess the current environment of care and determine the necessary extent of change (Abunadi, 2019; Purnawan and Surendro, 2016). The significance of competency mapping has been emphasized in the field of organizational research, although its role as a factor in organizational readiness has not been thoroughly evaluated based on the available literature (Isidori et al., 2022; Mallika Worlikar and Aggrawal, 2017).

1.1.3 Competency and predictors that influence it.

Competency, a multifaceted construct encompassing knowledge, skill, and attitude, plays a crucial role in measuring individual and organisational competencies, and influences organisational readiness for change. (Erosa and García, 2015; Westerhuis,

2011). It has been used as a benchmark for over 40 years to measure individual competencies as well as competencies from an organisational perspective (Pueyo-Garrigues et al., 2022; Wong, 2020). Competence and competency have been used interchangeably, the former being non-transferable and result-oriented, while the latter dives into human behaviour and is transferable between members within an organisation (Wong, 2020). The definition of competency itself has been widely debated and theorised by authors from different perspectives and lines of work, but what has been agreed upon is that it is the single essential component that ensures performance and maximises efficiency at work (Westerhuis, 2011).

The concept of staff competency can be analysed from two perspectives: individual competency and team competency (Leggat, 2007; Mokhtar, 2017). Individual competency refers to an individual's capacity to perform tasks and make decisions independently, and includes self-management, problem-solving, decision-making, and relevant technical skills (Shavelson, 2010). A person with a high level of individual competency is capable of working autonomously, taking initiative, and completing tasks without constant supervision (Worlikar and Aggrawal, 2017).

On the other hand, team competency is a critical aspect that pertains to an individual's ability to function effectively within a team environment (Leggat, 2007). This encompasses communication, collaboration, and conflict-resolution skills. A person with a high level of team competency is skilled at understanding the nuances of teamwork and can effectively balance their personal goals with those of the team (Edgar and Lockwood, 2021; Leggat, 2007; Oh and Choi, 2020). They possess the ability to work collaboratively with others, meaningfully contribute to team

discussions, and support team decisions even when they have the capability to complete tasks independently (Cole, 1998; Leggat, 2007).

Both are essential in various situations, and an accomplished professional ought to possess them. It is also worth mentioning that acting independently does not necessarily imply working in isolation; it can also entail taking the lead in a team setting and driving specific tasks or projects (Goleman, 2004; Shavelson, 2010; Wahl and Prause, 2013).

In the context of organisational readiness and the adoption of health information systems among nurses, we propose that competency-based assessment plays a crucial role in human resource development and enhances intrinsic organisational readiness (Isidori et al., 2022; McCalman et al., 2017; Wong, 2020). This assessment is instrumental in identifying, recruiting, and developing talented individuals, thereby ensuring the successful adoption of health information systems among nurses (Booth et al., 2021; Mather and Cummings, 2019).

1.1.4 Organisational designing and transformation

The organisational design theory proposed by Latham and Vinyard, encapsulated in their Baldrige User's Guide, provides a practical approach for organisational diagnosis, design, and transformation. This theory is the cornerstone of our research and has significantly shaped our understanding of organisational change and readiness.

The first key aspect of this theory is to diagnose the existing organisation. This involves understanding the organisation's current state, including its strengths, weaknesses, and areas for improvement. This is a critical first step in any organisational change initiative. This diagnosis forms the basis for the subsequent steps of the process.

a) Designing or Redesigning Systems

Transitioning from diagnosis, the theory emphasises the design or redesign of systems within an organisation. These systems are designed or redesigned to align better with the organisation's strategic objectives. From my experience, this often involves a significant amount of creativity and innovation, as well as a deep understanding of the organisation's strategy, culture, and processes.

b) Leading the Transformation

The third key aspect of the theory underscores the pivotal role of leadership in driving the transformation and steering the organisation towards its desired future state. This research found that effective leadership is often the difference between successful and failed transformation. Therefore, the role of leadership cannot be overstated.

c) The Baldrige Process

Integral to this theory is the Baldrige process, which helps drive organisations to be more competitive and achieve performance excellence. In this study, Baldrige process was utilised to assess the adoption of health information systems among nurses by improving their individual and team competencies to enhance organisational readiness. This process is a key component of the theory and provides a framework for assessing performance and driving improvements.

