

The Evaluation of Knowledge Management Maturity Level in a Research Organization

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Abstract: Currently, knowledge is considered as the most important asset of an organization and the knowledge management applies the internal and external assets of organization and provides a capability for the organization to develop new knowledge, innovation, and technology. It is essential to acknowledge the knowledge management in the mentioned organization, given that the studied organization is a knowledge-based organization with the assignment of designing and developing complex products in various domains of the target market, and taking into consideration the following reasons;

- Excessive increase in organizational information and lack of proper control on information;
- Lack of proper mechanisms to exercise the experiences of previous failure and learning from them for the future projects;
- The existence of various and disperse expertise in the organization's level and low-experienced workforce.

Hence, the first step in achieving the objectives of knowledge management is recognition of current status of the knowledge management capabilities at the organization's level and it can be achieved through the knowledge management maturity models. To obtain the opinions of project managers on the followings factors can be enumerated as the main objective in evaluating knowledge management maturity level in an organization:

- Collecting, sharing and applying the learned lessons (experiences)
- The existing strengths and limitations in current processes, procedures, and systems in regard to the learned lessons
- The challenges or obstacles in the path of sharing the learned lessons
- Recommendable improvement areas
- This paper is an account about the evaluation method of knowledge management maturity level in the studied organization in addition to the results of this evaluation.

Key words: Knowledge Management, Knowledge Management Maturity, Performance Domains

INTRODUCTION

Today, knowledge management (KM) is considered as an appropriate competitive tool for success in knowledge-based economy in such a way that many organizations have exerted to implement and apply KM. In order to properly implement and execute KM in an organization, the most important task is to identify its knowledge status, so that the know-how of development, organization, dissemination, and storage of the desired knowledge can be found out.

The maturity models elucidate on the development of an entity over time, and this entity can consist of any desired topic, whether humans, or an organizational unit, technology, process, etc. Generally, the maturity models have the following characteristics (Klimko, G., 2001):

- Development of a single entity is simplified and explained through a limited numbers of maturity levels (normally between four to six levels).
- Each level is defined by certain requirements which should be obtained by the entity at that level.
- The levels start with a primary level and reach a final level (which indicates the relative perfection).

Throughout the development and progress stages of the entity in each level, the progress of an entity is only possible from one level to next and level skipping is impossible.

The studied entity in this paper is the "knowledge management". Knowledge management (KM) is defined as the identification, acquisition, and application processes of knowledge in an organization in order to help through its business processes. The objective of this paper is to provide a guideline for organizations to evaluate their knowledge management maturity level. This paper is organized as follows: in section 2 the maturity model and knowledge management are explained and in section 3 the measurement method of knowledge management maturity level in an organization is investigated. The fourth section illustrates the results of the evaluation of knowledge management maturity level and finally section 5 includes the results as well as suggestions for future researches.

2. Maturity Model and Knowledge Management Audit:

Maturity model is a measurement model for whatever the knowledge management theory deals with. The maturity level analyzes the weaknesses and strengths in knowledge processes. It controls and manages knowledge production and distribution, and also evaluates the added value produced during the knowledge process. The maturity models are used to identify the development level of knowledge management processes based on acceptable criteria. Each maturity level requires knowledge audit process (evaluation). The knowledge audit is a systematic evaluation method on the following facts:

1. Knowledge management strategy
2. Intellectual properties
3. Knowledge flows
4. Knowledge needed by future and knowledge shortcomings
5. Organizational behavior and culture in sharing and producing knowledge

The knowledge audit seeks whether the needed knowledge is extracted and used at the time of need.

- The knowledge audit can detect knowledge strengths, weaknesses, threats, risks, and opportunities in an organization. Therefore, it examines and measures the organization's strategy, leadership, cooperation, education's culture, technological infrastructures, and knowledge processes.

- The knowledge audit leads to recognition of knowledge maturity in an organization. In other words, the maturity of an organization in knowledge is the efficiency of each skill and hidden knowledge transfer flows for the entire knowledge model cycle, from production to distribution and application of knowledge.

2-1. Capability Maturity Model (CMM) and Studying the Maturity Models:

CMM provides guidelines for software engineering organizations so that they can accurately control their software development and maintenance processes and the organization guides itself towards management and software engineering excellence (Kochikar, V.P., 2000). Recently, this model is accepted by several activists of this industry throughout the world as a standard for defining the quality of software processes. In CMM, five maturity levels are defined where each level is defined by a unique set of traits.

