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Abstract

As Chinese medicine (CM) has increased in popularity globally it now becomes imperative to investigate ways in which safe, efficient, effective and evidence-based approaches might be adopted into CM practice. In the case of western or more traditional healthcare delivery practice, IS/IT is often adopted and employed to assist in this regard and thus this paper examines how IS/IT might be used to support the delivery of CM. In particular, the paper investigates how IS/IT tools and techniques might be used in supporting CM clinics daily processes and thereby bring greater value to a country's healthcare. In doing so, this paper studies the current global CM situation and provides a solid foundation for how to design and develop an enterprise wide CM clinical management system.

Keywords: Information systems, Clinic management systems, Chinese medicine, IT investment portfolio.

1   INTRODUCTION

More than 80% of the world's population relies on herbal medicine (WHO, 2013). Australia reflects this trend too as the number of people using complementary and alternative medicine (CAM) is rising. Research shows that the number of visits to CAM practitioners by adult Australians between 2004 to 2005 reached 69.2 million, while the number of visits to medical practitioners was 69.3 million in the same year (Xue et al. 2007). Chinese Medicine (CM) is one of the most popular CAM practices today (Lukman et al. 2007). It is considered by many consumers to have fewer side effects, more effective treatment to the root of the disease, and is good for the overall health of patients (Chi, 1994). Unlike western medicine (WM), CM's unique methods of diagnosis (combine inspection, auscultation and olfaction, inquiring, and palpation in every diagnosis) give each patient personalized treatment (ibid). This more holistic approach, to some patients, is a benefit and an advantage.

As the popularity of CM grows and is adopted in western countries there is more pressure for it to be more evidence based and have a more scientific and systematic structure in its delivery. In Asia, much research has been done in: 1) scientific and evidence approval on the effectiveness and success of using CM treatments for diseases especially chronic diseases. For example, there have been many studies and clinical trials on using acupuncture to heal diseases like arthritis, stroke, and allergy (Li et al. 2008). 2) CM herb and formulation (CMF) analysis and study. CM mixed ingredient prescriptions and treatment methods provide interesting research opportunities to WM which often offer single-drug treatments (ibid). Research has been done on knowledge transfer and management of CM herb and CMF. For example, web accessible databases provide detailed information about each herb and CMF toxicity, usage, relevant scientific citations, basic molecular properties, and clinical effects (Lukman et al. 2007). 3) CM diagnosis is very individual and often relies on the physician's experience and knowledge (ibid). However, various studies have produced expert systems and applications using modern research methodologies and information systems/information technology (IS/IT). For instance, computational visualization techniques for the tongue help physicians to examine a patient's tongue and diagnose the conditions of the spleen and stomach (Yue and Liu, 2004). Further, some applications allow the generation of clinical alerts and thereby assist with making accurate interpretations or diagnoses (Lukman et al. 2007). Such studies thus show that IS/IT tools and techniques can play a key role in modern CM developments.

Clinical management systems (CMS) such as Patient Administration System (PAS), Electronic Patient Record (EPR), Clinical Knowledge Management (CKM) and Clinical Decision Support system (CDS), and Materials Management System (MMS) have been proved to be successful to facilitate superior healthcare delivery in WM (Lin et al. 2013; Wickramasinghe and Schaffer, 2010). Can these systems assist CM development and practice? Further, Can CMS support the integration between CM to WM so that all population can enjoy the benefits and advantages from CM treatments? Moreover, what are the possibilities and considerations when using IS/IT in CM clinics to support their daily key processes? This study serves to investigate how IS/IT might be incorporated into the delivery of CM, in particular the possibility of developing a suitable CM clinical management system (CMCMS).

2   STRATEGIC MANAGEMENT

Strategic management is a set of processes of analysis, creation, implementation and monitoring with the purpose to achieve and maintain a competitive advantage. It provides a framework for decisions about leadership, customer, finance, resource, system, technology, and time (Swayne et al. 2008). It helps organizations in making long term decisions, prediction about the business future position along with the sense of purposeful action planning (Swayne et al. 2008). A comprehensive understanding of the national and international strategic plan of CM practice is important for designing a suitable CMCMS.