Ultimately, Latham and Vinyard's organisational theory presents a comprehensive and applicable methodology for organisational transformation. It emphasises the significance of diagnosis, design, and leadership and delivers a clear structure for the adoption of health information systems in our context. This research and practical experience have revealed that this theory is a highly effective instrument for propelling organisational change and advancement. Therefore, this constitutes a substantial aspect of this research and its practical applications.

1.1.5 Introduction of the teaching hospital: Hospital Universiti Sains Malaysia

The Hospital Universiti Sains Malaysia is an 829-bed teaching and referral hospital located on the east coast of Peninsular Malaysia. It has a staff strength of over 3043, comprising both clinical and non-clinical professionals who work towards the common goal of providing healthcare services to the community of Kota Bharu, which has a population of 348,000 (Macrotrends, 2020), providing referral services for the state of Kelantan. In 2008, the Accelerated Program for Excellence (APEX) was entrusted to Universiti Sains Malaysia (USM) to transform higher education into a sustainable future. This goal was achieved through strategic thrusts centred on knowledge, future-forward thinking, uniqueness, sustainability, universality, humanity, sacrifice, change, and wellness. It has been translated into Hospital USM's vision and mission statements as a commitment to explore and enhance the quality of services for a sustainable tomorrow. To achieve the goals of these strategic thrusts, "Change" is an essential component; the organisation needs to evolve continuously based on internal and external pressures. The agility of the organisation to transform determines how the organisation achieves these goals (Gill, 2015; Rohrbeck, 2010). As an employee-centric organisation that invests in continuous training and development of staff competency and capacity, the assessment of organisational readiness would help understand barriers or resistance among employees and provide an opportunity to address them promptly (Leape et al., 2012; McAlearney et al., 2011; Ochurub et al., 2012).

1.2. Problem Statement and Study Rationale

This study aimed to investigate the role of competency as a component of organisational readiness in preparing Malaysian healthcare organisations for the implementation of health information systems, taking into account the obstacles encountered during the digital transformation of public hospitals. Previous studies have demonstrated the complex nature of translating knowledge into practice in healthcare settings (Chunharas, 2006; Colquhoun et al., 2017; Liverani et al., 2013). While healthcare organisations aspire to gain a competitive advantage by offering superior quality care, we have observed through the literature that the practicality of embracing innovation seems elusive. (ChePa et al., 2018; Damodaran and Olphert, 2000). In Malaysia, the digital transformation of healthcare in public hospitals is a costly example of organisational failure to adopt innovation (ChePa et al., 2018; Hassan and Megat Tajuddin, 2012). To the best of our knowledge, competency as a component of organisational readiness has not been assessed in Malaysian healthcare settings before the implementation of quality or organisational change initiatives.

Given the importance of our understanding of how the shared psychological states of individual members of an organisation affect the success of a change initiative, this would provide an opportunity to identify perceived barriers or resistance to change (Ahmad et al., 2018; Weiner, 2009). Solutions or change initiatives tend to occur ad hoc in nature, while staff competency and capacity building are complex, which may explain why employees fail to adopt well-intended innovations (Damodaran and Olphert, 2000; McKay et al., 2013).

Among healthcare professionals, nursing staff are the largest subgroup, representing the total capacity of human resources in a healthcare setting (Barzekar et al., 2019). The necessity to assess the competencies of highly skilled nursing professionals who are capable of adjusting to the ever-evolving contexts and challenges posed by the digital health revolution is of paramount importance (Ifinedo, 2018; Isidori et al., 2022). Developing individual and team competencies will further strengthen the overall strategy of meeting the challenges entailed by the digital transformation of the World Health Organization (WHO (World Health Organization)., 2019; WHO (World Health Organization) 2008).

This study examined the consequences of cultivating individual and team competencies among nursing staff, who comprise the largest segment of healthcare professionals, in response to the digital transformation challenges posed by the World Health Organization (Barzekar et al., 2019). Subsequently, the ensuing chapters provide an analysis of these competencies, the methods employed for the development and validation of a questionnaire, and their potential implications for the adoption of health information systems in healthcare organisations. Nurses' competency in digital health has not yet been assessed from the perspective of organisational readiness. Although organisational readiness has been approached in many disciplines and industries, it is a unique perspective on the subject and adds value to the existing body of knowledge.

1.3. Research Questions

1. What is the construct validity for the developed questionnaire for the adoption of Health Information Systems among nursing staff at Hospital USM?

2. What is the competency score for Organisational Readiness in the adoption of Health Information Systems among nurses at Hospital USM?
3. What are the predictors associated with staff competency for Organisational readiness in Health Information System adoption among nurses in Hospital USM?
4. What are the mediating factors associated with the staff competency score for Organisational readiness in Health Information System adoption among nurses in Hospital USM?

