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IDENTIFYING AND SELECTING THE STRATEGIC PROCESS USING THE CROSS-EFFICIENCY APPROACH BASED ON SATISFACTION LEVEL AND EXTENDED BALANCED SCORECARD

Abstract: *The strategy is a macro and strategic plan, and will only be implemented when it is defined in the form of various projects. In order to exploit the benefits of lean six sigma projects, these projects should be in line with the strategic goals of the organization. Organizations should select projects which are compatible with the organization overall goals and fulfill the strategic requirements of the organization. The purpose of this study is to identify the strategic process among the bank facility processes to use it in lean six sigma methodology in order to improve process performance and efficiency using a combination of cross-efficiency and extended balanced scorecard methods. In the first step, the criteria for selecting the strategic process were identified using the six measures of the balanced scorecard method. In the second step, after collecting information using the cross-efficiency model based on satisfaction level, the bank facility processes are ranked based on the efficiency score. The results show that the ranking of the processes under consideration is carried out without any interference, and one of the processes (process 3) is considered as the strategic process to use in the six sigma methodology.*

Keywords: *strategic process, cross-efficiency, satisfaction level, extended balanced scorecard, six sigma*

1. Introduction

Achieving higher performance is a goal that organizations have taken various activities in order to achieve it, and one of these activities is to emphasize and focus on organizational abilities capabilities and capabilities (Sok et al., 2013). A main question of many of the researchers and planners is why a number of companies have higher performance than

some others (Barney, 1991). Strategic alignment leads to a sustainable competitive advantage, improves business performance (Chen, 2010), provides a better understanding of the value of investments in the IT sector and organizational processes, as well as improves the strategic planning of the organizational systems (Chen, 2010, Bush et al., 2009). Coordination and alignment are important so that the concept of management

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can be considered as equivalent to the concept of coordination. According to many experts, the most important task of managers is to create and maintain coordination among different activities of the organization.

In strategic planning, it is necessary to review the short-term business plan and quality improvement program (Das.et al, 2008). Programs should be clear and should cover qualitative aspects. Coordination of quality programs with other programs is also necessary (Jun.et al, 2004). Organizations spend a lot of resources and time to develop their own strategies, but they most often fail to implement their strategies (Kaplan & Norton, 2004). We know that the strategy is a macro-strategic plan, and will only be implemented when defined and pursued in the form of various projects.

On the one hand, in recent years, organizations increasingly have turned to Lean Six Sigma approach and have solved their problems with this approach. In today's competitive world, the Six Sigma methodology is very applicable for organizations. The Six Sigma approach is primarily a way to improve capabilities of the business processes using statistical tools and its goal is to reduce defects, improve profitability, increase employee satisfaction, enhance product quality and ultimately increase customer satisfaction. It also reduces costs and eliminates wastes and activities that do not add value to the organization (Wang & Chen, 2010).

In order to exploit the benefits of the six sigma projects, organizations must coordinate these projects with the strategic goals of the organization. In a new approach to the six sigma methodology, top executives set strategic goals, measures, and actions to determine the projects that have the greatest impact on the organization's operating system. Organizations should select projects that meet the strategic needs of the organization and match the overall goals of the company (Ronal et al, 2002).

The purpose of this study is to identify the strategic process among the bank facility processes to use it in lean six sigma methodology in order to improve process performance and efficiency using a combination of cross-efficiency and extended balanced scorecard methods. The use of this approach makes the process selection consistent with the macro-strategic plans of the bank and finally improves process performance by employing the strategic process identified in the six sigma methodology.

2. Literature review

2.1. Strategic alignment and the balanced scorecard

Senior managers almost always discriminate their strategies into several key themes (issues). Generally, strategic themes reflect what the management team believes must be done to be succeed. Financial sectors and customers usually express the results which is desirable for internal stakeholders (shareholders and employees) and external stakeholders (customers, suppliers and society). Strategic themes don't reflect the financial results such as improvement in the considered values by the shareholders, or customer results such as more keeping the customers, and more market share. These themes reflect the views of senior managers about what should be done inside the company to achieve the strategic results. So, these themes generally are related to the internal business processes (Kaplan & Norton, 2004). Internal processes create and provide the value to the customers. Performance of this area is a leading indicator to support the subsets. Also, the objectives of growth and learning perspective, describe the integration of people, technology and other relevant organizations to support the strategy. Improvement in learning and growth criteria is a leading indicator for other three areas. A company must focus on several important internal processes that provide distinctive

values to the customers and are more important to enhance productivity and to secure the organizations franchise.