2.1   CM Strategies

WHO traditional and complementary medicine (T&CM) strategy 2014 to 2023 (updated from strategy 2002-2005) outlined the next ten years focus in three areas: 1) A knowledge base to allow T&CM (including CM) to be managed actively through appropriate national policies that understand and recognize the role and potential of T&CM. 2) Ensure quality assurance, safety, proper use and effectiveness of T&CM by regulating products, practices and practitioners through education and training, skills development, services and therapies. 3) Promote universal health coverage by integrating T&CM services into health service delivery and self-health care (WHO, 2013). In Australia, many activities have been done to echo and actualise these strategies, they are highlighted below:

- National registration of practitioners, acupuncture, and dispensers of Chinese herbal medicine commenced on the 1st July, 2012. Further, the CM profession is now included in the National Registration and Accreditation Scheme (NRAS) (CMBA, 2014).
- Policies, registration guidelines, codes and standards were created and published to assist the CM profession. Accreditation standards and processes for consultation were also developed.
- Developed and implemented through the Federation of Chinese Medicine and Acupuncture Societies of Australia Ltd (FCMA), Chinese medicine undergraduate and postgraduate courses in Australian tertiary education system.
- Australian Health Practitioner Regulation Agency (AHPRA) and Chinese Medicine Board of Australia (CMBA) commenced the national auditing program (CMBA, 2014).
- CMBA website is created which enables online service delivery and communication. Chinese Medicine Portal (CMP) is created and serves as an online CM knowledge pool where information and clinical data can be retrieved and accessed (Yang et al. 2009).
- AHPRA will directly allocate cost fundings to CMBA to assist various activities undertaken by the agreement and strategies (CMBA, 2014).

Internationally, various actions have been carried out in member states. For instance, in Canada, a comprehensive regulatory framework for natural health products including CM was introduced (WHO, 2013). In addition, policy, regulation, guidelines and information were developed. In United States, the National council for certification of acupuncture and Oriental Medicine developed assessment guidelines and examinations for acupuncturists and CM herbalists (Boodeker and Kronenberg, 2002). Switzerland is the first country in Europe to integrate CAM (including CM) into its health system. In fact, CM is covered by the nation's compulsory health insurance program (KLV) announced by the Federal Department of Home Affairs (DHA) in 1998. Furthermore, medical students take compulsory CAM lessons; doctors and non-medical practitioners are encouraged to take standardized training and certification in CAM (WHO, 2013).

2.2   CM strategy implementation improvements

While countries around the world are doing their best according to their situation in implementing the WHO's T&CM strategy and suggested actions, Australia has achieved some of the most impressive advances in the first two strategies (CMBA, 2014). Acknowledgement of continually increasing demand of CM leads to a need to build the knowledge base for active management of CM through national policies, regulations, and standards. Quality and safe CM products and practice are ensured and increased through the proper management and guidance of AHPRA, CMBA, and FCMA. In addition to build-on-top and fulfilling these two strategic activities, much work and attention is needed for the third strategy – integrate CM into the Australian health care service delivery and self-health care. China and Switzerland are considered as pioneers in this category and have many examples (WHO, 2013).

2.2.1   CM Integration - China and Switzerland

China is the birth country of CM which dominated the country's health system for thousands of years until the Opium war (Chi, 1994). In the nineteenth century, not only did CM experience a dramatic downward thrust, the whole Chinese civilization's self-confidence was at an all-time low after a series of defeats and humiliations by imperialist powers (ibid). Reformers at the time turned to science as the