Considering the mentioned deficiencies in the maturity models, by reviewing and comparing different management maturity models, and by integrating various knowledge management maturity models (KMMM), the general KMMM, namely GKMMM, was introduced (Pee, L.G., et al., 2006), which focuses on evaluating the three areas of knowledge management development in organizations. These areas include: people, processes, and technology.

Generally, KMMMs can be divided into two major groups:

1. CMM-based, which includes models developed based on the capability maturity model (CMM) of Software Engineering Institute (SEI). For instance, sample models includes Siemens's KM3 (Ehms, K., & M. Langen, 2002), Infosy's KM3 (Kochikar, V. P., 2000), Paulzen & Perc's KPQM (Paulzen, O., & P. Perc, 2002), Kulkarni & Freeze's KMCA (Kulkarni, U., & R. Freeze, 2004), etc.

2. Non-CMM based, which are models not derived from CMM (such as MG model presented by Knowledge Journal (KPMG Consulting. 1999), Klimko's KM3 (Klimko, G., 2001), VISION KM3 by Weerdmeester et al. (2003), 5iKM3 (Mohanty, S.K., & M. Chand, 2004), K3M (WisdomSource., 2004.), etc.).

3. Evaluation of Knowledge Management Maturity Level in the Studied Organization:

Organizations with similar purposes are evaluated such as NASA's Johnson Space Center according to the objectives of mentioned industry which are as follows:

- Achieving the technology required in three aspects of brainware, software, and hardware
- Meeting society's expectations
- Priority in making systems operational at the right time
- Focusing on expert and committed employees as an infrastructure for researches and designs
- Accessibility of the required technologies at the right time and in an effective manner
- Using the scientific and research capacities at national and international levels
- Institutionalizing the obtained capabilities with repeatability.

The GKMMM is used in evaluating the knowledge management maturity level of this center. In fact, this is a general model which is derived from several knowledge models. The main components of GKMMM (performance key domains, maturity level, and common characteristics) are presented in Table 1.

Table 1: Maturity level, performance key domains, and common characteristics of GKMMM

Maturity level	Description of maturity level	People/organization	Processes	Technology
Initial	No desire and will to use the current knowledge exist in the organization	The organization and its people have not yet understood the necessity	There is no formal process to collect, share, and use the organizational	There is no technological infrastructure

	or it is very little	of their knowledge resources management and are not aware of it	knowledge	specific for KM in the organization
Awareness	The organization has become aware and interested about its organizational knowledge but does not know how to do it	Management has understood the necessity to consider KM	The main knowledge which is necessary for the organization's routine tasks are documented	The KM projects pilots have started (not necessarily related)
Defined	The organization possesses fundamental infrastructure in KM	.The management is aware of its role in promoting KM at the organization's level .Essential awareness is provided in KM (such as informing courses)	.Processes have been designed and established for information management and content management .Also indices might be developed to evaluate the productivity growth caused by KM	Management fundamental infrastructures are created
Managed/established	The KM plans are properly created in the organization	.There are common strategy and standard approaches in KM .KM is towards the organization's major strategy	The quantitative evaluation of KM and its processes are being performed	The KM systems throughout the organization are utterly established and are acceptably used
Optimization/sharing	KM is deeply combined inside the organization and is continuously improved and is an innate part of all the organization's processes	The knowledge sharing culture is institutionalized	.KM processes are reviewed and improved regularly .KM current processes can be easily adapted to the new organization's needs	The current infrastructures of the organization's KM are continuously improved

This model divides the organization's maturity into five levels and evaluates the organization's maturity on three performance key areas: 1) people, 2) processes, and 3) technology. Each area is also divided into smaller parts which are as follows:

People: The aspects related to organizational culture, strategies, and guidelines supporting KM

- Sharing knowledge throughout the organization
- Supervising and applying knowledge
- Strategic consistency with the organization's goals
- Roles, responsibilities, authorities, and resources
- Motivation and reward

Processes: The aspects related to KM processes in an organization

- Learning processes and techniques

Technology: The aspects related to the technological infrastructures which supports an organization's KM.

