



DESIGN OF A KNOWLEDGE MANAGEMENT SYSTEM FOR THE RESEARCH-TEACHING NEXUS: EVIDENCE FROM INSTITUTIONAL AUDIT REPORTS

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ABSTRACT

Aim/Purpose	The need for Higher Education Institutions (HEIs) to maximize the use of their intellectual property and strategic resources for research and teaching has become ever more evident in recent years. Furthermore, little attention is paid in developing an enabling system that will facilitate knowledge transfer in the Research-Teaching Nexus (RTN). Hence, this study assesses the current state of practice in knowledge management of the nexus in higher education in Oman. It also explores the context of how Knowledge Management System (KMS) for the nexus can be designed and utilized by HEIs and challenges them to rethink their traditional approaches in managing their knowledge assets to boost individual and organizational learning.
Background	This study provides a Knowledge Management-based framework and design of a knowledge management system that support the academic community towards the improvement of the nexus. This study sets out ideas from various academic and professional experts on how academic stakeholders in the higher education can improve and promote knowledge transfer and make better use of its knowledge and research assets for teaching and learning. It stressed the importance of having the knowledge assets or resources that can easily be pooled, accessed, and made available to its intended stakeholders.
Methodology	Data were gathered from 29 out of 49 institutional quality audit reports of all HEIs in Oman. The panel comments were coded and analysed to extract valua-

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ble insights regarding the management of knowledge assets in research. Additionally, data were gathered from the institutional accreditation outcomes page of the same website. Manifest and latent content analyses were used in reporting the findings of the panel.

Contribution	The study will contribute to a greater understanding and acceptance of Knowledge Management (KM) in higher education and extended the body of knowledge concerning knowledge management for the RTN.
Findings	The reports revealed a very limited practice of the nexus in terms of people and culture, structure ad processes, and computing and web technologies. A few staff are involved in RTN work, there is an uneven understanding of the RTN among staff, limited joint research between staff and students are some of the reasons for this. Significantly, there is no explicit research framework or policy for the RTN, and systems and/or mechanisms are limited. Furthermore, the reports did not account any use of computing and web technologies for the nexus. These limitations can lead to students with less academic, research, and graduate skills. Hence, this study presents a feature design of a KMS that incorporates various RTN best practices, as informed by the reports and literature. The design will allow the staff to utilize the research assets in the classroom, at the same time, engages students in research and scholarly undertakings.
Recommendations for Practitioners	All HEIs must have a innovative system that integrates a formal agenda and approach, and set initiatives, strategies, policies, and procedures for knowledge management in utilizing research assets for teaching and learning. It must be designed so that RTN practices remain up-to-date, relevant, and responsive to the needs of the stakeholders, as well as, address academic accreditation challenges.
Recommendation for Researchers	Researchers can evaluate the knowledge management of RTN practices of other HEIs outside of Oman to effectively recommend the proper course of action for teaching and learning improvement.
Impact on Society	This study will redefine the role and contribution of HEIs, which are key players in advancing a knowledge economy. HEIs are expected to be powerhouses where academic knowledge is discovered, created, disseminated, shared, and re-invented. They must be able to fully grasp the value of managing knowledge to be able to effect positive and purposeful change to the community.
Future Research	Future work should include staff and student surveys that examine the knowledge management need of the learning organization to better inform the design of a KMS for the RTN. Thereafter, future research can test the stage to test the effectiveness of the conceptual design.
Keywords	knowledge management, knowledge management system, research-teaching nexus, social computing, tacit knowledge

INTRODUCTION

Higher Education Institutions (HEIs) are learning organizations producing rich knowledge resources that drive a knowledge economy. They have become key partners for economic growth and development (Halibas et al., 2017), hence, a significant number of changes have occurred in the higher education sector over the last decades. Most of these unprecedented changes were prompted by the globalization of education, university rankings, research funding, and many others. In light of these rapid transformations, a modern HEI needs to evolve into an organization that generates, integrates and advances knowledge to remain relevant and competitive (Teece, 2000). Therefore, becoming

“world-class” and achieving academic excellence is becoming major thrusts of most HEIs. This has led some HEIs to employ innovative teaching and learning strategies to address the growing academic needs and establish learning environments where knowledge sharing, collaboration, and innovation thrive, in effect, educational institutions to turn to technology as an enabling mechanism for teaching and learning. Computing and web technologies can provide learners with unlimited access to information, dynamic and interactive class, collaborative learning environment, self-paced learning, and many others. These technologies have also revolutionized the way HEIs deliver course content, conduct classes, provide feedback, assess student performance, and collaborate with the academic community. However, the increasing complexity of managing the different technologies has left HEIs uncertain on how to utilize the knowledge generated from these technologies for research and teaching. Therefore, HEIs need to better understand their knowledge force, assets and capital, and choose innovative technologies that fit their learning needs.

Research and teaching, which comprise the major functions of an HEI, are closely linked, intertwined, and considered mutually synergetic functions (Jusoh & Abidin, 2012). Most HEIs generally acknowledge the strong link between the Research-Teaching Nexus (RTN) and student learning. Inarguably, teaching disseminates knowledge and serves as a catalyst in the creation of new knowledge while research creates new or updated knowledge. The HEIs recognize that research knowledge is a critical asset that plays a major role in achieving academic excellence and continuous improvement. Alavi and Leidner (2001) believe that knowledge assets can produce a long-term competitive advantage. Similarly, Kipley et al. (2008) also believe the use of knowledge assets within an organization supports vital operations and activities that answer the demands of time. Hence, HEIs must have a sophisticated Knowledge Management System (KMS) that can manage research assets and resources. Having an effective knowledge management system is a significant key to knowledge creation, accumulation, transfer, application, and internalization (Johannessen, 2018; Lee et al., 2005). Numerous academic institutions are now starting to recognize the tremendous value of knowledge and are using innovative computing technologies as their enabling mechanisms to extract actionable insights for timely and informed decision making related to learning (Chen & Burstein, 2006). Academic stakeholders can benefit from the use of Knowledge Management (KM) in managing research to improve teaching and learning (Newell & Marabelli, 2014). Giving them the machinery, tools, and support will eventually accelerate their learning curves.

