Volume 3, Number 3, 2014

International Journal of Research in Industrial Engineering

www.nvlscience.com

A Method for Evaluating Project Management Standards, Based on EFQM Criteria, Using FTOPSIS Method

H. Golpîra[*]
Department of Industrial Engineering, Sanandaj Branch, Islamic Azad University, Sanandaj, Kurdistan, Iran

ARTICLE INFO

Article history :
Received:
June 08, 2013
Revised:
December 03, 2013
Accepted:
December 14, 2013

Keywords :

Project management standards, EFQM, FTOPSIS, Standards evaluation

ABSTRACT

In this paper, the fuzzy technique of order performance by similarity to ideal solution (FTOPSIS) is employed to evaluate some well-known project management standards (PMSs) based on the criteria introduced by European foundation for quality management model (EFQM) to have a new framework to compare standards as a new comprehensive method. To do this end, a brief review on some of the PMSs is introduced based on their frameworks, concepts and critical areas. The crucial index are extracted based on the EFQM model areas and because of multiplicity of the criteria, the TOPSIS is employed to assess the standards. In addition, fuzzy logic is applied to encounter with the vagueness of judgment about the coverage level of each PMS in each of the nine basic criteria of the EFQM model in order to evaluate them. Computational results which are shown in the following sections indicate the applicability and usefulness of the method.

1. Introduction

While most of the available project management standards (PMSs) are flexible and can be tailored for a particular environment, still there can be conditions that indorse one over another for a certain case. Crawford (2000) proposes an overview of the PMSs and guides for PM knowledge and performance, including a comparison of their content and a suggestion of their use in assessment and as a basis for qualifications [1]. Ahlemann et al. (2009) make an empirical study on the use of PMSs in German and Swiss enterprises and point out the prospects, the benefits and the major differences among them [2]. Ilieş et al. (2010) introduce the best practices methodologies recently used in PM, focusing on two of the mostly used frameworks– PMBOK (Project Management Body of Knowledge) and PCM (project cycle management) Guidelines. They reveal that the nature of the PMBOK makes it appropriate in all types of organizations, from all over the world, but the PCM Guidelines is well-adapted to the European commission's development policy and probably better in this specific case [3]. Buttrick (2012) compares three PMSs as PRINCE 2, ISO 21500 and BS 6079 comprehensively and puts stress on their weakness in covering the scope of the standards,

[*]Corresponding author
E-mail address: herishGolpira@Gmail.com

fully [4]. In addition, there have been numerous efforts to map the structures of some of these standards to each other, but there is no comprehensive contribution to compare them efficiently in previous researches. Moreover, Ahlemann et al. (2009) present that establishing consistent communication in a project and better process quality leads it to be better done [2]. Bayo-Moriones et al. (2011) demonstrate that assessments based on the European foundation for quality management model (EFQM) are gaining ground in improvement processes [5].

While PMSs are in different categories, the main purpose of this paper is to explore the coverage level of each PMS in each of the nine basic criteria of the EFQM model. Furthermore, a new framework to evaluate the related standards based on the EFQM model is introduced. To do this end, the basis of the PMSs and EFQM model are carried out from literature.

The paper contributes to the recent literature in several ways. First, it provides a good survey in the field of PMSs. Secondly, so far as we know; this is the first paper to reflect the comparative evaluating of the PMSs and makes a new framework available to assess the related comparable standards based on fuzzy logic and EFQM model. Finally, the coverage level of the standards could make the organizations able to have a better decision making related to their condition and level of performance in each of the basic criteria of the EFQM model which make the decision to be more reliable and organizational process oriented.

In the paper the EFQM framework and evaluating area and criteria are employed for evaluating 13 well-known PMSs to have an effective assessment of them to make a comprehensive comparison among them. In this way, the fuzzy technique of order performance by similarity to ideal solution (FTOPSIS) is used to work with vagueness of judgment about the coverage level of each PMS in each of the nine basic criteria of the EFQM model and evaluate them. The paper is structured as follows. The following section introduces the proposed method after a brief study on the project management standards, section 3 sets out and discusses the results achieved in the model and section 4 makes the conclusion, discusses the method limitations and proposes some future researches potentials.

