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Development of Tacit Knowledge Measurement Model for Academic Staff Activities

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Abstract
Academic staffs represent the main knowledge resources in universities. The development of academic staff's tacit knowledge is necessary to improve the competitive advantage of various activities that are provided by universities such as teaching and research and administrative. The measurement of tacit knowledge levels is important to improve many business operations like better allocating of tacit knowledge sources based on working context and accurate development of tacit levels depend on working strategies. The measurement of tacit knowledge is difficult due to intangibility of tacit knowledge. The main aim of this paper is to develop a model to measure the academic staff's levels of tacit knowledge by using useful and practical variables. The research data were collected through qualitative approach using interview with five experts of knowledge management. The proposed model shows the academic staff's level of tacit knowledge which evaluated according three main activates; research, teaching, and administrative. The main results of this study are set of suitable variables to measure the academic staff's levels of tacit knowledge such as experiences years, qualification levels, innovations, number and quality of publication, and assessment by tests. The major benefits could be gained from tacit knowledge measurement by using the proposed model is better understanding of knowledge resources in the university.

1. Introduction

During the last two decades, knowledge management (KM) has become one of the most interesting topics for researchers and practitioners [35]. This is because KM is a systematic approach of administering knowledge to maximize the competitive advantages of organizations through effective value in knowledge chains [21]. Knowledge is defined as a combination of experience, values, and skills to evaluate and incorporate new experiences and information based on the working context of an organization [30]. It is considered as a critical organizational asset that enables organizations to achieve competitive advantage [31]. As knowledge has been recognized as an important asset to the organization, it needs to be managed effectively. Thus, KM emerges as a new management concept that has been well-established in many

organizations [13, 14, 24]. Higher institutions or universities have also embarked in KM initiatives. Universities can play as significant role in development of knowledge based society through their employee's competence, skills, and expertise. Universities are considered as centers of learning, where people go there to seek and discover new knowledge through research and teaching activities [7, 34]. Managing tacit knowledge resources is more difficult than organizing explicit knowledge resources because of various reasons such as intangibility and dynamic [25]. The intangibility and dynamic of tacit knowledge increases the complexity and difficulty of measuring the level of tacit knowledge of academicians in universities. Consequently, the lack of quality or quantity of knowledge resource measurement can lead to decrease in the production performance, i.e., low quality and delay in production [2]. Thus, measurement of tacit knowledge resources in the university environment is significant to successful KM implementation in organizations [23]. It helps to evaluate and to ensure that the knowledge resources are used effectively for competitive advantages [5, 33, 18]. In addition, knowledge measurement helps upper management to evaluate the academics level of tacit knowledge [5, 33, 18]. According to importance and difficulty of tacit knowledge measurement, the main aim of this paper is to develop tacit knowledge measurement model to evaluate the academic staff level of knowledge in order to provide better understanding of knowledge resources in university environment.

2. Related Works

This section presents related works of knowledge measurement as major success factor of knowledge management implementations. On the other hand, various variables and methods used to measure the tacit knowledge are presented.

2.1. Knowledge Measurement

The KM implementation is affected by numerous factors to meet the objectives of an organization using the knowledge. [11] Surveyed 160 stakeholders of various business organizations to examine success factors of Knowledge Management (KM) implementations, he identified that the knowledge measurement is one of the major factors that could considered to success implementation of KM. On the other hand, [22] explained that the successful implementation of KM has a direct effect on organizational performances and an indirect effect on employee innovation. Based on the importance of success factor of KM, a survey for mid-level managers of the Iraqi MTS resulted in three factors that have a direct impact on KM success, namely, leadership, knowledge measurement, and KM implementations. The same results about the importance of knowledge measurement were confirmed by [4, 20, 5, 33, 18, 8, 28]. According to [16 and 4], knowledge measurement can be defined as an approach that used to identify organization level of knowledge resources (i.e. in quality or quantity levels). [25] stated that the knowledge measurement is the processes of evaluate the knowledge resources in order to accomplish many activities such as efficient sharing of explicit knowledge based on tacit levels in same context, [1] mentioned that the tacit knowledge measurement is necessary to enhance the businesses operations in organizations like better allocating of workers on working tasks based on their tacit levels. Thus, the knowledge measurement helps organizations to know what the resources they have currently and what the knowledge that would develop.