However, the study of Alavi and Leidner (1999) claimed that the use of KM is still in its infancy stage, and the research studies and literature related to its development are limited. Although HEIs have huge resources of knowledge, they are not able to take full advantage of the knowledge that resides in the minds of their stakeholders, especially the expertise of teachers and innovativeness of students. More so, they may be rich in data but poor in knowledge. Data analytics and intelligence can benefit the academic community in a wide variety of ways. Academic stakeholders need an efficient and effective way to support and enhance nexus between research and teaching. This academic evolution gives an HEI valuable opportunity to review, redefine, and reconceptualise their priorities and current practices, and explore opportunities for improved teaching and learning. As of writing, it is observed that the literature combining KM and the nexus concepts are still limited. It is still unclear if the literature on these two concepts converges or is distinct in context. Hence, this study will review the KM and RTN practices in higher education from extant literature to gain a good understanding of the synergy between these two constructs. It will also review the Oman Academic Accreditation Authority (OAAA) institutional quality audit reports and discuss the current challenges in the RTN that HEIs in Oman faced. Most importantly, the main aim of this study is to introduce a synergistic framework and system that will integrate KM in the RTN and explore opportunities where this can be successfully designed. This study attempts to add to the literature that underpins the nexus, explores the role of technology in the knowledge sharing and transfer among the academic stakeholders, and provide recommendations that can strengthen the nexus to improve individual and organizational learning.

The research questions are:

1. What are the best practices and challenges that HEIs in Oman faced in the Research-Teaching Nexus as informed by the institutional quality audit reports?
2. How can a knowledge management system be designed to facilitate and support activities in the RTN?

The succeeding section will present the important concepts and related literature on KM and RTN. Thereafter, a section will discuss the findings after the content analysis of RTN section of the institutional quality audit reports among HEIs in Oman. Subsequently, the next section will present the potential integration of KM in the RTN. The design of a KMS is inferred from the results of the literature review and content analysis of the audit reports. Finally, the last section will conclude and recommend future work.

LITERATURE REVIEW

This section reviews the literature on KM and the RTN, and their relationship, including enablers, processes, and/or dimensions. These concepts have been generally studied separately and are considered distinct research areas. The factors that inhibit and facilitate knowledge management for the nexus are also discussed in this section.

KNOWLEDGE MANAGEMENT

Johannessen (2018) defines knowledge management as an organizational activity that is aimed at improving knowledge and its related activities, organizational learning and behaviour, and performance. Knowledge management is used to exploit, and harness individual and collective knowledge acquired from the experiences and competencies of people within the organization through creation, collection, storage, transfer, and utilization (Bollinger & Smith, 2001; Pemberton & Stonehouse, 2000). Doing so ensures that valuable and critical knowledge is not lost but communicated to people.

KM ENABLERS AND PROCESSES

Some significant drivers can hasten a successful and effective KM implementation. Several authors have identified and studied key enablers which include people and culture, structure and process, technology (Choi & Lee, 2002; Gold et al., 2001; Horvath, 2000; Nonaka et al., 2000). Likewise, the integration of technologies supports KM processes which include discovery, capture, sharing, and application (Becerra-Fernandez & Sabherwal, 2010) as illustrated in Figure 1.

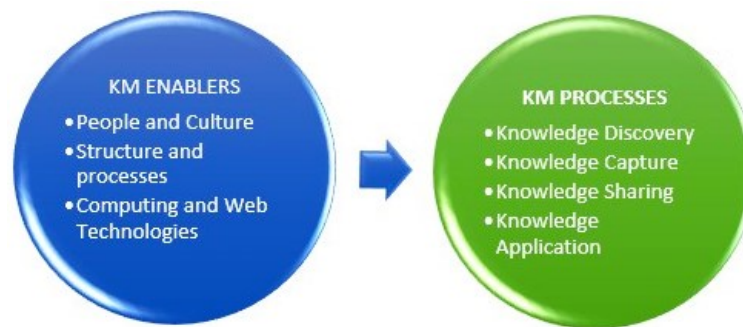


Figure 1: KM Enablers and Processes

KM Enablers

Several factors and organizational resources play crucial roles in facilitating knowledge management; these are the following.

People and Culture. Having the right culture can encourage and promote knowledge sharing among people. On the other hand, culture in the KM context refers to the values and norms that describe an organization. Culture is oftentimes cited as a critical issue in managing organizational knowledge (Alavi et al., 2005; Chang & Lin, 2015). One of the strategies in strengthening the academic culture in the RTN is by promoting a strong partnership and collaboration among the academic community which comprises of students, teachers, and industry experts.

Structure and Processes. KM diffusion in an organization necessitates having a strong organizational structure and processes. Figure 2 shows the Socialization Externalization Combination and Internalization (SECI) model with four modes of knowledge conversion as defined and expanded by Nonaka and Takeuchi (1995) which describes the continuous process of interaction between explicit and tacit knowledge (Nonaka, 1994). The SECI model describes how knowledge can be created, transferred, and recreated in an organization. According to Lin and Huang (2008), its applicability can be extended to the education context. Moreover, this model remains to be the universally accepted fundamental theory in knowledge conversion within KM (Andreeva & Ikhilchik, 2011).