- Technological empowering

3-1. KM Maturity Evaluation Method in the Studied Organization:

In GKMMM, a series of guidelines are defined for each performance key domains (people, processes, and technology) at each level (except for level 1). Based on these guidelines as well as their missions and entities, the organizations can provide a questionnaire or checklist to evaluate and determine their maturity through questionnaire distribution or auditing.

In order to evaluate the KM maturity in the studied organization, two groups of questionnaires, one including 25 and the other one including 21 questions, were designed with the help of industry experts and KM department. Each question had positive aspect, and was 4-point or 2-point questions. For 4-point questions, in order to measure the agreement level and quantizing the analyses, the following values were allocated to options "completely disagree" (1), "disagree" (3), "agree" (5), and "completely agree" (7) respectively. For 2-point questions, score (1) was allocated to the "No" option and (2) to "Yes" option. After measuring the answers in regard to each performance key area, if the consent average of all performance key domains in a level is higher than 60% (the 60% figure is chosen from the NASA's Johnson Space Center) and if the organization has passed the previous levels, the organization is considered at that KM maturity level. By identifying the current status of KM, the organization can define improvement projects based on the defined common characteristics for higher levels. The evaluation procedure of KM maturity level in the organization is shown in Figure 1. In order to evaluate the KM maturity level in the organization, 2 groups of questionnaires were designed. Since some of the questions were designed in such a way that only the KM administrator code was able to answer them, therefore

two separate questionnaires were designed for KM administrator code and the rest of the statistical population. The questionnaire was manually distributed among 65 people (who are the members of KM responsible team, project managers, and experts), and 61 completed questionnaires were collected accordingly. This indicated 94% participation. Based on the scores allocated to each question (for 6-point questions 1-6 and for 2-point questions 1-2), the total agreement percentage with each question was calculated after collecting the answers from the participated statistical population. For example, if our statistical population includes 40 people and the answers to a 6-point question are according to Table 2, then the total agreement with that question can be obtained from the following equation:

$$P_j = \frac{\left(\sum_{i=1}^{L_j} X_{ij} * n_{ij} \right)}{\left(\sum_{i=1}^{L_j} n_{ij} \right) * L_j} * 100$$

Where;

P_j = agreement percentage with question j (at percentage)

X_{ij} = the score of option i of question j

n_{ij} = the number of people answered to option i of question j

L_j = the number options of question j

By calculating the above-mentioned formula for table (2), an agreement percentage of 69% was obtained.

Table 2: Example of opinions distribution about a question

Option	Option's score	No. of people answering to each option (n _{ij})
Impractical	1	1
Completely disagree	2	3
Disagree	3	7
Neutral	4	13
Agree	5	10
Completely agree	6	6

If this figure is higher than 60% (60% is a value determined by the organization and the considered industry chose this value based on the NASA's JSC), it means that the industry is at that KM maturity level, provided that the previous levels are passed.

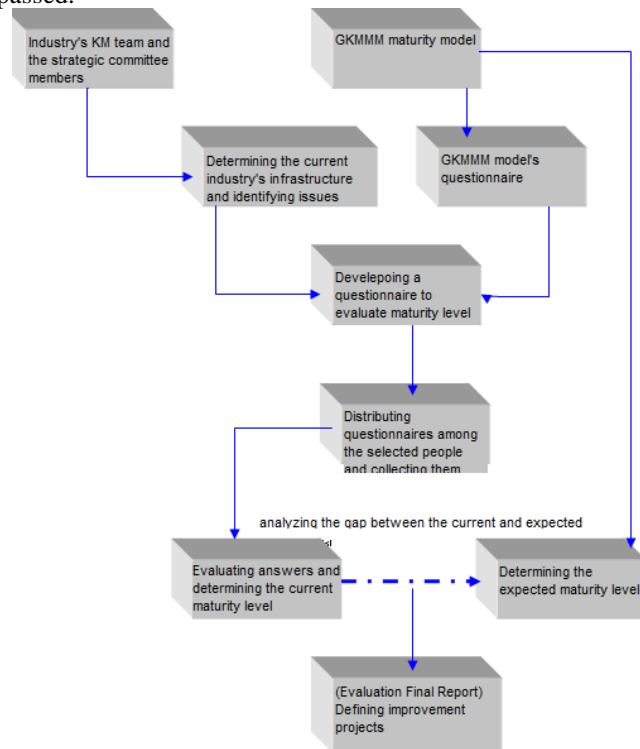


Fig. 1: Evaluation of the KM maturity level in the organization under study

4. Results Analysis:

In this section, different analyses carried out on the organization’s KM maturity level are presented. In Table 3, the organization’s KM maturity level in each enablers area is indicated.