2. The principal of the method

2.1.Project management standards

Standardization of PM frameworks began in 1980 and continued in USA, Britannia, Japan, Australia, South Africa, New Zealand, China and India. Table 1 illustrates 13 well-known PMSs and their basic properties and the following paragraphs introduce them, briefly. It is noteworthy that the mentioned years in Table 1 demonstrate the establishing date of each PMS.

Table 1: Project management standards

#	Date	Standard name	Utilization	Standard category
1	1987	PMBOK: Project Management Body of Knowledge [6]	Project Management Institute (PMI), USA, International	General management skills
2	1988	APMBOK: Association for Project Management Body of Knowledge [1]	United Kingdom, National	General management skills

Table 1. Continued

#	Date	Standard name	Utilization	Standard category
3	1996	BS6079: British Standard Guide to Project Management [1]	United Kingdom, National	Both operational and strategic project management
4	1997	ISO 10006 Guidelines to Quality in Project Management [1]	Swiss, International	Quality management tool rather than a project management standard
5	Start at 1989, first issue at 1996	PRINCE 2 [4, 6]	Central Computer and Telecommunications Agency (CCTA), UK Government standard for IT project management, Europe	IT project management
6	2002	PMMM: Project Management Maturity Model [1]	Crown Copyright product by the Office of Government Commerce (UK), National	Public and private sector project management
7	2001	P2M: Project & Program Management [6]	Japan, National	To manage individual and multiple projects
8	1998	OPM3: Organizational Project Management Maturity Model [1]	Project Management Institute (PMI), USA, International	Global standard for organizational project management
9	1996	ANCSPM: African National Competency Standards for Project Management [1, 6]	South Africa, National	Global standard for project management
10	Start at: 1993 First issue at 1998	AIPM: Australian Institute of Project Management [8]	Australia, National	General management skills as a global standard
11	1996	NOSPM: National Occupational Standards for Project Management [9]	National and Scottish Vocational Qualifications	Both operational and strategic project management
12	1999	IPMA (ICB): International Project Management Association (Competence Baseline) [7, 10, 15]	Switzerland, National	Global project management standard
13	2002	PMCDF: Project Manager Competency Development Framework [1]	Project Management Institute (PMI), USA, UK, South Africa, Australia, International	Use in professional development of project managers rather than for use in selection or performance evaluation

The PMBOK is a completely new document and the first available body of knowledge of PM. It added contract/procurement management and risk management to the previous six primary criteria of its old version reported from 1983 as: scope, cost, time, quality, human resources and communications [11]. Its 3rd edition, from 2004, contains 44 criteria as shown in Fig. 1.

The APMBOK embraces practices and knowledge that could apply to various projects and/or part of the time which is much more comprehensive approach. The 4th edition of APMBOK, from 2000, contains 7 main headings, with 42 areas that are shown in the Fig. 2. In this body of knowledge a short examination of all areas and topics as well as recommendation for each topic are given.

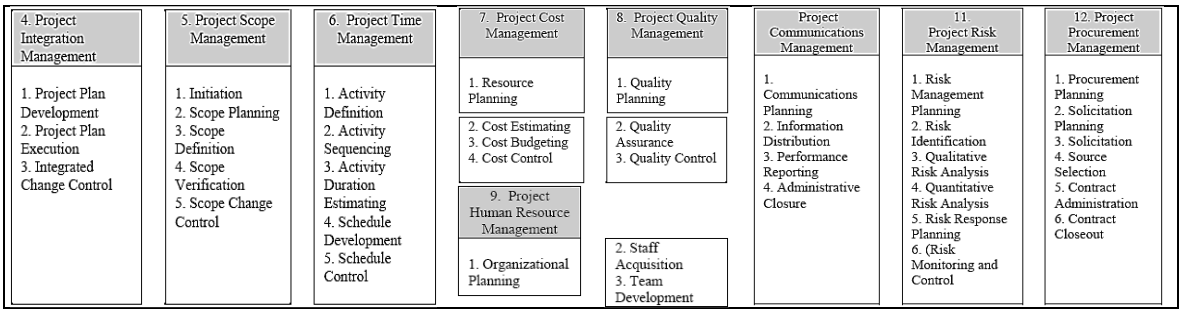

Figure 1: PMBOK components [6]