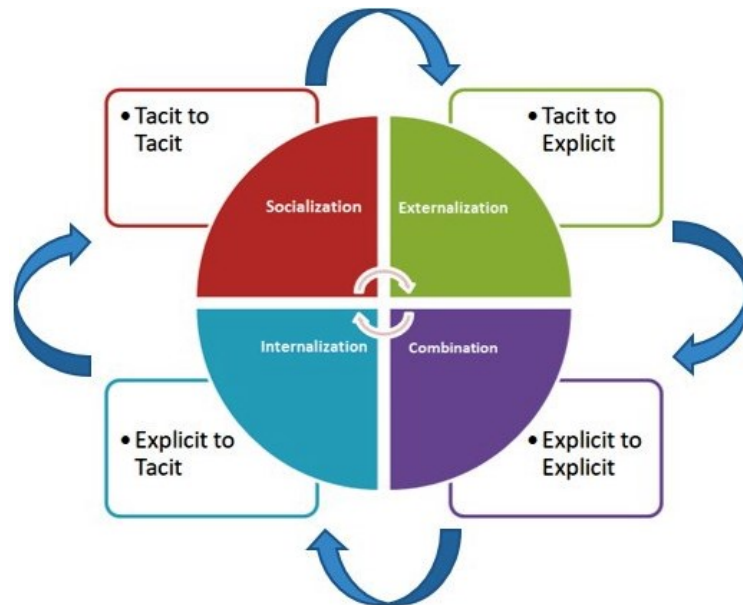


Figure 2: SECI model of knowledge conversion

Socialization is the process of sharing of tacit knowledge through social participation in formal and informal communities, whether face-to-face or virtual. Knowledge in socialization, which includes technical know-how, expertise, and experiences, is acquired through observation, imitation, practice, and social interactions (Chatti et al., 2007). Tacit knowledge is shared from one person to another through conversations, dialogues, and meetings in social groups (Sørensen & Lundh-Snis, 2001). It resides in the participant's mind rather than stored somewhere else.

Externalization is the process of expressing tacit knowledge into explicit knowledge. However, tacit knowledge is difficult to capture. It has to be understood in an intuitive level before it is codified because it represents the most valuable organizational knowledge (Hajric, 2018). In externalization, tacit knowledge is captured, documented, and annotated so that it can be distributed within the organization. Blogs and wikis are good examples on how collective knowledge is codified and recorded into formal written documents (Cress & Kimmerle, 2008; García et al., 2011; Hsu & Lin, 2008; Kosonen & Kianto, 2007). Discussion forums, which provide the participants' opportunities to share their tacit knowledge in online social spaces, can be documented. Moreover, podcasting and videocasting support externalization by capturing the sharing of tacit knowledge within the learning organizations (Grace, 2009).

Combination integrates knowledge into a system of explicit knowledge (text, image, videos, and animation) which can be stored, searched, and accessed in a central repository and made accessible to relevant people. Likewise, existing knowledge can be combined, reorganized, and updated to form new knowledge. For instance, academic stakeholders should be able to search and gather information about theses, dissertations, or any scholarly papers and use these to create academic-related reports.

Internalization is learning by doing (Nonaka et al., 2000). It internalizes explicit knowledge into tacit knowledge by using and learning from it. For instance, processes are followed (or internalized) by everyone because a common understanding or shared cognition of the rules and procedures has been achieved. New knowledge of certain processes is likely to reside in the minds of the people within the organization.

Computing and Web Technologies. The system, which is designed to facilitate knowledge management activities, is known as a Knowledge Management System (KMS). It is used to capture, store, and transmit individual and collective knowledge and create a common understanding of the knowledge within an organization. The KMS can also be used as an extensive repository of data, information, and knowledge. KMS are used for knowledge discovery, creation, and retrieval (Huang & Liaw, 2004). It can capture both tacit and explicit knowledge that can be shared and disseminated to others.

Knowledge management processes

Becerra-Fernandez and Sabherwal (2010) identified four (4) major KM processes with sub-processes as illustrated in Figure 3. First, knowledge discovery involves the creation of new explicit and tacit knowledge through combination and socialization, respectively. New explicit knowledge is created through combination by relating and synthesizing multiple or prior explicit knowledge to create a new complex explicit knowledge, on the other hand, tacit knowledge is also created through socialization. Second, knowledge capture involves the transformation of tacit to explicit knowledge and vice versa through externalization and internalization. The tacit knowledge is captured, documented and articulated, as well as, internalized by the people in the organization. Third, knowledge sharing is the process of communicating explicit or tacit knowledge to others through socialization and exchange. It is synonymous to knowledge transfer among individuals, groups, and organizations. Fourth, knowledge application involves the use of explicit and tacit knowledge for decision making and other relevant work.



Figure 3: KM Processes

In summary, KM implementation is a collective effort that is fostered and sustained by the members of the organization and requires significant organizational change over time. It requires receptive people and culture, strong structure and processes, and new approaches in computing and web technologies. At the same time, it is facilitated by processes that include knowledge discovery, capture, sharing, and application. The enablers and processes discussed herein will be used as guides to design an effective knowledge management system.

THE RESEARCH-TEACHING NEXUS

The Research-Teaching Nexus, or commonly called as the nexus, is the relationship and interaction between research and teaching to improve learning (Musthafa & Sajila, 2014). Willcoxson et al. (2011) emphasized that nexus can be actualized when students are engaged in research work. The literature review presents varying views of academics on the concepts and dimensions of the RTN (Boyd et al., 2010, Baldwin, 2005). Musthafa and Sajila (2014) describes the nexus as having various links between teaching and research to improve student learning and outcomes. Also, Taylor (2008) recognizes that the RTN generally considers the pedagogical relationship and mutual benefits of the interaction between teaching and research. Accordingly, Willcoxson and colleagues (2011) assert that the practical interpretation of the nexus is utilizing research to inform teaching and providing opportunities for students to engage in research work.