Table 3: KM maturity level of research organization separated based on each enablers

Levels	Technology	Process	People
Level 1		*	
Level 2	* 65%	53%	* 69%
Level 3	19%	63%	52%
Level 4		55%	62%
Level 5	71%	54%	54%

As shown in Table 3, the organization’s KM in people area (Peo) is at maturity level “2”, because the figure obtained from the questionnaires shows a 69% agreement which is higher than the acceptance value of maturity level (i.e. 60% which is determined based on NASA’s JSC). It is remarkable that given that, according to GKMMM, passing the maturity levels should be continuous, thus in spite of the fact that the industry has obtained 62% at level “4” in the people domain, and it has not yet passed the people’s level “3” (i.e. it has obtained less than 60% at level “3”), thus maturity level “2” is acceptable for the organization’s people domain. Similarly, the organization is at maturity level “1” in processes domain (Pro), which is the lowest level, and is also at maturity level “2” for the technology domain (Tech).

By averaging the obtained values from different domains (people, processes, and technology) at each level, the total maturity level of KM can be obtained. Table 4 shows the total level of KM maturity.

Table 4: KM maturity level

Level s	Maturity
Level 1	
Level2	62%
Level3	45%
Level 4	58%
Level 5	60%

As shown in Table 4, the total KM maturity level of the mentioned organization is at level “2”.

Then, the KM maturity level was investigated separately for each domain and each level in the opinion of KM administrator code and various job positions participating in this survey.

In Figure 2 the KM maturity level in each empowering domain from the opinion of KM administrator code is compared with the entire industry.

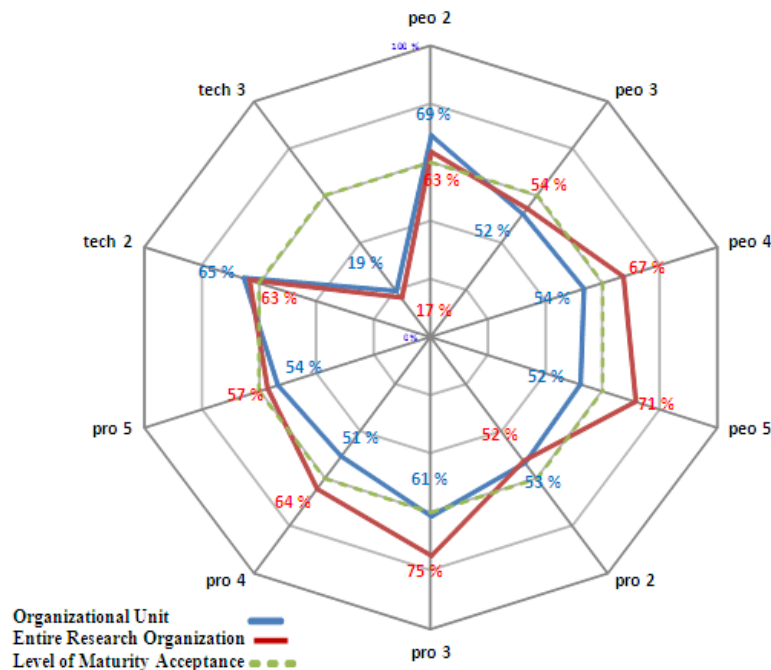


Fig. 2: KM maturity level separated based on each domain and each level from the KM administrator organizational unit and the entire research organization

As shown in Figure 2, the opinions of the knowledge management administrator of organizational unit and the entire research organization about the maturity level in each domain and each level are different at people domain (level 4 and 5) and processes domain (level 3 and 4). At other levels of domains, nearly there were similar opinions between KM administrator code and the entire industry.

The industry's maturity acceptance level is considered as 60%. According to the opinions of industry experts and KM administrator code that this organization has certainly not passed the fourth level of technology domain, therefore no question was designed for maturity level "4" of the technology domain.