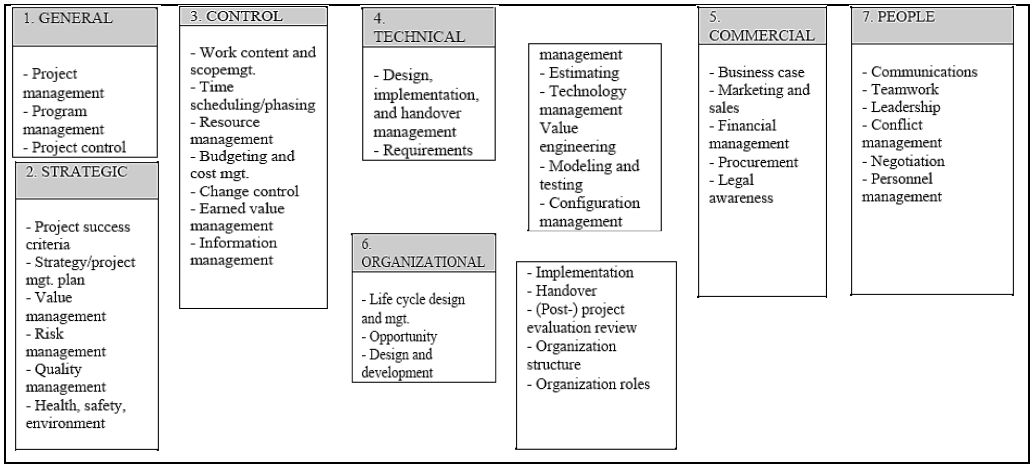

Figure 2: APMBOK components [6]

The BS6079-1:2010 aims to help organizations attain a desired result of a project efficiently and effectively. It also aims to contribute to the learning within projects and so continually improve the organization's PM proficiency. The philosophies provided in this standard are as relevant to small organizations/projects. The standard aims to pay attention to the management challenges encountered in different project environments and to propose possible approaches based on four guidelines as: (1) guide to PM, (2) PM vocabulary, (3) guide to management of business related project risk and (4) guide to PM in the construction industry [12]. One of the most important deference between this standard and the other ones except, ISO 10006 is that it is not used as the knowledge base or standard for professional certification programs [1].

The ISO 10006 delivers guidelines to quality in PM, so Crawford (2000) introduces it as a quality management rather than a PM standard and it is applicable to projects of varying complexity, size and length. Its main purpose is to construct and maintain quality in projects through a systematic procedure that guarantees: (1) stated and implied needs of customers are understood and met; (2) interested stakeholders needs are understood and evaluated and (3) The organization’s quality policy is incorporated into the management of projects [1].

The PRINCE 2 is first published in 1996 and has grown to become a de facto ‘standard’ as a PM method recently –in the UK and more than 150 countries worldwide. The scope of the PRINCE 2 and BS 6079 are more closely aligned. The benefits of using this standard are as follows. (1) using the standard improves a project performance in both the public and private

sectors that leads the country enhances its benefits as a whole, (2) very little alternative ‘open copyright’ method is existing for organizations to draw on, (3) its scope considers all the processes needed to direct, manage and undertake a project, (4) its philosophies is of high quality, in general, reflecting good practice, (5) its training is very easy, (5) There is a growing requirement for ‘accreditation’ to be proven in a supplier/contractor context [4].
The PMMM follows the Software Engineering Institute's (SEI) Capability Maturity Model's (CMM) five evolutionary maturities levels, and examines maturity development across nine knowledge criteria in the PMBOK as shown in Fig. 3. It integrates both the PMBOK Guide and CMM, respectively, to provide a comprehensive, straightforward, and easy-to-follow plan for advancing organizational PM maturity [12].