Table 1: Engagement of staff and students in the RTN

Dimensions of the RTN	Staff	Student
Research-led <i>(students as the audience, emphasizes research content)</i>	Staff teaches and disseminates research findings – reading list, citation in learning materials, research colloquiums	Students learn about research findings
Research-oriented <i>(students as the audience, emphasizes research process)</i>	Staff provides research training and materials to students, inside or outside the class	Students learn about research processes and methodologies in development seminars/workshops/ training and other research activities to gain research skills
Research-based <i>(students as participants, emphasizes research process)</i>	Staff conducts research with students	Students participate in research and inquiry-based activities
Research-tutored <i>(students as participants, emphasizes research content)</i>	Staff forms research groups and facilitates research discussions	Students participate in small group discussions about the research findings

HEIs are increasingly realizing the value in establishing and enhancing the linkage between teaching and research for professional and organizational benefits (Freestone & Wood, 2006). There have been continuous discussions and conferences regarding the effective alignment of research and teaching by HEIs (Moeung, 2013). Likewise, a significant number of HEIs, which have different institutional structures and priorities, are gradually transforming from simple teaching institutes to research-intensive institutions. Nonetheless, this study will use the dimensions conceptualized by Healey (2005) and defined by Griffiths (2004) that defines the engagement of the staff and students with the nexus (except research-tutored) as illustrated in Table 1.

Institutional accreditation of HEIs in Oman

The Sultanate of Oman, commonly called Oman, is an Arab country in the Gulf state and a member country of the Gulf Cooperation Council. Oman has numerous local and international colleges and universities in the region. Its higher education is supervised by the Ministry of Higher Education that collaborates with the Oman Academic Accreditation Authority (OAAA) to help develop the higher education sector through institutional quality audits and accreditation.

The institutional accreditation of higher education in Oman has a two-stage process: Quality Audit and Institutional Standards Assessment. In the Quality Audit, an HEI will submit a portfolio that describes its quality assurance and enhancement activities. These are assessed and verified by the au-

dit panel during their on-site visit. The panel will then produce a Quality Audit Report that is published by the OAAA. This report is a public document that provides the comments of the external audit panel on a range of key academic and administrative areas of an HEI for formative purposes. It is comprised of narratives, including their commendations, affirmations, and recommendations, from the audit panel against the applicable standards set by the OAAA.

Higher Education Institutions (HEIs) are faced with the challenge on how to break the silos that exist between teaching and research, and the need to create synergies surrounding these two intertwined academic functions. This study will look out how HEIs in Oman utilised the nexus for learning. The next section will describe the methodology used in this study.

RESEARCH METHODOLOGY

A high degree of quality in planning, data collection, and analysis was maintained throughout the study to extract the right information contained in the data. This study looked for predetermined subjects, patterns, and relationships that can answer the research questions (Hillebrand & Berg, 2000; Polit & Beck, 2006). It used content analysis to interpret the explicit comments of the audit panel through systematic reading, classification, and coding of data. Content analysis, which is a popular qualitative data analysis technique, validates or extends a theoretical framework or theory. Bryman and Bell (2007) define content analysis as a systematic method that examines patterns of communication in documents. The goal of content analysis is to reduce the volume and complexity of the data collected, identify themes, elicit meanings, and draw valid inferences or conclusions from the data (Bengtsson, 2016; Polit & Beck, 2006). It does not have rules and limits to the type and size of the text to be transcribed (Hillebrand & Berg, 2000). The quantitative method can be used to analyze the patterns in the texts, whereas, qualitative methods can be used to extract meanings from the texts. Several methods were used to perform content analysis for this study. These are described in the succeeding sections.

DATA COLLECTION

The data were gathered from 29 out of 49 institutional quality audit reports of all HEIS in Oman wherein seven (7) reports were confidential and 13 reports have no RTN section. These reports were published in the OAAA website from 2009 to 2019. The panel comments in Criterion 4.9, which is the Research-Teaching Nexus section, were coded and analysed to extract valuable insights regarding the management of knowledge assets in research. Additionally, data were gathered from the institutional accreditation outcomes page of the OAAA website.

DATA ANALYSIS

First, manifest content analysis is used in reporting the findings of the panel. As stated by Dooley (2016), explicit rules are used to analyse and interpret when using manifest analysis. Because of this, high reliability can be achieved in manifest content analysis especially when it is implemented using a computer. However, this analysis can produce low validity because of text reduction that tends to alter the meaning of the text. To compensate for this limitation, a latent content analysis was also performed. Dooley (2016) highlighted the importance of this analysis in achieving higher validity due to human presence in encoding and interpreting text. However, this analysis likely yields low reliability because of human errors. Therefore, this study used a combination of manifest and latent analysis in handling the comments reported in the Quality Audit reports.

The content analysis was carried out in the following sequence:

1. Text Selection – extracted the full text in the relevant criteria (Section on Research-Teaching Nexus) for each quality audit portfolio.