salvation for China and considered WM as part of the new western science wonders (ibid). This environment facilitated the spread and increasing influence of WM in China (ibid). At the same time, with newly developed science methods, WM was considered to be more advanced than CM (ibid). Chinese experienced and compared the treatment of both medicine types and they gradually shifted their preference to WM (ibid). By the time WM was introduced to the majority of Chinese, advanced transportation and trade supported adequate supply of drugs and equipment which helped the sustainability of WM in China (ibid). CM lost its dominance from the early twentieth century until recently when large Chinese civilizations acknowledged the importance and necessity of modernization (ibid). In this process, some intellectuals and key government officials believed that adopting various levels of western science should be accompanied by perfecting traditional Chinese culture (ibid). They proposed that CM must learn from the scientific knowledge of WM and WM must study the popular and widespread spirit of CM (ibid). Today, China is the only country in the world which has the two medicine types practised alongside each other at every level of the healthcare services (Hesketh and Zhu, 1997). Further, both public and private insurance covers both medicine types (WHO, 2013). In fact, 95% of general hospitals where WM is practised include CM departments and provide CM services for outpatients and inpatients (Hesketh and Zhu, 1997). The integration and collaboration between the two systems or medicine types is well illustrated by research which reports that 40% of the prescriptions from WM hospitals are CM and equally 40% WM prescriptions are from CM hospitals and clinics (ibid). All WM schools devote around 15% of curriculum time to CM, additionally, nurses are trained in both medicine types and many perform acupuncture independently (ibid). Similarly, CM students must undertake some compulsory courses from WM (ibid). CM herbs and formulations are now available in the form of tablets, capsules, powder and ampoules which greatly contribute to the increased consumption of CM (ibid). In China, WM is seen as more effective in acute situations or where the aetiology is known, while CM is more effective for immune conditions, chronic illness and where the aetiology is unknown (ibid). In the 21st century, China is the place where WM has been greatly influenced by CM, and it is a place where both medicine types have served to its maximum benefit for one fundamental and very important principle – people-centred health and wellness (ibid).

The Swiss government recognising the ever-growing demand of CAM (including CM), has integrated CM into its national primary care system (WHO, 2013). CM practice exists in mainly two forms: 1) Individual CM practice with Qualified CM physician and/or acupuncturist in clinics. 2) Qualified CM physician and/or acupuncturist work in WM general practice with WM doctors, some of these doctors are qualified in at least one CAM discipline (Sundberg et al. 2007). Research shows that CM and acupuncture receive the most referrals from WM doctors and about 40% of patients request for CM treatments (Sundberg et al. 2007).

2.2.2 *CM and WM integration map*

Incorporating CM into modern healthcare practice and delivery appears to have great value (Lin et al. 2013). This is recognised by many countries (WHO, 2013). Now the question becomes "how should the two medicine types complement each other and be practised side by side?" This remains an open question for discussion. It is normal that answers vary between countries (WHO, 2013). A blended system which takes the best of each and compensates for the potential weaknesses in each is WHO's vision (WHO, 2013). Figure 1 illustrates the different stages of CM and WM integration; it can also be used as a road map for implementation design, progress and updates.
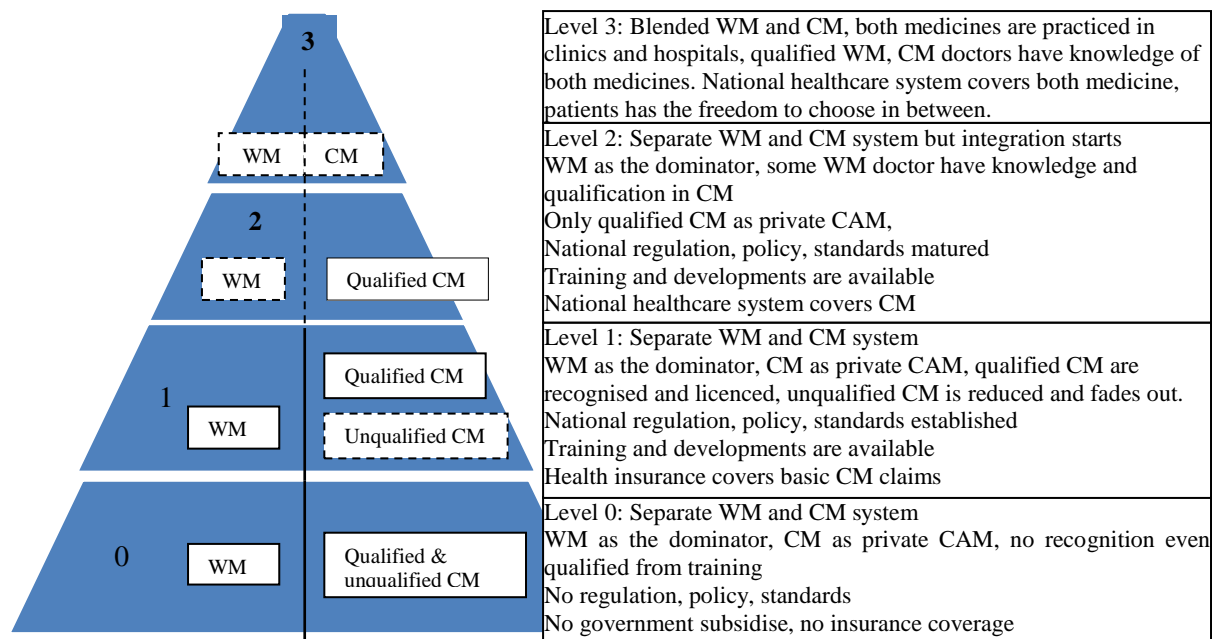
3