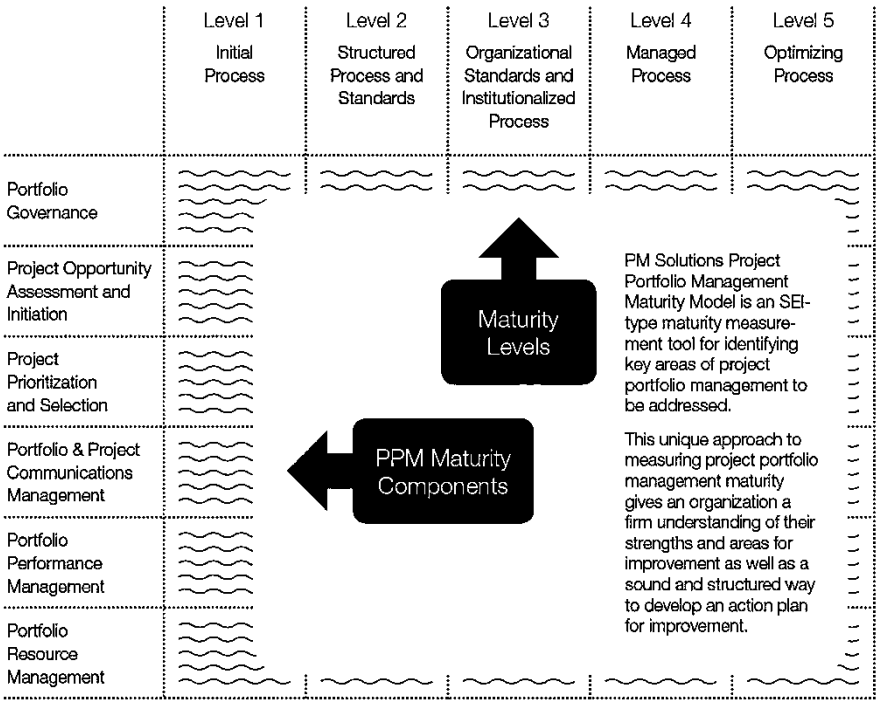

Figure 3: Principals of PMMM [13]

The P2M is proposed as a guide to standard Japanese PM to enhance awareness about the breakthroughs and practical capabilities which are vital for a knowledge-intensive information society. It is organized to recognize three kinds of projects consisting of concept development (scheme model), implementation (system model) and operation (service model) and to generate diversified, creative and synergistic business models [13].
The OPM3 suggests the key to organizational PM maturity with three elements as: (1) knowledge elements (learn about hundreds of organizational PM best practices), (2) assessment element (evaluate an organization’s current capabilities and identify areas in need of improvement), (3) improvement element (Use the completed assessment to map out the steps needed to achieve performance improvement goals). It has a wide range of benefits to organizations, senior management, and those engaged in PM activities as follows: (1) reinforces the link between strategic planning and execution, (2) recognizes the best practices that support the employment of organizational strategy through successful projects (3)

recognizes the "precise capabilities" that recognizes the "best practices", and the dependencies among those "capabilities" and "best practices" [1].

The ANCSPM is structurally similar to the AIPM, but it has only one level of performance. In addition, it introduces the computer and English skill as the two additional abilities of a project manager.

The AIPM includes the following components: (1) units of competency: the significant major functions of the profession, (2) elements of competency: the building blocks of each unit of competency, (3) performance criteria: the type of performance in the workplace that would establish adequate evidence of personal competence, (4) range indicators: define the situations in which the performance criteria would be applied. The standard incorporated the nine knowledge areas of the PMBOK directly into the knowledge part of their qualification program [6].

The NOSPM has been written as 51 separate units of competence, each relating to a distinct functional area. It covers the full range of PM functions including the strategic and the operational ones between them. It is fully well-matched with the APMBOK and has been established through consideration of previously defined PMSs [9].

The IPMA is the other international organization which is operating as a PM development association in addition to PMI. The IPMA competence baseline (ICB) is its well-known PMS. There are 28 main and 14 additional elements of PM knowledge recognized from an analysis of the four national documents. The 28 main elements are presented as a "sunflower" (see Fig. 4) to overcome the difficulties of achieving agreement on a knowledge structure [1].

PMBOK and ICB are differing under many aspects. PMI has its roots in North America whereas IPMA is well spread in Europe. One can see the comprehensive comparison between these two associations' standards in [14].

The PMCDF is proposed to cover a range of competencies needed by project managers and to apply widely, regardless of the nature, type, size or complexity of the projects being managed. The broad nature of the standard is essential to guarantee that PM competency in individuals is transferable across industries and those industries and organizations can use the PMCDF to construct industry and organization competency models [15].