2. Text pre-processing – cleaned the text by eliminating statements which are not relevant to the research questions to improve the quality of the texts.
3. Text search (manifest content analysis) – keyword search in the pre-processed text. The keywords used were “knowledge” and “knowledge management”. The search returned only five reports that match this search phrase. Hence, these words were taken verbatim in reporting evidence of good practice for the KM in the RTN and are presented in the findings section. According to (Bengtsson, 2016), manifest analysis can be done by using words very close to the original text or the text itself, and describe what is evident in the text.
4. Text selection (latent content analysis) – texts that match the existing theories were selected by the coders. Specifically, this study uses the directed approach in content analysis wherein the codes are referenced from a theory or existing KM framework (Hsieh & Shannon, 2005) presented in the preceding section. Moreover, Graneheim and Lundman (2004) specified that at least two (2) coders should perform separate analysis, discuss and obtain a consensus of the results. Likewise, the coders’ preconceived knowledge and perspectives were taken into consideration to minimize any research and researcher biases (Long & Johnson, 2000). Therefore, two (2) coders, who were also the authors, were asked to perform the coding separately to minimize subjectivity. First, they were asked to read and re-read the reports several times to gain familiarity and insights and avoid misrepresentation of the texts (Bengtsson, 2016; Krippendorff, 2004). Second, the coders were directed to look for basic patterns while keeping in mind the research objectives. Third, the coders were required to identify phrases and assign it to the existing codes. They were also required to note positive and negative comments. Finally, each stage was performed several times to ensure the quality of the coding.

FINDINGS AND DISCUSSIONS FROM QUALITY AUDIT REPORTS

This section presents the findings that were derived out from the analysis of the quality audit reports, specifically, the section on the RTN. Existing theories and previous research studies were also used in discussing the findings of the reports (Elo & Kyngäs, 2008).

The Oman Accreditation Council of Oman requires that HEIs in Oman must have a system that effectively incorporates its research and scholarly activities into student learning and teaching activities (OAAA, 2019b). The evidence of good practice for the KM in the RTN among HEIs in Oman as reported in the Quality Audit reports (OAAA, 2019c) are as follows:

“...the College encourages its academic staff to carry out research and **share their research knowledge** and experiences with other professionals in their discipline through the publication of articles, books and research reports, and participation in conferences, seminars and workshops”

“...the Panel acknowledges that staff participation in research and consultancy is relevant to **maintaining currency of staff knowledge** and skill...”

“...there were some indications from academic staff that subject coordinators **incorporate current research knowledge in their subject** domains into the relevant teaching materials.”

“...students who were a part of this project, and with whom the Panel met, clearly gained significantly through the experience of **communication of the research findings** in Europe and the **knowledge** of the contribution to the healthcare of Omanis through the collaborative research”

“...to move the College towards achieving research and **knowledge transfer** goals, it has now developed a research policy...”

The reports from these HEIs indicate that research knowledge is shared, transferred, and communicated. At the same time, their staff participates in research activities and incorporate up-to-date research knowledge in the subjects they are teaching. Likewise, one (1) HEI reported that it has developed a research policy to achieve its research and knowledge transfer goals. Moreover, HEIs in Oman are gradually improving their research-teaching nexus as evidenced in the recent institutional accreditation outcomes that revealed 50% of the HEIs have a “Met” rating, 50% have a “Partially Met” rating, and none received a “Not Met” rating in the RTN (OAAA, 2019a).

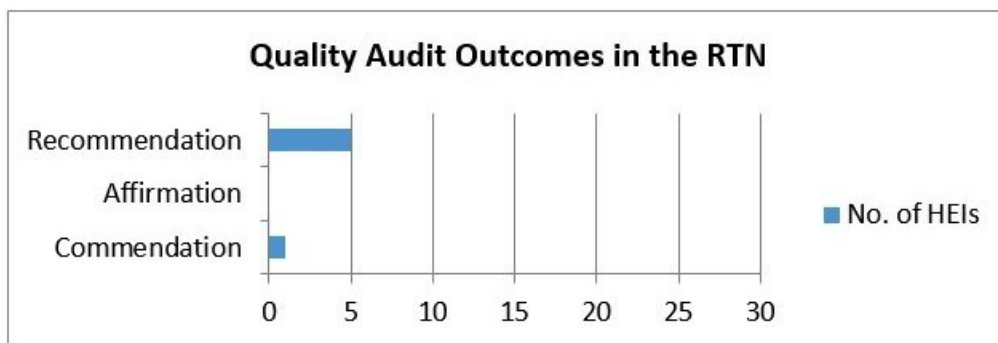


Figure 4: Quality Audit Outcomes in the RTN

Figure 4 shows the quality audit outcomes that HEIs in Oman received for the RTN. A commendation was awarded to one (1) HEI that was able to demonstrate good curriculum with strong research components in their undergraduate programmes, active engagement of students in research projects and development activities having external funding, and promotion of the nexus involving the industry. At the same time, this HEI was recognized by external organizations for their strong practice in the nexus. In contrast, there are five (5) HEIs that received recommendations from the audit panel and their comments concentrated on the minimal evidence of system, policy, and practice, little or no impact to teaching, undeveloped research skills, and limited support and resources to carry out RTN work. No affirmations were awarded to any HEI in Oman.

Table 2 summarizes the issues surrounding the RTN among HEIs in Oman as reported by the audit panel in the quality audit reports. The three (3) themes in the first column were taken from the KM enablers whereas the sub-themes emerged from the comments of the audit panel in the quality audit reports. As regards people and culture, the reports revealed that 13.8% of the HEIs have staff who carried out RTN work only through their initiative or motivation and without institutional support. Likewise, only 6.9% of the HEIs have limited number of staff doing RTN work while 3.4% of them have reported uneven understanding of the RTN. The reports further describe that 3.4% of the HEIs have produced few pedagogic research and the other 3.4% of the HEIs have produced a limited number of joint research between staff and students. The reports also indicated that 6.9% of the HEIs have limited RTN practice necessary in developing the research skills and graduate attributes of students. Most of the audit panel’s comments emphasized the need to take action to enhance the nexus by integrating research and scholarly findings in the classroom to improve the learning experience of students. An HEI’s foremost mission is knowledge generation and dissemination (Howell & Annansingh, 2013). However, most of the comments of the audit panel pointed out the insufficiency of the HEIs to effectively manage the knowledge assets generated from research - transfer, dissemination, and utilization. Knowledge sharing can happen when academic stakeholders communicate with each other (Ibrahim & Heng, 2015).