Level 3: Blended WM and CM, both medicines are practiced in clinics and hospitals, qualified WM, CM doctors have knowledge of both medicines. National healthcare system covers both medicine, patients has the freedom to choose in between.

WM | CM

Level 2: Separate WM and CM system but integration starts
WM as the dominator, some WM doctor have knowledge and qualification in CM
Only qualified CM as private CAM,
National regulation, policy, standards matured
Training and developments are available
National healthcare system covers CM

2

WM | Qualified CM

Level 1: Separate WM and CM system
WM as the dominator, CM as private CAM, qualified CM are recognised and licenced, unqualified CM is reduced and fades out.
National regulation, policy, standards established
Training and developments are available
Health insurance covers basic CM claims

1

Qualified CM

WM

Unqualified CM

Level 0: Separate WM and CM system
WM as the dominator, CM as private CAM, no recognition even qualified from training
No regulation, policy, standards
No government subsidise, no insurance coverage

0

WM

Qualified & unqualified CM

Figure 1.   CM & WM integration map

Our analysis suggests that CM and WM integration in Australia is at a stage similar to level one (Lin et al. 2013). CM authorities and individuals are working towards level two where only qualified CM physicians are allowed in clinics, WM doctors are trained and have basic knowledge of CM. The two systems are still separate but more overlap and cross over occurs with more referrals and co-workers (CMBA, 2014). It is important then to understand where the Australian CM is heading in order to identify the scope and plan what IS/IT is needed for CM clinics in the next ten years under the national and international strategies. The research question guiding our exploratory study is then "how can IS/IT be designed and adopted to support the integration of CM and WM in the Australian healthcare contexts?"

3   METHODOLOGY

This research will use Case Study (CS), and Design Science (DS) methodology to guide the various research activities. CS is a commonly used and well recognised research strategy in Healthcare Services and IS research (Yin, 1999). It attempts to examine a contemporary phenomenon in its real-life context (Yin, 1994). Through a typical single case study, the research domain can be examined and a deeper understanding of the key and critical circumstances and conditions can be unearthed (Yin, 1999; Flick, 2009). Additionally, CS tools and techniques such as semi-structured interviews, thematic and artefact analysis provide valuable data and information for developing the CMCMS and thus will be incorporated. In selecting the case clinic, this research will use a range of selection criteria which include, clinic size; number of patients; number of clinic staff; comprehensive stock include: Chinese herbal medicine, acupuncture needles and other clinical supplies. The chosen clinic is in Melbourne, Australia. DS methodology has its roots in the field of engineering and science (Hevner et al. 2004). It "seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished" (Hevner et al. 2004 p76). DS has been commonly used in IS/IT research because it is aimed at developing executive information systems and system support emerging knowledge processes with effective development methods and system solutions for particular user group requirements or models (Hevner et al. 2004). This study will go through four research processes of DS: 1) Identifying the research problem; conducting literature review; and organising data. In this process semi-structured interviews will be carried out in the case clinic guided by the interview protocol. Data will be collected, categorised, and stored in a database. 2) Solution design, a solution framework and structure will be crafted for the research problem. The existing clinical (as-is) situation will be modelled and analysed, and then the new (to-be)