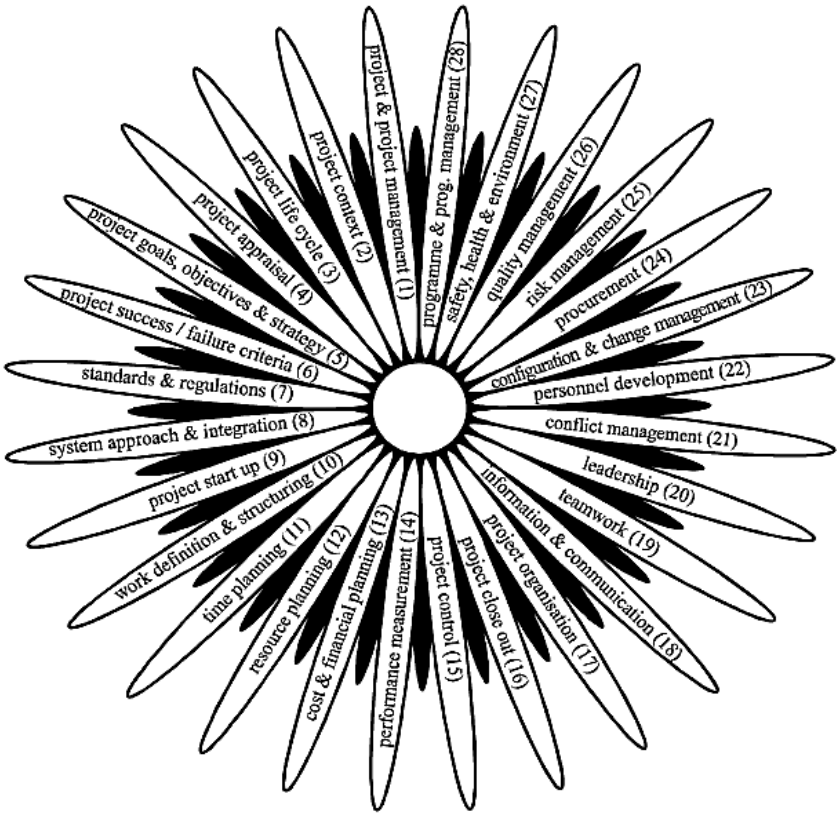

Figure 4: ICB main elements of PM [1]

2.2.The proposed method

The TOPSIS method, recognized as a classical multi attribute decision making (MADM) method, was first introduced by Hwang and Yoon (1981) [16]. The basic principle of the method is based on the notion that each alternative should have the shortest distance from the positive ideal and the largest distance from the negative one [16]. The overall importance of each alternative depends on criteria often exposed by a fuzzy number that makes the decision making close to reality. The processed method based on the FTOPSIS model is shown as follows [17]:

Constructing fuzzy decision matrix (see Eq. (1)).

$$D = \begin{bmatrix} \tilde{Y}_{11} & \dots & \tilde{Y}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{Y}_{P1} & \dots & \tilde{Y}_{Pn} \end{bmatrix} \quad (1)$$

where, $\tilde{Y}_{pj}$ is fuzzy rating of alternative (in this paper alternative means standard) p related to jth criteria (in this paper the criteria means the areas defined by the EFQM method) which is in this study defined by a fuzzy triangular number.

Normalizing the fuzzy decision matrix denoted by $\tilde{T}$ in Eq. (2).

$$\tilde{T} = [\tilde{t}_{pn}]_{p\times n} \quad p = 1,2,...,P \text{ and } j = 1,2,...,n \quad (2)$$

Calculating fuzzy weighted decision matrix as shown in Eq. (3).

$$V = \begin{bmatrix} \tilde{v}_{11} & \cdots & \tilde{v}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{v}_{P1} & \cdots & \tilde{v}_{Pn} \end{bmatrix} = \begin{bmatrix} w_1 \tilde{t}_{11} & \cdots & w_n \tilde{t}_{1n} \\ \vdots & \ddots & \vdots \\ w_1 \tilde{t}_{P1} & \cdots & w_n \tilde{t}_{Pn} \end{bmatrix} \quad (3)$$

where, w is obtained from the EFQM criteria weights.

Defining fuzzy negative $\tilde{v}_j^- = (0,0,0)$ and fuzzy positive ideals $\tilde{v}_j^+ = (1,1,1)$.