As regards structure and processes, the reports revealed that 13.8% of the HEIs have no explicit research framework or policy for the RTN and 24.1% of the HEIs have limited system and mecha-

nisms in place to support the nexus, hence, learning impact is minimal. The reports further revealed that 10.3% of the HEIs have inadequate research activities. Moreover, the reports show that 3.4% of the HEIs equally have limited work done in the nexus due to high teaching load, limited collaboration with other HEIs, and inadequate library resources making it impossible to do work for the nexus.

Table 2: Common RTN issues faced by HEIs in Oman

Theme	Sub-themes	% of HEIs
People and Culture	Uneven understanding of the RTN	3.4%
	Few staff are doing RTN work	6.9%
	Limited pedagogic research	3.4%
	RTN work is only through personal initiative	13.8%
	Limited joint research between staff and students	3.4%
	Undeveloped research skills of students	6.9%
Structure and Processes	No explicit research framework or policy for the RTN	13.8%
	Limited system, mechanisms, and learning impact	24.1%
	No widespread research activities or practices	10.3%
	Less financial incentives	3.4%
	Minimal RTN work due to high teaching load	3.4%
	Limited collaboration with other HEIs	3.4%
	Inadequate library resources for research work	3.4%
	Limited documentation	3.4%
	No dissemination approach	3.4%
No direct trainings for research	3.4%	
Computing and Web Technologies	-	0%

These financial and environment restrictions limit the work of staff for the nexus. Other reported issues related to this include limited documentation (3.4%), no dissemination approach (3.4%), and no direct training for research (3.4%). The study of Yasir, Majid, and Yasir (2017) assessed the role of management enablers and the mediating role of trust in knowledge sharing and found out a positive association. The link between research and teaching should be enhanced by developing and implementing a formal institutional approach for the enhancement of student learning. HEIs must ensure that an explicit system of policies, procedures, and protocols are in place to promote engagement in the nexus to achieve their educational and institutional goals. Accordingly, Shih and Tsai (2016) stated that there is an increasing demand for expertise and resource sharing in HEIs. Therefore, promoting a KM-based research culture to build intellectual capacity is required.

Significantly, the reports revealed that none of the HEIs uses computing or web technologies to facilitate their RTN practices. This presents a good opportunity to design a KMS for the RTN that is discussed in the next section. The use of a knowledge management infrastructure can facilitate the access, exchange, and management of knowledge. Further, its use can motivate individuals to access, use, and share their knowledge with colleagues and management (Yasir et al., 2017).

FEATURE DESIGN OF A KMS FOR THE RTN

This section presents the feature design of a KMS that incorporates various RTN practices. The design will allow the staff to utilize the research assets in the classroom, at the same time, engages students in research and scholarly undertakings.

There have been several studies that inform the design of a KMS. The study of Arpaci (2017) examined the adoption of cloud computing in education to knowledge management, Likewise, Badilescu-Buga (2013) proposed a social innovation model where several actors participate in knowledge generation and sharing. Moreover, Adams and Freeman (2000) implemented a system that captures group memory and knowledge transactions in an organization. Significantly, the study of Alavi and Leidner (1999) suggested that online communities of practice can share best practices in research, these include knowledge indexes, experts directory, discussion forums, and many others. Hence, there is good potential for KMS in enriching the nexus. Having this system will allow an academic community to create and share research knowledge, as well as, actively participate in research interactions and collaborations.

Knowledge dissemination or sharing is the core purpose of an HEI. Knowledge must be continuously shared so that it becomes of value. A learning organization must be able to effectively manage its knowledge assets and exploit its usefulness to teaching and learning. Figure 5 shows examples of knowledge resources or assets for the KM-RTN. These are not fixed assets rather dynamic assets that can change over time. The knowledge resources include, but not limited to, final year projects, research projects, journal articles, conference articles, work in progress, patents, and books. The assets can also be extended to include research reviews, comments, wikis, audio and video materials, policies, guidelines, research portfolios, and so much more.

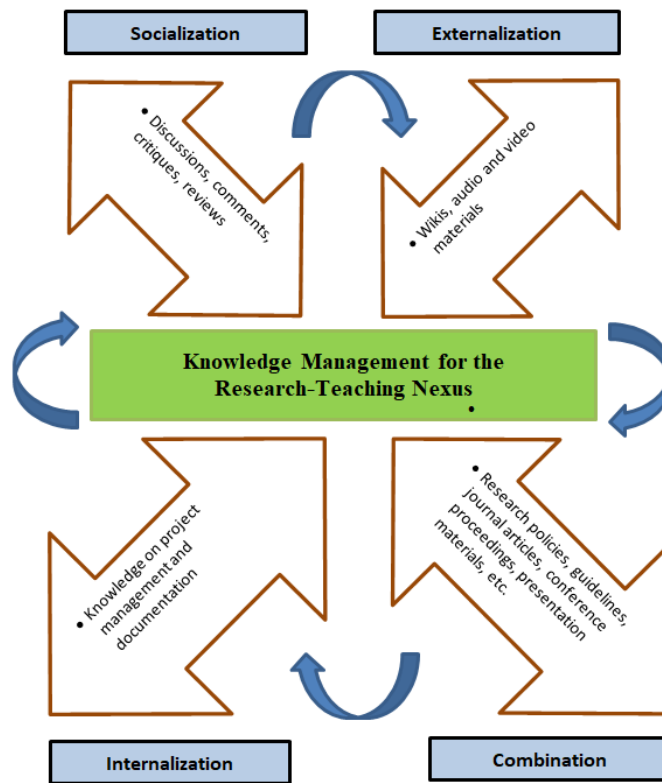


Figure 5: Knowledge assets shared in the RTN

Table 3 presents a summary of the functions and features of a KMS that integrates KM to the RTN based on the literature review and content analysis. The first column presents the four (4) KM modes of knowledge conversion in the SECI model. The second column presents the four (4) dimensions of the RTN defined by (Healey, 2005). The third column integrates the two concepts and provides a list of potential functions that can serve as design requirements of a KMS for the RTN.