Given that no question was designed to evaluate the level "4" of KM maturity in the technology domain (tech) and also the questions related to the technology level are only designed for the KM administrator code, therefore level (4 and 5) related to technology are not investigated.

Figure 3 illustrates the total maturity level of KM from the points of view of KM administrator code as well as the entire industry.

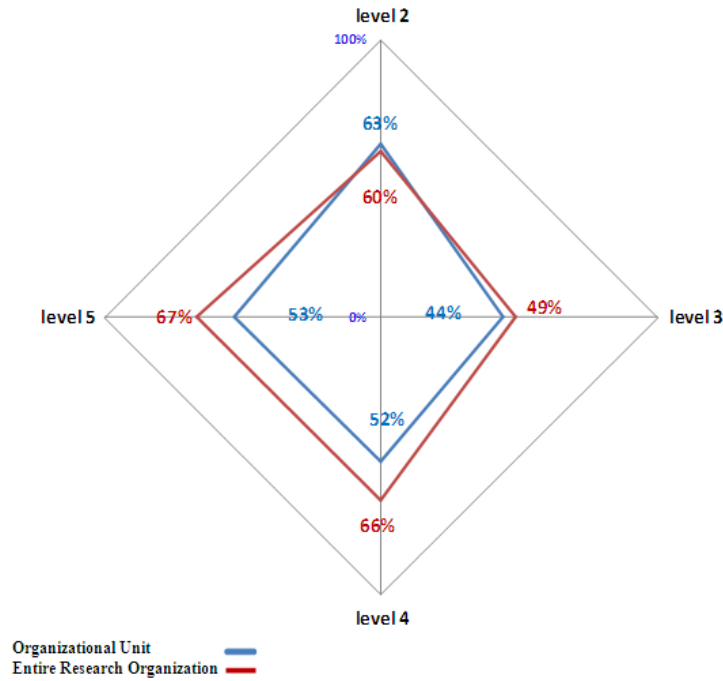


Fig.e 3: KM maturity level in each domain from the opinion of managers and the entire industry

As shown in Figure 3, both the administrator code and entire industry believe that the industry has only passed KM maturity level "2" and has not yet passed level "3".

The comparison between KM maturity level in each domain from the opinion of the managers and other people participating in the survey is presented in Figure 4.

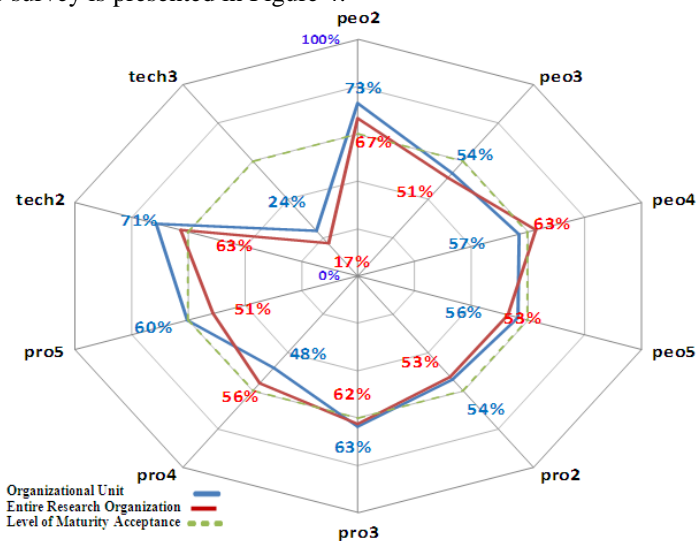


Fig. 4: KM maturity level in each domain from the opinion of managers and the entire industry

The comparison between the total KM maturity level from the opinion of the managers and other people participating in the survey is presented in Figure 5