1.4. General Objectives

Development and validation of the competency questionnaire assessment of the current level of competency, and determination of potential predictors and mediators for Health Information System adoption among nurses in Hospital USM.

1.4.1 Specific Objectives:

1. To develop and validate a competency questionnaire for health information system adoption among nurses in Hospital USM.
2. To determine the current competency scores of nurses for health information system adoption in Hospital USM.
3. To determine the predictors associated with the level of competency for health information system adoption among nurses in Hospital USM.
4. To determine the mediators associated with the level of competency for health information system adoption among nurses in Hospital USM**.**

1.5. Hypothesis:

1. The competency questionnaire is a valid and reliable tool for evaluating competency required for Health Information System adoption among nurses in Hospital USM.
2. This validated tool could be used to determine the current level of staff competency.
3. There is an association between competency level and independent variables example (age, highest professional qualifications, and years of experience).
4. The competency level is associated with the mediator effect arising from categorical independent variables.

4.1. Grade mediates the relationship between Age and Competency.

H1: Age is positively related to grade.

H2: Grade is positively related to competency, even after controlling for age.

H3: When grade is controlled for, the relationship between age and competency is significantly reduced.

4.2 Professional qualification mediates the relationship between Age and Competency.

H1: Professional qualification is positively related to grade.

H2: Professional qualification is positively related to competency, even after controlling for age.

H3: When professional qualification is controlled for, the relationship between age and competency is significantly reduced.

4.3. Grade mediates the relationship between Years of experience and Competency.

H1: Years of experience is positively related to grade.

H2: Grade is positively related to competency, even after controlling for years of experience.

H3: When grade is controlled for, the relationship between years of experience and competency is significantly reduced.

4.4 Professional qualification mediates the relationship between years of experience and Competency.

H1: Professional qualification is positively related to years of experience.

H2: Professional qualification is positively related to competency, even after controlling for years of experience.

H3: When professional qualification is controlled for, the relationship between years of experience and competency is significantly reduced.

CHAPTER 2:
LITERATURE REVIEW

As the world emerges from the pandemic, it is crucial for healthcare organisations to adopt new systems to address the shifting requirements of patients and stakeholders in the evolving landscape. This study aims to delve into the realm of competency as a component of organisational readiness and explore its potential as a tool to navigate the digital evolution of organisations amidst these changes. Understanding the implications of failure is crucial, given the high-risk nature of large-scale investments (Alami, 2016; Sadhu Charan and Paramita, 2016). Therefore, this study conducts an analysis of the role of organisational readiness in mitigating these risks, beginning with an exploration of the original vision behind an organisation's formation and the purpose of these structures to counter future challenges which we describe as volatility, uncertainty, complexity, and ambiguity (VUCA). However, our approach to understanding organisational readiness is based on the perspective of enterprise architects for health system management.

2.1. Volatility Uncertainty Complexity Ambiguity (VUCA).

VUCA is a multifaceted concept that presents significant challenges for modern enterprises. In today's fast-paced business world, organisations that effectively navigate the challenges posed by VUCA and respond to shifting circumstances are more likely to thrive and achieve long-term success (Murugan et al., 2020).

Volatility is characterised by a rapid and significant change that occurs over time. In a volatile environment, organisations must be prepared for sudden shifts and be able to adapt quickly to changing circumstances (Sultanow et al., 2020). Uncertainty is an

unclear situation, with little understanding of what may happen next. Uncertainty can make it challenging for organisations to anticipate the future. Complexity is characterised by the presence and interconnectedness of numerous crucial decision-making elements. Navigating a complex environment can be difficult because of the complexity of determining how various factors influence each other and identifying the optimal approach (Sultanow et al., 2020). Ambiguity refers to a lack of clarity regarding the activities in a specific situation (Murugan et al., 2020). One can gain insights into the contributing factors of an event and the intricacies of their interplay, yet still grapple with determining an effective course of action to take in response (Daoudi et al., 2021).

In the current operational landscape, organisations face a VUCA environment, which is primarily influenced by factors such as globalisation, digitalisation, heightened competition, shifting markets, demographic changes, enhanced connectivity, and evolving consumer preferences. These factors have led to a more complex and uncertain environment in which organisations must be agile and adaptable to stay competitive.