system will be designed. A range of IT tools and techniques will be used in designing the system solution, these include: Business Process Modelling, Unified Modelling Language (UML) diagrams, and prototyping. 3) Evaluation, the prototype and modules of the proposed system will be evaluated with specification, expectation, and precise scope. 4) Research completion, research findings will be summarised and published.

4   IT INVESTMENT PORTFOLIO AND COLLABORATION

Effective IT investments and IT portfolios should constantly match the underlying business strategy (Weill and Ross, 2009). Planned ongoing use of interlocking business practices and competencies collectively gain superior value from IT investments (Weill and Aral, 2006). These well-designed, well-understood and transparent IT investments or portfolios attract many IT assets and returns (Weill and Ross, 2009). An important consideration becomes what allocation of IT should be followed to support infrastructure, transaction, informational and strategic needs (Weill and Aral, 2006). The average company IT investment studied by Weill and Aral (2006) have the following percentages: 46% infrastructure, 26% transactional, 17% informational and 11% strategic. With this in mind, it is however important to focus on how the technology is used rather than the technology itself, as different IT investment delivers different values and returns (Weill and Ross, 2009). IT infrastructure is the foundation and it is shared across multiple business units or functional areas (Weill and Ross, 2009). It is mainly aimed at providing a flexible base for future business initiatives or reducing long-term IT costs through standardization and consolidation (Weill and Ross, 2009). Transactional investments primary purposes are reduce cost of goods sold and increase output for the same cost (Weill and Ross, 2009). For example digitalize company's repetitive transaction. Informational investments provide information for purposes such as accounting, reporting, compliance, communication or analysis, which deliver company profits. Strategic investments help stimulate innovation and thus position an organization for growth (Weill and Aral, 2006). The above categorizations provide estimate proportions for an IT investment; however, there are other things one should investigate before the start of an IT project or portfolio. These include an analysis of the current IT environment, identification of where IT investments are applied and what changes should be considered (Weill et al. 2012).

4.1   Analyse the IT environment

Improvements start with knowing the current situation, what is the standard or benchmark, finding the gap between the current and the to-be (Wickramasinghe et al., 2005). As mentioned earlier most countries around the world, except China, consider CM as a CAM and do not regulate and subsidise CM in their healthcare system. IT developments in CM in most countries are very limited, manual system is still very common in most CM clinics (Lin et al. 2013). In this study we identify a few common CMCMS from different countries - SmartTCM Australia, TCM Herbalist Israel, TCM Organiser Canada, and Shen Professional Venezuela. Their functions, features and limitations are compared and summarised below.

Language: All four CMCMS include both English and Chinese. Shen Professional allows additional choices of Spanish, German, and Portuguese (Shen Professional, 2014). Australia is a multicultural and large immigrant country (Jupp, 2002), CM practice must include a much wider range of languages such as Vietnamese, Korean, Italian, Greek, and Indian which are not possible in Smart TCM (Smart TCM, 2014). When using Chinese language, it is important to know that it contains two components – Pinyin and the character system. Pinyin, like English letters, is used for pronunciation and has four tones. The same Pinyin with different tone means totally different things and result in different Chinese characters. In this aspect, it is a major disadvantage that TCM Herbalist only uses Pinyin without tones and characters (TCM Herbalist, 2014). This can be very confusing to the user, which more problematically can result in a wrong prescription.