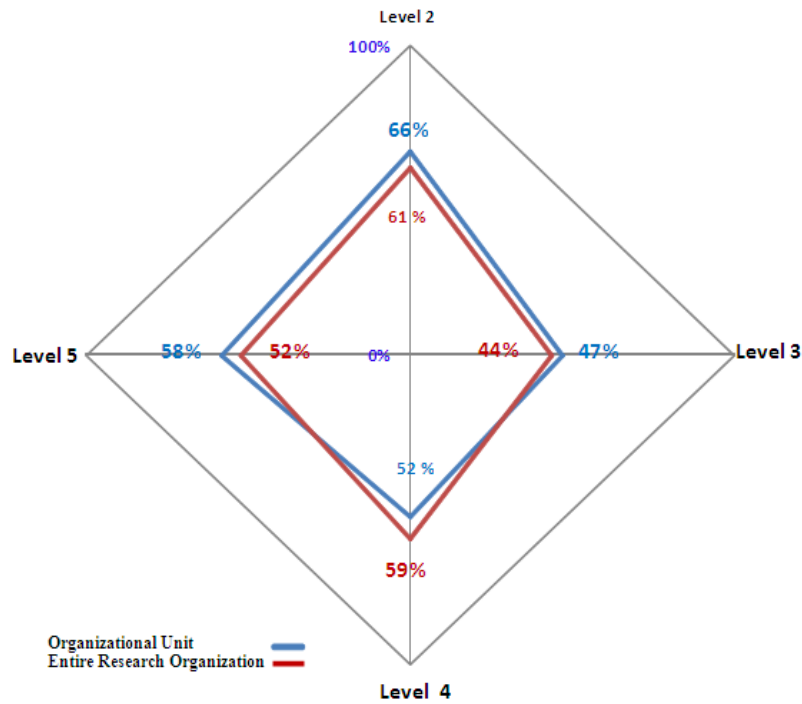


Fig. 5: Total KM maturity level from the opinion of managers and the industry

The opinions of different job positions in regard to the total KM maturity level are shown in Figure 6.

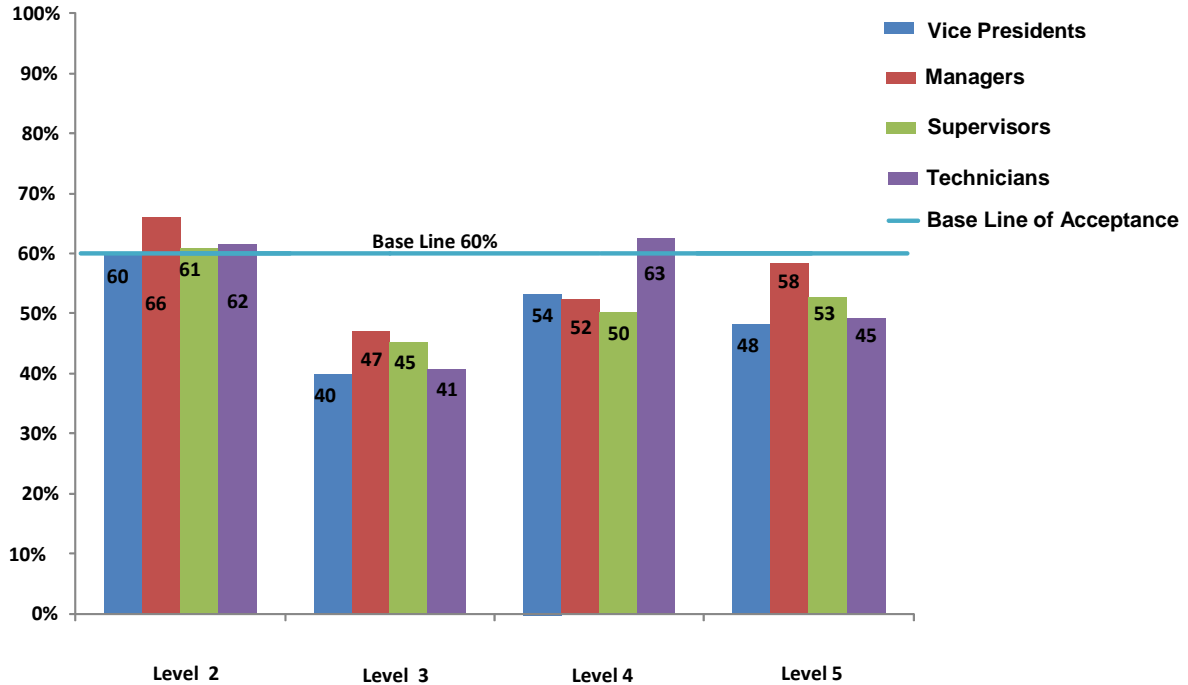


Fig. 6: Opinions of different job positions in regard to the total maturity level of KM

Figure 7 presents different opinions of job positions in regard to the organization's KM maturity level in people area.