The COVID-19 pandemic is a prime example of the impact of the VUCA on organisations. This pandemic has led to significant global volatility and unprecedented uncertainty. The situation has been highly complex, with numerous factors to consider, including the scientific understanding of the virus, development and distribution of vaccines, and the economic and social implications of the pandemic (Murugan et al., 2020; Van Riel, 2022). This ambiguity makes it challenging for businesses to determine their best action (Murugan et al., 2020).

Healthcare organisations are complex adaptive systems; however, when resilience towards VUCA is not considered in the organisation's strategic plans, the risk of failure

is significant. Unlike other industries, hospitals serve as gateways for life and death within a community (Pandit, 2020).

2.1.1 Success Factors to Navigate in VUCA

Developing additional skill sets that are specific to adapting to a VUCA environment is pertinent for organisational leaders and enterprise architects. Sultanow et al. proposed through their work the other skill sets such as:

a) Navigation: Organisational leaders must focus on setting directions and providing recommendations, and not just following corporate decisions. They should strive to understand the company, its industry, and sustainability opportunities to identify trends and become trusted advisors to senior executives (Sultanow et al., 2020). It involves navigation skills, including keeping the course, detecting shifts, taking immediate action when necessary, and preventive and proactive measures to address challenges and generate new business models or innovations that fulfil sustainability criteria.

b) Early adopter skills: Leaders within an organisation in a VUCA world must have early adopter skills in technology and sustainability (Sultanow et al., 2020). They should know and apply new ideas, ideally hands-on architects, to enable a company to gain and sustain a competitive advantage. Additionally, as new technologies are introduced, enterprise architects must quickly incorporate them into future enterprise architecture (EA) designs and transformations.

c) Entrepreneurial skills: To respond to VUCA challenges and transform an organisation, leadership agility is required, which can be achieved by adopting

an entrepreneurial mindset. Successful leaders engage in networking activities to obtain the necessary resources, suggesting that these resource-seeking activities are essential for achieving an entrepreneurial mindset (Sultanow et al., 2020). An entrepreneurial mindset is the ability to have a singular vision while navigating VUCA factors through communication, networking, and agile decision making. Organisational leaders must communicate and interact well with others, instilling confidence and building on past practical experience and implementation ability. Using this ability, an enterprise architect can strategically anchor isolated objectives to common ones.

d) Value creation skills: In the VUCA world, organisational and enterprise architecture management no longer automatically add value to a company. Change initiatives must create and demonstrate sustainable value for organisations and stakeholders. Top-tier management must prioritise value creation and design the target architecture to capture potential value-adding impacts (Sultanow et al., 2020).

e) Data science skills: Data can detect influences, respond quickly, and distil high-level business intelligence and insight. Enterprise architects in an organisation must standardise data and build a reference architecture that defines and describes data science and Artificial intelligence (AI) tools and frameworks, maps organisational capabilities onto the architecture, and identifies potential business AI use cases to identify new business models or changes in direction due to VUCA turbulence (Sultanow et al., 2020).

Through an exemplar we would like to illustrate from an organisational perspective, how the actions taken by Oxford University Hospital (OUH) to manage the pandemic offer insights into the critical success factors that underpin successful leadership in

harsh and challenging times. Their results emphasise the significance of organisational culture, collaboration, and clarity of strategic intent in achieving success during times of volatility, uncertainty, complexity, and ambiguity. Organisational culture is a critical component of any organisation, and OUH recognised this early on. Their report characterised organizational culture as foundational beliefs, presumptions, values, and methods of communication that formulate an organisation's distinct social and psychological environment (Pandit, 2020). In the context of OUH, this includes the organisation's vision, values, norms, systems, symbols, language, assumptions, beliefs and habits (Pandit, 2020). Their strategy highlights that Oxford University Hospitals (OUH) collaborated extensively with charity organisations to strengthen the research-clinical interface, resulting in positive outcomes for both patients and staff. Collaborative arrangements, which are evident to both healthcare providers and recipients and have proven to be beneficial, will become the standard practice in the healthcare industry in the future.

Undoubtedly, having clear strategic intent is an essential aspect of an organisation's success. It is imperative for leaders to present a definitive plan that offers reassurance to the staff, emphasising that the organisation is well prepared and possesses a clear sense of direction (Pandit, 2020). Furthermore, the OUH assumed responsibility for operational execution of modifications in inpatient areas across hospitals. To prepare the staff, they provided simulation training and personal protective equipment, while also fostering collaborative efforts with all relevant parties. This collective approach aims to achieve a common objective. From our perspective, this relates to the context of empowering our staff with competencies that would allow them to leverage existing technologies, such as health information systems, to empower their day-to-day nursing

activities. This would, in turn, enable them to enjoy a better quality of life and be commensurate with increased job satisfaction.