[12] founded that tacit knowledge measurement is the main factor to improve organizational performance by evaluate and improve the employee's levels of tacit knowledge which results to make the right decisions and support organizational profits. [10] Pointed out that a significant positive relation exists between tacit knowledge evaluation and job performance for low, middle, and upper levels of management. Thus, an organization needs to measure the tacit knowledge of its employees to ensure the compatibility of such tacit knowledge with the organizational objectives. Tacit knowledge measurement is important to determine the explicit impact on improving the skills and experience of employees. Therefore, an organization that pays more attention to measuring the tacit knowledge of employees and determining their explicit knowledge can help improve its income and competitive advantage. On the other hand, [19, 15], stated that the accuracy of explicit knowledge should follow the organizational strategies. Thus, an organization can ensure its successful alignment between strategies and explicit knowledge to enhance the outcome.

In terms of the knowledge measurement in universities, [6, 17] considered a university as a main source for knowledge creation. Thus, a university needs continuous improvement in knowledge to provide efficient knowledge to all students, lecturers, and external organizations; such improvement explains the university's needs to measurement factors to provide useful knowledge to all. Higher education institutions such as universities provide teaching skills, learning processes, innovation tools, and research criteria to improve the knowledge of its lecturers and students [27]. Thus, universities are considered major and important sources of knowledge creation to support organizations with new knowledge that will solve company problems. The main goal of KM implementation in universities is to improve research, teaching and administrative activities through managing the worker's tacit knowledge. However, KM in universities needs to identify the level of tacit knowledge of lecturers to better manage knowledge resources (i.e., allocate tacit knowledge resources in the university in order to share the highest tacit knowledge with others) [34]. Thus, universities need to measure the tacit knowledge of its workers accurately to understand the knowledge resources in an organization.

2.2. Tacit Knowledge Measurement Methods

[26] mentioned three main methods that can be used to measure the level of tacit knowledge of an employee, including (1) informal method, where the employee's level of tacit knowledge can be evaluated by monitoring and understanding the explicit impact on the experience, skills, and competencies of the employee as a tacit knowledge; (2) formal method, where the employee's level of tacit knowledge can be measured by direct tests (objective test, multi choice test, et al.); and (3) employee characteristics, where the employees' level of tacit knowledge can be clarified through their attributes (i.e., qualifications such as PHD, Master, Bachelor, non–education.

According to [9], an academic organization can use (1) qualification levels and (2) years of experience as critical variables to evaluate the tacit knowledge of an academic employee. The qualification level (i.e., PhD, Master, and Bachelor) is a significant indicator of variances of academic staff's knowledge. For example, a worker who has a Master qualification should develop many studies to obtain a PhD qualification and gain additional knowledge in his field (i.e., increased tacit level). On the other hand, a lecturer who has 20 years of experience normally has a higher level of tacit knowledge than workers with less years of experience (i.e., two years' experience).

The European Commission (2013) argued that two variables can be distinguishes the academic staff levels of tacit knowledge, namely (1) computer-based testing using quizzes and (2) observing individuals skills through work activities. For example, the organization uses quizzes and tests to evaluate the level of tacit knowledge of a worker on the basis of his working context. The organization can also evaluate the workers' level of tacit knowledge by observing their work activity performances. The observed assessment can be computed depending on various indicators, such as speed of completion of working tasks and accuracy of work activities. For example, workers who complete their activities faster than other workers have the highest level of tacit knowledge. Both testing and observing assessment variables can measure the level of workers' tacit knowledge based on the current skills and experiences of workers. Regarding the computer-based testing variable, organizations can measure a worker's level of tacit knowledge directly. For example, organizations can establish a procedure for short quizzes for the employees. The question in the quizzes, related to working environment and based on the answers of workers, can evaluate a worker's level of tacit knowledge.