Table 3: KMS functions and features for the RTN

KM mode	RTN dimension	KMS functions/features
Socialization	Research-tutored	<ul style="list-style-type: none"> • Commentaries in topic pages • Discussion forums/chatrooms • Community Yellow Pages or Experts Directories • Following and follower feature • Voting or Star Rating Feature
Externalization	Research-oriented	<ul style="list-style-type: none"> • Wikis and blogs about the research process and methodologies • Training video and audio media about the research process
Combination	Research-led	<ul style="list-style-type: none"> • Knowledge Assets Management (Repository/ Warehouse of Research Assets) <ul style="list-style-type: none"> - journal articles, conference proceedings, poster papers, research presentations, and other scholarly materials related to the RTN - RTN policies, research manuals, and funding guidelines - RTN newsletters • RTN metrics and analytics
Internalization	Research-based	<ul style="list-style-type: none"> • Project management including project and ethics approval, mentor selection • Researcher Profile and Portfolio management

Khakpour (2015) mentioned that KM is most effective in learning communities. In socialization, staff and students engage in countless research discussions but HEIs have no means of capturing the tacit knowledge generated from these meetings. HEIs can provide a tailored social platform to capture and record the knowledge generated through the use of online discussion forums. Online communities, which are networks of students, staff, researchers, and experts, can use this platform to facilitate research discussions, share ideas, comment and critique research works, and the likes. Anyone can ask informational or open-ended questions from the community members regarding any research issue and solicit tips and expert advice. The answers they provide can be voted or rated by the community members. Moreover, a member can follow each other using a following and follower feature. Therefore, the benefits that a member receives include collaborative and peer-to-peer learning, expert coaching or mentoring, and engagement in deep-level professional dialogues. Some examples of successful implementation of discussion forums for research include Researchgate, arXiv.org, Academia, and many others. Unstructured knowledge is generated in socialization which may pose a potential problem in codification. Hence, a KMS for socialization implements topic/keywords tags.

Several HEIs have undertaken several initiatives to integrate research into teaching. In externalization, for instance, they can create wikis and blogs that discuss research processes and methodologies.

Likewise, they can conduct organized seminars and workshops to inform students about the research process. Their training materials may involve audio and video media that captured the tacit knowledge of an expert. They can use these materials to be better informed on the latest developments in the research process and practice in their respective disciplines.

Explicit knowledge can easily be captured and stored in the knowledge base. HEIs hold numerous explicit forms of knowledge such as journal articles, conference proceedings, posters, and presentations. However, most of these knowledge resources may be inaccessible to staff and students and most of the time, are left unassisted on how to search for them. Hence, they are not able to access the knowledge resources generated by their stakeholders. In combination, the knowledge assets are compiled in knowledge repositories or warehouses for easy search and retrieval. Knowledge transfer is faster and easier when knowledge is properly organized and stored. This necessitates having an institutional policy that defines the knowledge management process (Dhamdhere, 2015). Likewise, HEIs can also produce RTN metrics and analytics which can be derived from these knowledge assets. The common issues faced in implementing combination include change notification, the non-uniformed format of documents, and administrative and security issues.

Once students can internalize the knowledge they gained, they can become co-producers of knowledge alongside their research mentors. Both staff and students can use their new knowledge to conduct research activities and become skilled in doing research. They can independently seek project and ethics approval, select research mentors or supervisors, manage their project, and create their research profile.

Similarly, the issue of copyright must be considered when knowledge is archived (Dhamdhere, 2015). Publisher's permission needs to be sought when using a publication for teaching, especially for non-open access journal articles. Likewise, Aswath and Gupta (2009) also consider the consistency, interactivity, and user-friendliness of interfaces of the knowledge-based system to be designed accordingly.

CONCLUSION AND RECOMMENDATION

This paper extends the literature of KM and the RTN in HEIs, most especially on the management of research assets for teaching and learning. The study suggests that HEIs should require their staff to utilize their knowledge assets in research and engage students in research and scholarly undertakings so that they become effective knowledge producers or workers. Subsequently, The study recommends that HEIs must have a formal agenda and approach, and put in place initiatives, strategies, policies, and procedures for knowledge management in research and teaching. Likewise, this study challenges HEIs to review their RTN practices and processes and explore ways where knowledge assets in research can be effectively disseminated, shared, and utilized for teaching and learning.

This study further advocates the need for HEIs to adopt KMS to better facilitate knowledge sharing in the Nexus as well as remain relevant and competitive in an ever-increasing knowledge society. Gibb (2005) stated that successful learning organizations of the 21st century are the ones that effectively manage and utilize their knowledge assets. So, the provision of a technology platform or tool that can better facilitate the complex engagement of academic stakeholders and access and sharing of information is a welcome opportunity. Therefore, HEI management should consider the development of a KMS for the RTN.

Future work should include staff and student surveys that examine the knowledge management need of the learning organization to better inform the design of a KMS for the RTN. Thereafter, future research can test the stage to test the effectiveness of the conceptual design.