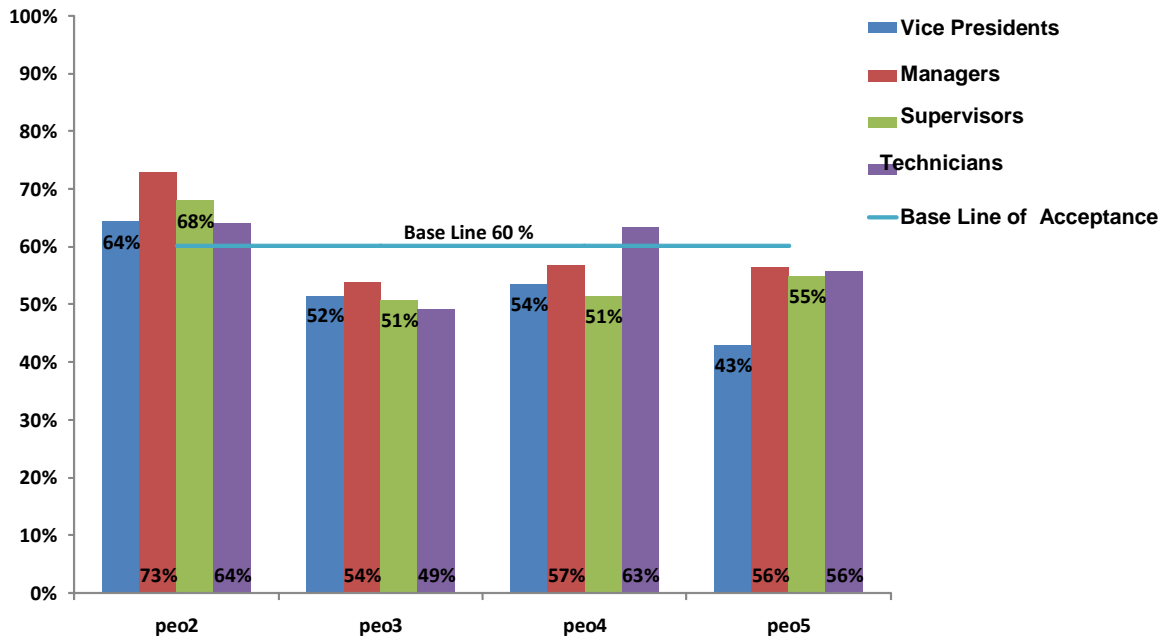


Fig. 7: Opinions of different job positions in regard to the organization's KM maturity level in people domain

Figure 8 presents the opinions of different job positions in regard to the organization's KM maturity level in processes domain.