The most clear practical model of tacit knowledge measurement in universities was developed by [26]. The main aim of the developed model is to measure the levels of tacit knowledge of the academic staff of universities by combining four variables, namely, (1) qualification level, (2) years of experience, (3) assessment level, and (4) observing level. They were identified scales and importance values to all these variables. The most important variable is assessment using quizzes, with a 0.4 importance coefficient compared with 0.2 for other three variables. Each measurement variable is scaled from 0 to 10 points according to the attribute variances of each variable. For example, a lecture who has master (instructor) in the classification of qualification level will get 6\10 as evaluation of the qualification level. Mathematical formulas compute the overall level of tacit knowledge of any worker based on the four proposed variables as shown by Figure 1. These formulas multiply the worker evaluation of each variable by the importance coefficient and sum all evaluations as a measurement result; the mathematic formulas are the following:

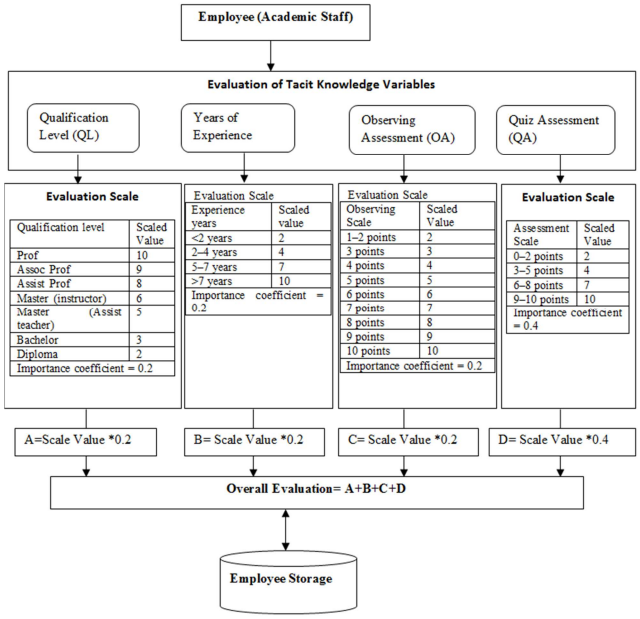

Figure 1. *Measurement variables.*

A= Qualification Level Evaluation* Importance coefficient
B= Experience level evaluation* Importance coefficient
C= Observing level evaluation* Importance coefficient
D= Quiz assessment * Importance coefficient
Overall Evaluation= A+B+C+D
(Al-Oqaily et al., 2015)

3. Research Method

The construction of the proposed mode is on the feedback from experts in knowledge management field. The feedback of experts was collected by using qualitative approach (interview). The qualitative method provides detailed information that helps to achieve powerful objectives [3]. The experts were chosen based on their working experiences in knowledge management. All those interviewed were experts in knowledge management because they taught knowledge management subjects more than 7 years, also they have conducted studies in knowledge management field, and most of them are supervising several postgraduate students in knowledge management field. Table 1 illustrates the main information of expert's profiles.

Table 1. *Experts Profiles.*

Expert Name	Current Position	Experience Year	Organization
PROF PETER WOODS	Head of knowledge management center	45 years	Multimedia university-Malaysia
PROF MOHD SHARIFUDDIN AHMAD,	Lecturer	19 years	Tenaga Nasional, Malaysia (COIT)
PROF NOR'ASHIKIN BTE ALI, DR.	Lecturer	14 year	Tenaga Nasional, Malaysia (COIT)
PROF MOHAMMED HUSSEIN MANHAL	Assistant Professor Business Administration Dept.	12 year	Basra University - Iraq
ZAIHISMA BINTI CHE COB	Lecturer	10 years	Tenaga Nasional, Malaysia (COIT)

4. Development of Tacit Knowledge Measurement Model (TKMM)

Tacit knowledge measurement model is developed based on critical analysis of qualitative data collection. The main results of experts' interview is classified in four sections which are (1) scales value of measurement variables; (2) importance value of measurement variables; (3) tacit knowledge measurement formulas; and (4) comparing and sorting the academicians based on tacit knowledge level.

4.1. Tacit Knowledge Measurement Variables' Scales Values

The results of gathering data from expert panel show that the academic staff's level of tacit knowledge can measure by using eight variables. The eight variables provide efficiency measurement because they are related to academics environments. Each variable consist from two main stand point which are scales value and importance value. This study uses qualification levels; years of experience; supervisor assessment; assessment based quiz; number of publication; quality of publication; achievement within context of work and successful innovations as a variables to measure the academic staff's levels of tacit knowledge.