Furthermore, a collaborative approach of OUH's partnership with the university and the charity organisations was critical to its success. The partnership helped OUH expand its research-clinical interface, positively impacting staff and patients (Pandit, 2020). The report underscored that the partnership was palpable to both staff and patients and served to promote mutual welfare.

The aforementioned scenario exemplifies how a healthcare organisation can successfully navigate a VUCA environment by maintaining clarity in both strategic thought and action while concurrently fulfilling the expectations of both its internal and external stakeholders. However, the mediation of change was not accidental; it was a meticulously chosen strategic foresight in play, considering the constraints from hindsight.

Although corporate leaders and change management architects have realised the importance of organisational readiness, several tools have been identified in the literature review. These tools have been used for various degrees of inference. Based on our analysis of three meta-reviews of organisational readiness, the survey tools share commonalities in identifying readiness at an individual level but lack specificity (McCalman et al., 2017; Miake-Lye et al., 2020; Shahrasbi and Paré, 2014). We infer that the tools must be customised or redesigned to include contextual factors which differ with the type of organisation, the researcher's perspective, the level of the anticipated change, and the intended research location (Miake-Lye et al., 2020). The design of the tools was a response to a particular expected change. In the absence of a unified framework, the concepts are abstractions and subjective, which could lead to contradictions that could further impede the purpose of assessing organisational

readiness, which is the antecedent step to the implementation of anticipated change (Dearing, 2018; Simpson and Dansereau, 2007; Smith, 2005).

Contextual factors influence employees' overall behaviour depending on how they perceive it (Weiner, 2009). For instance, if policies are employee-friendly, which leads to a positive perception, it will positively influence valence, leading to enhanced commitment to change (Ahmad et al., 2017; Al-Hussami et al., 2018; Weiner, 2009).

Improved organisational readiness increases the likelihood of positive outcomes such as implementation effectiveness. However, it should be noted that change effort begins at the macro level of the organisation, where the conditions are primed to enable the change to be directed towards the micro level, that is, the individual (Pop et al., 2018). In essence, the macro systems of an organisation enable the preconditions for change initiation, while employees drive the efforts towards positive outcomes. Organisational culture leads to behavioural changes in employees (Michie and West, 2004; Robbins and Galperin, 2010).

There has been an ongoing debate within academic circles as to whether one explores organisational readiness during the pre-implementation or implementation phases (Harlos et al., 2012; Myklebust et al., 2020; Weiner, 2009). Another issue in developing tools for organisational readiness assessment is that they are empirical in design, which tests assumptions, with the inherent flaw being that they differ in context. Nevertheless, methodological studies result in the creation of tools that employ theoretical constructs, such as the theory of planned behaviour. It is vital that most of the tools based on the literature which were created for organisational readiness assessment were either tested in laboratory conditions or lacked a theoretical rationale as to how change occurs at the individual or executive level (Gagnon et al.,

2012, 2014b; Helfrich et al., 2009). Response validity has not been reported for over 96% of the tools used for organisational readiness (Gagnon et al., 2014b).

As we understand the importance of contextual factors, we approach the premise of organisations and how they are structured, as change without situational awareness would only increase the risk of failure.

2.2 Organisation

Greenberg and Baron defined organisation as a "structured social system consisting of a group of individuals working towards meeting an agreed objective." This definition helps us understand the micro and macro interactions between small and large organisations. As an organisation's strength increases, individual, team, and unit dynamics increase. While everyone is assigned a specific role based on their qualifications and job descriptions, they are nevertheless part of the larger picture that the organisation envisions through its strategic goals. These are imbibed in the vision and mission statements of the organisation. Organisational design, such as the Galbraith Star Model (Figure 2.1), sheds light on how organisations navigate daily to make decisions that eventually influence employee behaviour (Kesler and Kates, 2010). The model was categorised into five themes.

a) Strategy: The organisation specifies its vision and mission and outlines the course for a competitive advantage. It forms the strategic thrust of the organisation, which employees are expected to embrace to realise the goals set forth by the organisation (Kesler and Kates, 2010).
b) Structure: An organisation may further be divided based on the niche area of the services it renders. This is achieved through specialisations, the distribution