Calculating the distance of each alternative (standard) from fuzzy negative and fuzzy positive ideals by Eq. (4) and Eq. (5).

$$d_p^- = \sum_{j=1}^{n} d(\tilde{v}_{pj}, \tilde{v}_j^-), \; p = 1,2,...,P \quad (4)$$

$$d_p^+ = \sum_{j=1}^{n} d(\tilde{v}_{pj}, \tilde{v}_j^+), \; p = 1,2,...,P \quad (5)$$

Calculating the closeness coefficients by using Eq. (6).

$$C_p = \frac{d_p^-}{d_p^+ - d_p^-} \quad (6)$$

3. Simulation and results

To establish the method, the EFQM evaluating criteria are widely employed for assessing these 13 well-known PMSs to have an effective assessment to make a comprehensive comparison among them. In this way, the FTOPSIS is used to assess the standards in its multi-criteria decision making area. In the FTOPSIS method, the only subjective input needed is criteria weights which are in this study obtained from the nine basic criteria weights of the EFQM method. The standards are studied and the judgment about the coverage level of them in the field of each EFQMs sub-criteria are extracted and gathered using linguistic variables in the range of "very low", "low", "median", "high" and "very high" level of coverage which the results are shown in Table 2. The linguistic variables are transformed to the triangular fuzzy numbers, using Table 3. The coverage level of each standard according to each criterion is calculated with the geometric mean of the fuzzy scores under that criterion -sub-criteria- for that specific standard. The criteria crisp weights are multiplied to the criteria scores of each standard to create the fuzzy weighted decision matrix as the step (3) of the FTOPSIS method defined in section 2.2. The remaining steps of the FTOPSIS method are followed consequently. The results are shown in Table 4.

According to results in Table 4 one can see that the standard 2 -PMBOK- is the best standard in covering the EFQMs criteria. However, that is the standard 8 -OPM3- that introduced as the best standard in covering the "result" field of the EFQM method and the PMBOK achieve the second place. Assessing the other standards is successfully illustrated in each of the two main fields of the EFQM model and the total evaluation is either obtained in the last column of the table. Moreover, Table 2 can helps the organizations/projects and their managers to make a more reliable decision choosing an appropriate standard in order to guarantee their success.

Table 2: Expert judgment about coverage level of EFQM models criteria by PMSs

Criteria	Sub-criteria	Standards												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Leadership	a1	L	M	VL	VL	M	M	L	VL	M	M	M	M	M
	b1	L	M	VL	M	M	M	L	M	M	M	M	M	L
	c1	M	M	VL	L	M	M	L	L	L	L	L	L	L
	d1	L	M	L	M	M	M	L	M	L	L	L	L	L
	e1	L	M	L	L	M	M	L	L	L	H	M	L	L
Policy & Strategy	a2	M	H	M	M	M	VL	L	M	L	VL	VL	VL	VL
	b2	M	M	M	M	L	M	L	M	L	VL	VL	VL	VL
	c2	M	M	M	M	L	M	L	M	L	VL	VL	VL	VL
	d2	M	H	M	M	L	VL	L	M	L	VL	VL	VL	VL
Human resources	a3	H	H	L	M	M	M	M	M	M	M	M	M	M
	b3	H	H	L	H	M	VL	L	H	VL	VL	VL	VL	VL
	c3	H	H	L	H	M	VL	L	H	M	VL	VL	VL	VL
	d3	VL	VL	L	H	M	VL	L	VL	VL	VL	VL	VL	VL
	e3	VL	VL	L	H	M	VL	L	M	VL	VL	VL	VL	VL
Companies & references	a4	H	H	L	L	M	L	L	L	L	VL	VL	VL	VL
	b4	L	H	L	L	M	M	L	M	L	VL	VL	VL	VL
	c4	L	H	L	L	L	L	L	L	VL	VL	VL	VL	VL
	d4	L	H	L	L	L	M	L	M	VL	VL	VL	VL	VL
	e4	L	H	L	L	M	M	M	M	VL	VL	VL	VL	VL
Processes	a5	H	H	M	M	M	L	VL	M	VL	VL	VL	VL	VL
	b5	L	H	M	M	M	M	VL	M	VL	VL	VL	VL	VL
	c5	L	M	L	M	L	L	VL	M	VL	VL	VL	VL	VL
	d5	H	M	L	M	M	M	VL	H	VL	VL	VL	VL	VL
	e5	L	M	L	M	L	L	L	H	VL	VL	VL	VL	VL
Customers results	a6	VL	M	VL	VL	VL	VL	VL	H	VL	VL	VL	VL	VL
	b6	VL	M	VL	VL	VL	VL	VL	H	VL	VL	VL	VL	VL
Population results	a7	M	M	L	M	L	VL	VL	L	M	M	L	L	L
	b7	M	M	L	M	L	VL	VL	L	M	M	M	M	M
Society results	a8	VL	VL	VL	VL	VL	VL	VL	L	VL	VL	VL	VL	VL
	b8	VL	VL	VL	VL	L	L	L	L	VL	VL	VL	VL	VL
Key results of performance	a9	M	M	M	M	L	L	VL	L	VL	VL	VL	VL	VL
	b9	M	M	M	M	L	L	VL	M	VL	VL	VL	VL	VL