Multi-user & access: All four CMCMS have versions for two user level password security and backup with extra cost on every additional level after the first. TCM Organiser has three user level accesses including administrator, physician, and dispenser (TCM Organiser, 2014).

Multi system, devise & discipline management: CM medicine and acupuncture are covered by all four systems, however only TCM Herbalist covers massage and other CAM disciplines. All four CMCMS include sub systems like patient management system (include booking and patient personal records), patient medical record; Prescription management and assistance; and reports and document management. TCM Organiser has a better accounting system which handles some extra accounting functions like split bills, tax and insurance calculation (TCM Organiser, 2014). TCM Organiser can be used on multiple devices such as PC, Mac, USB, and tablets while the other three CMCMS are restricted to PC and laptops. Clinic stock management is not in Smart TCM and TCM Herbalist. These features may not seem to be as must-have for some clinics but it is a necessary when CM and WM are integrated or reach to level 2 of figure 1. As the two types of medical practices become more and more integrated, it is our contention that it will be even more necessary that CM can be practiced like WM in all hospitals and clinics with many users and devices. Further CM should also be accessible by many medical modular management systems and disciplines.

4.2 Where IT investments are applied and what changes should be considered

4.2.1 Infrastructure

Current CM practice in developed countries like Australia and New Zealand tends to be in private clinics which include reception; consultation and treatment rooms with doctors, acupuncturists, and masseur; as well as dispensers (North, 2008). It is common that a CM physician works for several clinics at different times. A clinic may also have several branches at different suburbs (North, 2008). Like WM clinics, a local-area network (LAN) infrastructure with real-time access to a standard central database is an idea setting (Studnicki et al. 2008). This is illustrated in figure 2.
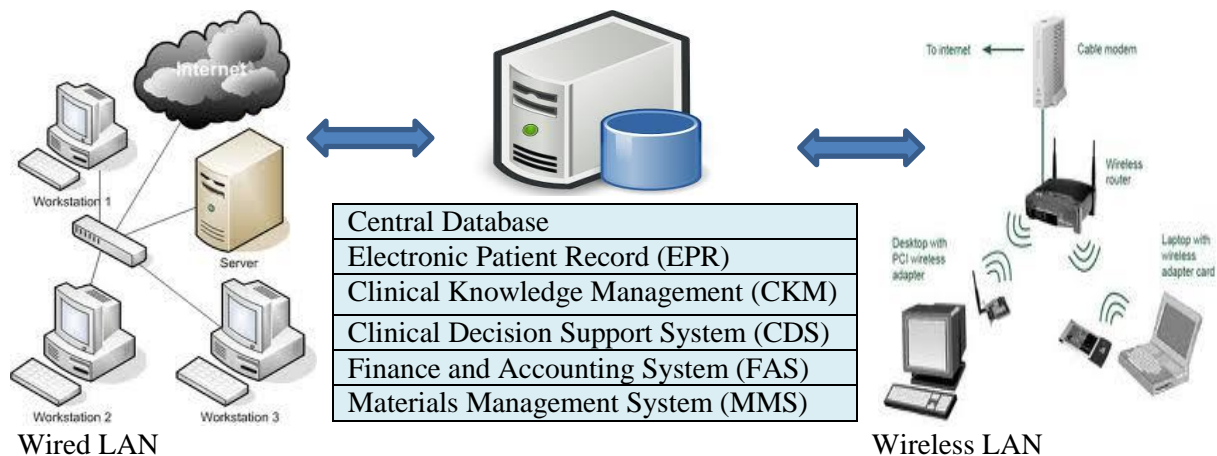

| Central Database |
| Electronic Patient Record (EPR) |
| Clinical Knowledge Management (CKM) |
| Clinical Decision Support System (CDS) |
| Finance and Accounting System (FAS) |
| Materials Management System (MMS) |