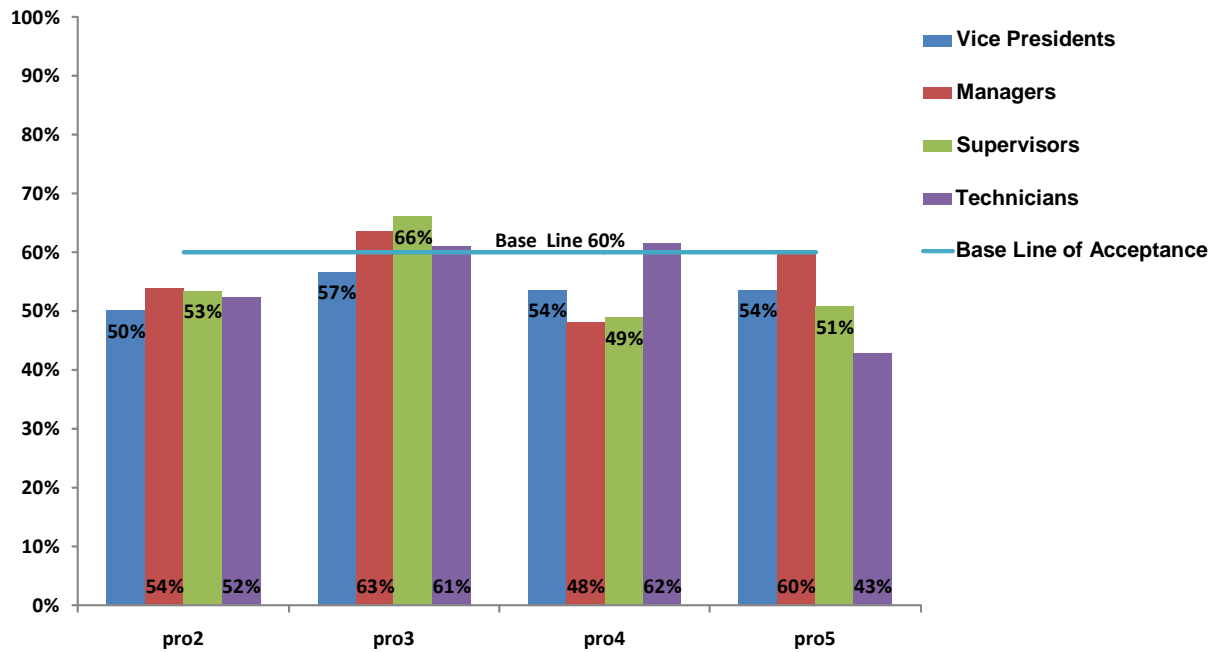


Fig. 8: Opinions of different job positions in regard to the organization's KM maturity level in processes domain

Figure 9 presents the opinions of different job positions in regard to the organization's KM maturity level in technology domain.

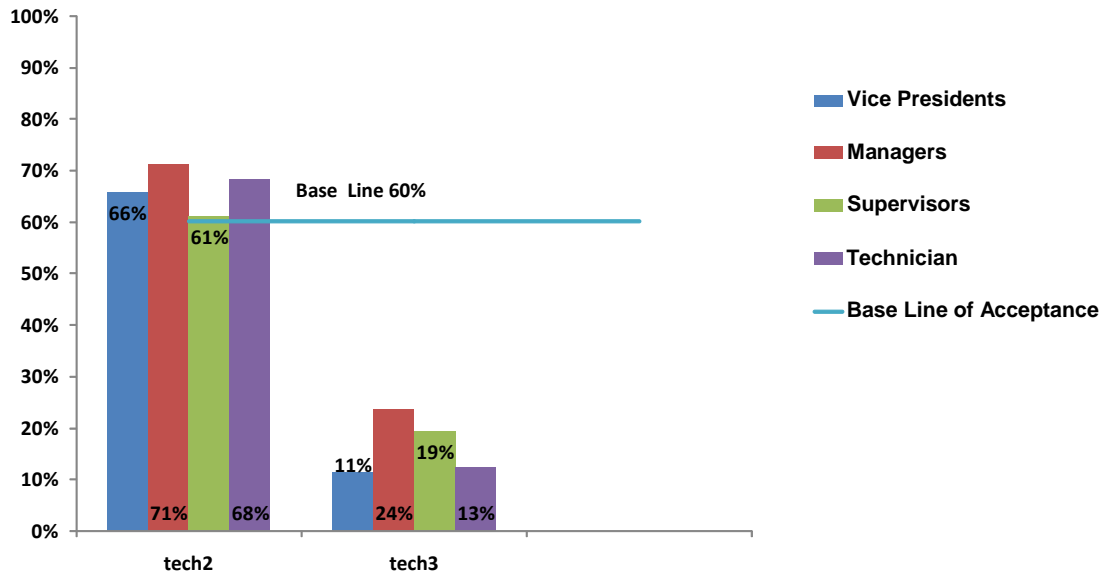


Fig. 9: Opinions of different job positions in regard to the organization’s KM maturity level in technology domain

Conclusions:

By analyzing the results of the study, according to Table 2, the industry’s KM maturity level was at level “2” for the people domain, at level “1” for the processes domain, and at level “2” for the technology domain. According to Table 3, the industry’s total maturity level was at level “2”. It is obvious that in order to promote the KM maturity level, it should be promoted in every empowering domain and given that the maturity level of the processes domain is lower than the other domains as well as KM’s total level, therefore the priority should be for planning to promote this domain.

It is remarkable that since the mentioned industry has not yet 100% passed the maturity level “2” of technology and people domains (it is fairly higher than 60%), therefore it is essential to define improvement plans for level “2” of technology and people domains, by investigating the guidelines (questions) related to technology and people domains at level “2” and also identifying the weaknesses which have hindered achieving a 100% success. The quality of the improvement plans and their results should be measured at the next stage of KM maturity level evaluation.

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