Table 3: Reference table of transforming linguistic variables to fuzzy numbers

Linguistic	Scale of fuzzy number
Very low	(0.00,0.10,0.25)
Low	(0.15,0.30,0.45)
Media	(0.35,0.50,0.65)
High	(0.55,0.70,0.85)
Very high	(0.75,0.90,1.00)

Table 4: Results of method simulation

#	Score of the standard in the field of results	Score of the standard in the field of enablers	Total score	Level of the standard in the field of results	Level of the standard in the field of enablers	Total assessment
1	0.081387166	0.080972151	0.081156688	3	5	4
2	0.117320253	0.110415074	0.113483802	2	1	1
3	0.072836127	0.069276286	0.070860301	4	7	6
4	0.081387166	0.093105719	0.087892518	3	2	3
5	0.060441317	0.089507414	0.076555458	5	3	5
6	0.052887042	0.072604494	0.063826529	7	6	7
7	0.040319081	0.058428736	0.050360734	9	8	9
8	0.125191032	0.087941123	0.104475969	1	4	2
9	0.054540264	0.050111159	0.052081126	6	9	8
10	0.054540264	0.043972977	0.04867362	6	10	10
11	0.049685252	0.042888845	0.045912503	8	11	11
12	0.049685252	0.038522245	0.043483424	8	12	12
13	0.049685252	0.037543634	0.042940323	8	13	13

4. Discussion, conclusion, limitations and future researches potentials

In this paper the usefulness of the FTOPSIS method based on the EFQM methods' criteria and sub-criteria in order to assess the PMSs is examined. The results which are shown in Table 4 lay stress on the superiority of the PMBOK which is illustrated by some other previous researches. This main result shows the validity of the method. The comprehensive review of the PMSs which its results are shown in Table 2 helps the managers to have a quick exact view of the standards to make a better selection among the standards. Moreover, amalgamating of the EFQM as the excellence method and the PMSs in such a modular mathematical manner is a new approach that establishing consistent communication in a project and better process quality to lead it to be better done.

As in other empirical studies, the findings and implications in this study should be interpreted with caution, due to their limitations. Firstly, in establishing the comparison between the standards, the related literature is widely used and an expert's idea about the applicability and drawbacks of them is not employed. Secondly, the method is prepared by the crisp weights of each criteria belongs to the EFQM method. So, a logical extension would be to use fuzzy weights for the criteria. Thirdly, the method uses a FTOPSIS method to evaluate the standards. One can use the other MADM methods to make a comparison.

References

[1] Crawford, L. (2000). *Global body of project management knowledge and standards*. Morris (Wiley), pp. 1153-1193.

[2] Ahlemann, F., Teuteberg, F. and Vogelsang, K. (2009). Project management standards – Diffusion and application in Germany and Switzerland. *International Journal of Project Management*, Vol. 27, No. 3, pp. 292-303.

[3] Ilieş, L., Crişan, E. and Mureşan, I. N. (2010), Best practices in project management. *Review of International Comparative Management*, Vol. 11, No. 1, pp. 43-51.