4.1.1. Qualification Levels

The tacit knowledge of academic staff can be evaluated through qualification level. The qualification level (i.e., PhD, Master, and Bachelor) is a significant indicator of the variances of academic staff knowledge for example, a worker who has a Master qualification should develop many studies to obtain a PhD qualification and gain additional knowledge in his field (i.e., increased tacit level). Table 2 illustrates the qualification level scales values.

Table 2. *Qualification level scales values.*

Qualification level (QL)	Scaled Value
PhD	10 (highest value)
Master as instructor	8
Master as assistant teacher	6
Bachelor	4
Diploma	2

4.1.2. Years of Experience

Tacit knowledge of academic staff can be evaluated through years of experience for example; a lecturer who has 20 years of experience normally has a higher level of tacit knowledge than workers with less years of experience (i.e., two years' experience). Table 3 illustrates the years of experience scales values.

Table 3. *Years of Experience scales values.*

Experience year (EY)	Scaled value
<2 years	2
2-4 years	4
5-7 years	7
>7 years	highest value)

4.1.3. Supervisor Assessment

Universities can also evaluate the academic staff's level of tacit knowledge by observing their working performances. The observed assessment can be computed depending on various indicators, such as speed of completion of working tasks and accuracy of work activities. For example, workers who complete their activities faster than other workers have the highest level of skills and experiences which clarify the tacit knowledge. Table 4 illustrates the observing level scales values.

Table 4. *Observing Level Scales Values.*

Observing Level (OL)	Scaled value
1-2 points	2
3-4 points	4
5-6 points	6
7-8 points	8
9-10 points	highest value)

4.1.5. Assessment Based Quiz

The tacit knowledge of academic staff can be evaluated through assessment approach i.e. short answers quiz and long answer quiz for example, the organization uses quizzes and tests to evaluate the level of tacit knowledge of a worker on the basis of his working context. Table 5 illustrates the assessment level scales values.

Table 5. *Assessment level scales values.*

Assessment Level (AL)	Scaled value
0 point	0
1-2 points	2
3-4 points	4
5-6 points	6
7-8 points	8
9-10 points	highest value)

4.1.6. Number and Quality of Publication

The tacit knowledge of academic staff can be evaluated through number and quality of publications in certain field.

The high quality and number of publications come from a high level of tacit knowledge. Thus, universities can use these two variables to identify the contribution of an

academic researcher's tacit knowledge. The publication quality depends on the sources of related publications (i.e., journals). For example, ISI indexing has a higher quality than Scopus or traditional Internet indexing. The number of publication variables can be used to consider the level of tacit knowledge of a researcher. For example, a researcher who has published 25 papers has a higher level of tacit knowledge than another researcher who has only published 2 papers, because conducting a research maximizes the researcher's perception and enhances the use of tacit knowledge. Table 6 illustrates the number and quality of publication scales values.

Table 6. *Number and Quality of publication scales values.*

Number of publication (NP)	Quality of publication (QP)	Scaled value	Number of publication (NP)	Quality of publication (QP)	Scaled value	Number of publication (NP)	Quality of publication (QP)	Scaled value
0 papers	ISI	0	0 papers	Scopus	0	0 papers	Conference	0
1-3 papers	ISI	2	1-3 papers	Scopus	2	1-3 papers	Conference	2
4-8 papers	ISI	5	4-8 papers	Scopus	5	4-8 papers	Conference	5
9-15 papers	ISI	8	9-15 papers	Scopus	8	9-15 papers	Conference	8
>15 papers	ISI	10	>15 papers	Scopus	10	>15 Papers	Conference	10

4.1.7. Achievement Within Context of Work

The tacit knowledge of academic staff can be evaluated through achievement within context of work such as participation in certain programs, external seminars, workshops, and training. Thus, the employee's certificates in participation of these programs can indicate their level of tacit knowledge, which means that the achievement within the context of work is one important variable to measure the level of tacit knowledge of employees. For example, communication companies encourage their employees to participate in external trainings to improve their skills in dealing with customers, after which, the employees will receive their successful training certificate indicating their level of tacit knowledge. Table 7 illustrates the achievements within context of work scales values.