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BIOGRAPHIES



Dr. Alrence S. Halibas is a seasoned administrator and educator who has an excellent academic track record for the past 20 years. She is currently the Senior Program Manager for Digital Marketing at RMIT University, Vietnam. She once served as an Assistant Professor and Program Leader of the Faculty of Computing Sciences at Gulf College, Oman from Apr 2012- Jan 2020. Prior to joining Gulf College, Dr. Halibas held the post of the Dean of the College of Computer Studies and Associate Dean of the School of Engineering and Information Technology at La Salle University, Philippines, from Jul 2000 to Mar 2012.

Dr. Halibas is a holder of several IT certifications, an active researcher, and a reviewer. She has published research papers in several refereed journals and peer-reviewed conference proceedings, including the Institute of Electrical and Electronics Engineer (IEEE) and Informing Science Institute (ISI), USA. Her research works are indexed in Scopus, EBSCOhost, IEEE, Google Scholar, and other reputable research databases. Moreover, Dr. Halibas has participated as a technical panel member

and session chair in numerous international research conferences. Her current research interests include learning analytics, educational management and technology, entrepreneurship, and marketing.



Dr. Rolou Lyn R. Maata is a PhD holder, certified SAP lecturer, licensed professional teacher, research reviewer, and a computer science professor taught in higher education institutions from various universities in Philippines, Bahrain and Oman. She has more than eighteen (18) years of administrative and teaching experience in academe and held various positions such as Department Head for Information Management and Computer Science, Associate Dean for College of Computer Studies and Engineering, Dean and Alumni Head.

She joined Gulf College in 2014 as Lecturer and was promoted as Assistant Professor in 2017. Presently, she is the Final Year Project (FYP) coordinator of Faculty of Computing Sciences (FCS). Also, Dr. Rolou is a certified SAP Lecturer issued by SAP University Munich, Germany and the main contact of SAP University Alliances EMEA from her previous international university in Bahrain. She was also one of the professors who led the integration of SAP for the improvement of Business Informatics Curriculum in Bahrain. She attended various trainings related to SAP ERP in Napier University, Scotland, UK and SAP University, Waldorf, Germany.

Dr. Rolou is also a certified research reviewer of The Research Council (TRC) Oman and Institute of Informing Science in USA. She presented and published research papers in local and international conferences and research journals. Her research interests lie in the area of IoT, Educational Technology, Enterprise Applications, and Computer Security.



Mr. Mohamed Abdul Kader Varusai is a computing lecturer, programmer and internal quality auditor. He has 15 years of total teaching experience in India and Oman. He also worked as a Senior Software Engineer in the IT industry and had worked for many international projects. Mr. Varusai is currently pursuing his Ph.D. degree in Data Mining. He completed his Master of Philosophy in Computer Science from Periyar University, India in 2007, Master of Computer Applications in 1999, and B.Sc. Computer Science in 1996 from Manonmaniam Sundaranar University, India. He is an excellent teacher as well as a lifelong learner.

Also, Mr. Varusai is a Certified Internal Auditor and a holder of several IT certifications. Additionally, He serves as a supervisor and assessor for final year projects students in Gulf College. He has published research and conference papers in journals including IEEE. His research interests include software engineering, human-computer interaction, and data mining.



Dr. Ali Al-Badi is the Deputy Dean for Academic Affairs and Research, at Gulf College; previously he worked as an Assistant Dean for Postgraduate Studies & Research, Associate Professor in the Department of Information Systems at Sultan Qaboos University (SQU), Muscat, Oman. Dr. Ali received his education in different countries (Oman, Kingdom of Saudi Arabia, UK and USA). Ali has more than 27 years of practical and academic experience in IS/IT field. Immediately, after obtaining his B.Sc. in Computer Science from Reading University, UK in 1991, he worked in the Center for Information Systems, SQU, where he gained most of his practical experience. Ali joined the academia in 1999 and completed his PhD in UK in 2005. From

Sep 2007 – March 2011 Ali held the CIS Director's position, sharing his time between managing the Center and performing his academic duties. From Sep 2012 – Sep 2015 Ali held the Head of Department position at the Information Systems, College of Economics & Political Science, Sultan Qaboos University, Oman. Furthermore, Ali contributed to 15 different IT-focused committees both at the university and national level.

Dr. Ali Al-Badi is an active researcher, having a good record of publication (citations: 910; h-index: 145; h10-index: 25), published more than one hundred and twenty-four (124) international conference/journal papers, chapters in a book or report. His work has been cited in ISI, DBPLP, Scopus, ACM, IEEE, Google Scholar and other databases. He regularly reviews papers for international journals and conferences. In addition to publishing single or co-authored papers, Dr. Ali is also well-known for his patience and commitment in helping and empowering our students in sharpening their research skills. As a result of his hard work and his scholarly activities, he received a number of awards/recognitions including "Excellence in Research Award" from Clute Institute, Colorado, USA, "Certificate of Outstanding Contribution in Reviewing" and "Best Researcher Award" from Sultan Qaboos University, Oman, and "Best Paper Award" at a conference in Paris, France. He also co-supervised, supervised/ supervising number of postgraduate students at local, regional and international universities. Dr. Ali Al-Badi received several internal, TRC and HMTF strategic grants and Microsoft worth total of 142,393 OMR. He is on editorial board of number international journals and reviewers for international journals. Dr. Ali also chaired local and international conferences/workshops and was invited as a Keynote speaker at 5 different conferences.



Mr. Peyman Nouracy has been teaching English as a Foreign Language for more than ten years. He has taught at both institutional and higher education level. At present, he is an English Language Lecturer at the Centre for Foundation Studies (CFS) and the College Research Coordinator at Centre for Postgraduate Studies and Research (CPSR). His area of interest in research includes Translation Studies, Teaching English as a Foreign Language (TEFL), Critical Discourse Analysis, Linguistics, and Comparative Literature. He has published his research papers in reputable international refereed journals. To date, he has published four books on

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