[4] Buttrick, R. (2012). *PRINCE2 and the National and International Standards. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB0QFjAA&url=https%3A%2F%2Fwww.axelos.com%2Fgetattachment%2F06f826f5-8a48-4ebf-a067-13626db92de9%2Fcase-studies-and-white-papers%2Fprince2-and-national-and-international-standards.aspx&ei=NAXsVOP1E8uNaOu6gMAD&usg=AFQjCNGqaznQzFeUX2cXsKcm_30lhHDbvg&sig2=QhX0Q0zz63dzPrG0xLrt8Q&bvm=bv.86475890,d.d2s&cad=rja*

[5] Bayo-Moriones, A., Dıaz-de-Cerio, J. M., Escamilla-de-Leon, S. A. and Selvam, R. M. (2011). The impact of ISO9000 and EFQM on the use of flexible work practices. *International Journal of Production Economics* Vol. 130, pp. 33–42.

[6] Gvozdenovic, T., Miljanovic, M., Aleksandar, J. and Crnogorcic, Z. (2008). Bodies of knowledge in project management and project quality management. *International Journal for Quality research*, Vol.2, No. 1, pp. 69-76.

[7] Project Management Institute. (2008). *Organizational project management maturity model (OPM3) knowledge foundation.2nd Edition, Project management Institute Inc. Pennsylvania USA.http://marketplace.pmi.org/Pages/ProductDetail.aspx?GMProduct=00101095801*

[8] McPhee, I. (2007). *Project Management – some reflections on the management of projects in the Australian public Sector.Australian Institute of Project Management.http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CDEQFjAC&url=http%3A%2F%2Fwww.anao.gov.au%2F~%2Fmedia%2FUploads%2FDocuments%2Fspeech_to_aipm_9_oct.pdf&ei=gQnsVJrUB8nvUM-1hLAE&usg=AFQjCNG5tQmsiKduhKH7BML-DqkllWzdGA&sig2=rHvbOAUDvwBDrkzKzJQCpA&bvm=bv.86475890,d.d2s&cad=rja*

[9] Morris P., Pinto J. K., (2011). *The Wiley Guide to Project Organization and Project ManagementCompetencies.*Willey.*https://books.google.com/books?id=RCDN2WIxwrgC&pg=PA222&lpg=PA222&dq=National+Occupational+Standards+for+Project+Management&source=bl&ots=sgn8FewR5h&sig=Bkfztv8l0XltJbK57EP7GE8ZLWA&hl=en&sa=X&ei=-xHsVM_UCsLKaMmwgLgL&ved=0CFQQ6AEwCQ.*

[10] Caupin, G., Knopfel, H., Morris, P.W.G., Motzel, E., Pannenbacker, O. Perez-Polo-F., Seabury, C. (1998). ICB IPMA Competence Baseline, 3rd Edition,*International Project Management Association,* Zurich.http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CCsQFjAC&url=http%3A%2F%2Fwww.lpva.lt%2Fcms%2Ffiles%2Flpva%2Fresources%2F4640_IPMA_ICB_EN.pdf&ei=bRTsVPShB9HjaqmygeAK&usg=AFQjCNExpFyQrSf4LijbYoi43JKQCOyzpg&sig2=ubwgmZV6NyF7JQDhZl8T0A&cad=rja

[11] Dinsmore, P. and Cabanis-Brewin, J. (2006). The AMA Handbook of Project Management. Amacom, USA, (English language).

[12] Crowford, J.K. (2006). *Project management maturity model, second edition (PM solutions research),* Auerbach Publications.

[13] Ohara, S. (2005). Booklet on P2M. *Project Management Association of Japan.*

[14] Eberle, A., Meyer, H. and Rosen, D. (2011). A comparison of PMI and IPMA approaches. Projekt Management Aktuell. pp. 31-34.

[15] Project Management Institute, (2007). *Project manager competency development framework.* 2nd edition, *Project Management Institute*.http://tecdigital.tec.ac.cr/file/5710155/PMI_Estandar.

[16] Hwang, C.L., Yoon, K., (1981). Multiple attribute decision making: methods and applications. *Springer*, Berlin, Heidelberg.

[17] Golpîra, H. (2012). Making comparison between fuzzy and non-fuzzy MCDM to calculate weight factors of project activities. *Journal of Industrial Management, Islamic Azad University of Sanandaj*. pp. 23-34.