Table 7. *Achievements within The context of working Scaled and evaluation values.*

Achievements within The context of working (AW)	Scaled value
0	0
1-2	2
3-5	3
6-8	4
9-10	9
>10	highest value)

4.1.8. Successful Innovations

The tacit knowledge of academic staff can be evaluated through the number of success innovation and suggestion can support working environment. Thus, an organization can use successful innovations as a variable to measure the level of tacit knowledge of employees. For example, Thomas Alva Edison was the first innovator who established the basics to innovate electricity, which means that Edison has the highest level of tacit knowledge during that century, knowledge which enabled him to invent electricity. Table 8 illustrates the Successful Innovation scales values.

Table 8. *Successful Innovation scales values.*

Successful Innovation (SI)	Scaled value
0 Innovation	0
1 Innovation	2
2 Innovation	4
3 Innovation	6
4 Innovation	8
>=5 Innovation	highest value)

4.2. The Measurement Variables Importance Value

The importance values for same variable may differ based on measurement purpose for example, in the measure the tacit knowledge for research activities the importance values of the number and quality of publications are more than the important value of qualification levels or years of experience variables. Thus, it is necessary to distinguish between the variables importance depend on measurement purpose. The importance summation of all variables in same class should be 1 to structure the measurement processes as will explain later in this section. Table 9 illustrates the importance values of each variables depend on the measurement activities.

Table 9. *The importance values of measurement variables.*

Measurement Purpose	Measurement Variables	Variable Importance	
Teaching Activities	Experience of Years	0.2	
	Qualification Level	0.2	
	Observing Level	0.2	
	Assessment level	0.2	
	Successful innovation	0.1	
	Working achievements	0.1	
Researching Activities	Number of publications	ISI	0.25
		Scopus	0.15
		Conference	0.1
	Experience years	0.2	
	Qualification levels	0.2	
	Successful Innovation	0.1	
Administration Activities	Experience years	0.3	
	Qualification level	0.3	
	Observing level	0.2	
	Assessment Level	0.1	
	Successful innovation	0.1	

4.3. Tacit Knowledge Measurement Formulas

According [25], finding, there is only one formula used to measure the academic staff levels of tacit knowledge practically. The experts are strongly agreeing that, the academic staff levels of tacit knowledge can be measured for research, teaching and administrative activities. This research develops three new formulas based on Al-Oqily's formula concepts which are;

(1) Tacit level for researching = $0.25*N_{Pi} + 0.15*N_{Ps} + 0.1*N_{Pc} + 0.2*E_Y + 0.2*Q_L + 0.1*S_I$

(2) Tacit level for teaching = $0.2*E_Y + 0.2*Q_L + 0.2*O_L + 0.2*A_L + 0.1*S_I + 0.1*A_W$

(3) Tacit level for administration = $0.\ 3*E_Y + 0.3*Q_L + 0.2*O_L + 0.1*A_L + 0.1*S_I$

Where, N_{Pi} is mean a number of ISI publications, N_{Ps} is mean a number of Scopus publications, N_{Pc} is mean a number of conference publications, Q_L is mean qualification level, E_v is mean experience year, S_I is mean successful innovation, A_L mean is assessment level, O_L is mean observing level, A_W is mean achievement within the context of work.

4.4. Comparing and Order the Academicians' Tacit Knowledge Level

According to interview finding, the comparison between the academic staffs tacit knowledge can be managed through classify the tacit knowledge evaluation as three main classes; (1) strong tacit level, medium tacit level, and low tacit level. For research and teaching activities, the top 20% tacit knowledge evaluation considered as strong tacit level, the next 30% tacit knowledge evaluation considered as medium tacit level, and the next 50% tacit knowledge evaluation considered as low tacit level. For administration activities, the top 5% tacit knowledge evaluation considered as strong tacit level, the next 15% tacit knowledge evaluation considered as medium tacit level, and the next 80% tacit knowledge evaluation considered as low tacit level. This is because, the number of academic staff that needs to be allocated for research and teaching activities are greater than the number of academic staff allocated for the administration activities. Thus, the classifications of measurement, evaluation are different depending on the measurement purpose. Figure 2 illustrates the overall development aspects of proposed TKMM.