Wired LAN   Wireless LAN

Figure 2.   CM clinic LAN infrastructure

Both wired and wireless LAN is commonly used in small business and WM clinics (less than five computers). A typical setting in a medium-large clinic contains both where wired access in examination rooms, administrative areas, and documentation scanning (Stream and Fletcher, 2008). Wireless LAN can provide mobility, for example, when mobile laptop, tablet are used in the clinic. For CM clinics that are small and not equipped in IT at all, it is good to start with wired LAN for the following reasons:

- It is generally easier to implement and maintain. It also allows greater amount of data transmission (Stream and Fletcher, 2008).
- Speed can be much faster with Gigabit routers and it is not sensitive to dead spots which occur sometimes during consultation in wireless LAN (Stream and Fletcher, 2008).
- It is relatively more secure and stable as once the network security or firewall is installed and configured, the network is generally well protected, particularly if it is not directly connected to the Internet (Stream and Fletcher, 2008).

As CM practices become more common in WM clinics and hospitals (such as the situation of level 2 in figure 1), more computers and devices are used, wireless LAN may be a better choice as it provides

great mobility which allow information access anywhere in the practice without limitation to fixed stations. Many large hospitals use wired network as the core backbone and wireless access in specific areas (Stream and Fletcher, 2008).

4.2.2 Transactional

Transactional IT investment has been consistently linked to improve performance as its main purpose is to process the basic and often repeated transactions in an organization with the replacement of computer technology hence it helps to reduce cost (Weill and Ross, 2009). For example, In CM clinics, material management (include CM medicine, equipment, and other clinical supplies) is a repeating and resource-demanding task. CM medicine quality varies by a range of parameters which include: source of location, age, produce process, authentication, company standards, etc. All this information must be available to assist diagnosis treatment usages as it directly affects patients' health. It also needs to be managed for ordering and re-ordering purpose. If a certain medicine is flagged as bad or dangerous, it should not be ordered for prescription and it should have an alert message to support the CDS. Manage the ordering can shorten the waiting period as reorder can be triggered as soon as a reminder appears when stock is close to run-out. This ensures no overstocking and shortages of medicines for prescriptions.

4.2.3 Informational & strategic

Strategically and ideally, all CM practice and integration to WM should reach level three in figure 1. The reality is this may take quite a long time as every country's traveling speed is different. However knowing the destination and goal give all countries guidance in planning IT strategic investments. Whether you are aiming high and want to take jumps and skip levels or move slowly with a step at a time, the decision is for authorities and individuals to make. Research shows that it is usually safer, less costly, has higher chance of success by implementing the change one module or level gradually (Weill and Ross, 2009).

Medical workers are heavily engaged with knowledge and information hence it is very important to invest in information systems which provide the support and control for decision-making, communication, quick and quality information at the point of care. These systems include: electronic patient record, medical document management system, clinical knowledge management system and clinical decision support system. It is ideal that these systems have developed and followed one universal standard and regulations to avoid different versions and confusion. They should also be placed at a centre point or pool where information can be shared and accessed by different healthcare providers at real-time with security protection.

5   CONCLUSION

This paper reports on our research in progress study in investigating the possible role for IS/IT to support the delivery of Chinese medicine. Specifically, it has served to identify essential key considerations of developing a suitable CMCMS. This was done by performing an in depth review and analysis of the literature of CM practice and mapping our findings into the proffered CM/WM integration framework developed. In designing the integration framework, we drew on existing IS literature pertaining to the design and development of a suitable IT portfolio as recommended by Weill and others (Weill and Ross, 2009; Weill and Aral, 2006). In so doing, we recognise the importance of strategic management and planning in CM practice internationally and nationally for the near future. In line with the strategic plan set forth by the WHO (WHO 2013), we analysed the current situation of IS/IT usage of CM clinical management and existing systems. From an IT investment point of view, we specified and recommended the IT portfolio covering infrastructure, transaction, information, and strategic proportions, layouts, and settings. In addition, the research methodology is defined and explained. This paper thus serves as a pre-requisite to the development of a suitable CMCMS. Future studies will include conducting the case study, designing, creating, implementing and then evaluating the CMCMS.

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