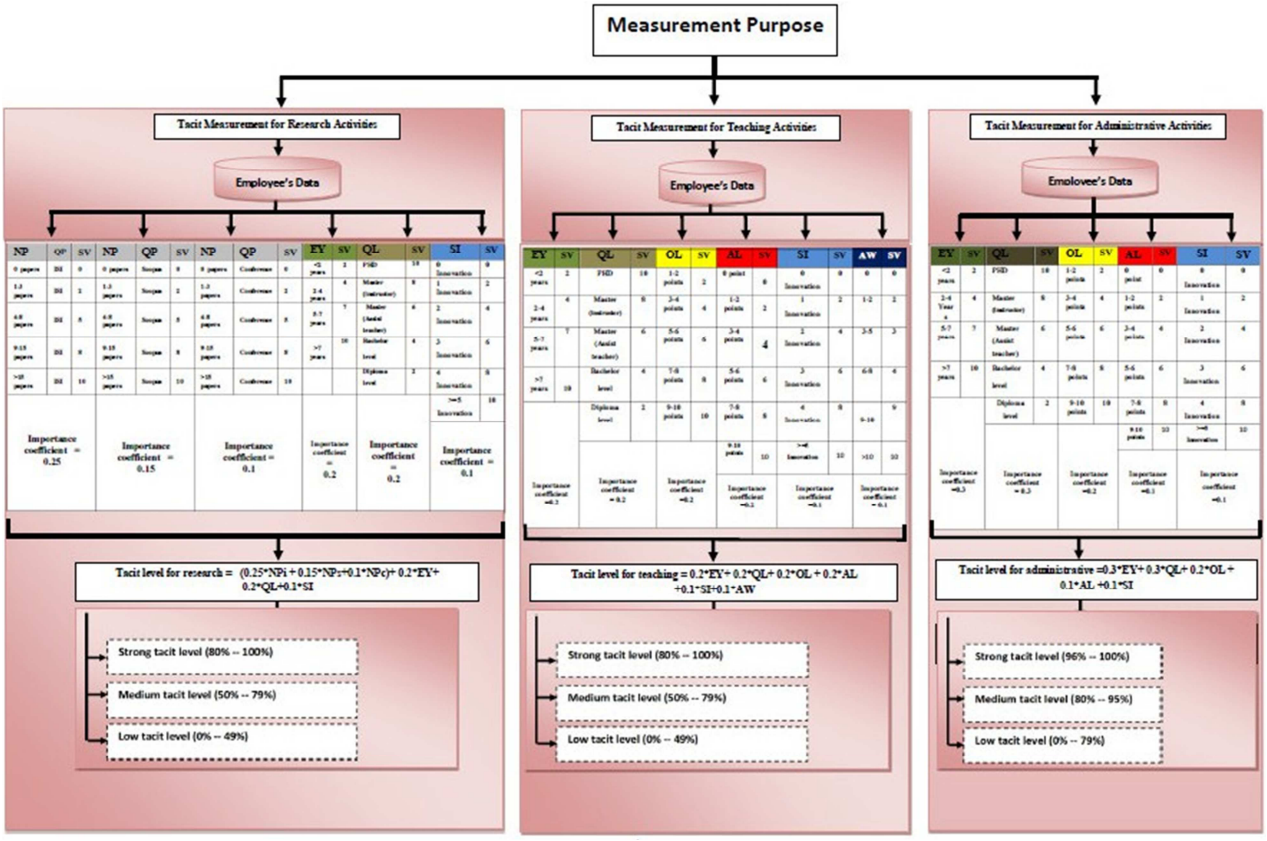

Figure 2. *Proposed TKMM.*

5. Conclusion

The organizations are care of mange their knowledge resources to improve their businesses operations and competitive advantages. Knowledge measurement is one from the most important success factors of knowledge management implementation. Organizations need to know the quality and quantity of tacit knowledge resources in working environment. However, the tacit knowledge measurement is difficult due to intangibility of tacit knowledge resources. This paper focuses on tacit knowledge

measurement of academic staff in universities. The tacit knowledge of academic staff could measure according to various working activities using 8 practical variables; qualification level, years of experience, assessment by quiz, observing assessment, number of publications, quality of publications, successful innovation, and achievements within the context of working.

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