Various definitions have been proposed for strategic alignment in various strategic management texts. In all of them, the integration and coordination between the organization applications and the organization goals is considered (Gutierezz, 2006). According to Lauftman, strategic alignment refers to the use of IT in an appropriate and timely manner consistent with the strategies, goals and business needs. Rosser sees the alignment as the best possible use of the organization resources to achieve its business goals. Studies show that strategic alignment is not a static concept, but it has a dynamic nature (Luftman & Kempaiah, 2007). Balanced scorecard is a strategic planning and strategic management system used by businesses and industries around the world to coordinate business activities with the organization strategies (Gomes & Romão, 2015).

The balanced scorecard, which has attracted a lot of attention today, is not only a comprehensive and integrated measurement tool, but it is also a management system with a new strategic management approach that was introduced in the 1990s. Norton and Kaplan, by introducing their performance measurement system, drew managers' attention to the point that it would be better to assess employee performance with a more general approach. Kaplan and Norton suggested that in order to perform a complete evaluation of performance, the performance should be assessed from four perspectives: financial, customer, internal processes, and learning and growth perspectives (Niven, 2002). Norton and Kaplan, in their other research entitled "The Strategy Map" examined the importance of employee satisfaction and the environment and society (communications). The last two perspectives are important in integrating the main factors in the balanced scorecard (Rezaei & Hosseini, 2011).

Balanced Scorecard is a combined financial and non-financial framework that aims to align organizational strategies with business goals, increase employee incentives, improve communication, and improve organizational performance (Rompho, 2011). Strategic alignment in an organization has the following key components (Kaplan & Norton, 2001):

1) Appropriate organizational strategy
2) Organizational coordination
3) Human resource coordination and alignment
4) Coordination and alignment of organization planning and control systems.

In this study, criteria and indicators to evaluate the processes in the Bank facilities group were defined based on the Balanced Scorecard measures.

For this purpose, with regard to the six main measures of the Balanced Scorecard, after reviewing the literature and interviewing with experts of bank, selected indicators related to each measure were identified using the group name technique. Table 1 presents indicators for each of these measures with regard to investigated processes.

Table 1. Key Indicators with respect to six perspectives of Balanced Scorecard

Financial perspective: • Direct revenue • Direct costs	Customer perspective: • The number of customers • Repetition rate of customer service	Internal processes: • Rate of labor use • Response times to customer requests
Employee satisfaction: • Number of complaints of staff • -Staff movement rate	Environment and community perspective (communications): • Alignment with major social strategy and social needs • Compliance with environmental laws	Learn and grow: • Staff training hours • Number of employees with advanced degree

2.2. Lean six sigma

Six sigma is considered as an intelligent and wise method in managing business activities of an organization or a department. The first principle in six sigma is the customer.

The three main purposes of using six sigma are:

• enhancing customer satisfaction
• reduction of time required by activities
• fault decreasing

Six Sigma was introduced for the first time in the mid-1980s as a business process improvement model by Bill Smith, an engineer of reliability at Motorola (Brady and Allen, 2006). Six Sigma is a powerful business strategy that enhances service efficiency and significantly reduces defects in provision of services (Antony, 2005). In fact, Six Sigma is an effective methodology to accelerate the improvement of the quality of products and services, along with the elimination of activities and processes without value added (Kwak & Anbari, 2004). The fundamental concept of lean thinking lies in eliminating losses and creating value in the organization. Lean thinking is an attitude to increase productivity and continuous value creation and to minimize costs and losses. Thus, it can be said that the purpose of using the sigma method is to reduce defects, losses, and evident errors through quick methods and techniques such as lean thinking and (shah et al., 2008). The goal of the Six Sigma is to

grow, and this growth is achieved not only by reducing costs but also by increasing productivity (Bryne et al., 2007). D. Hess & Benjamin (2014) in a study entitled " Applying Lean Six Sigma within the university: opportunities for process improvement and cultural change", used a combined Six Sigma approach to improve cultural change at a university. The study findings showed that if the goal is to change the cultural and behavioral patterns of staff and students, it is necessary to use lean methodology and lean thinking in combination with six sigma. The DMAIC cycle is the most common methodology in lean six sigma to improve organizational processes. Bhat and Jnanesh (2013) in a study entitled "Enhancing performance of the health information department of a hospital using lean Six Sigma methodology" used a combined approach of lean six sigma to improve the performance of a hospital's information system. Shanmugaraja and Nataraj (2012) in a study entitled "Total performance excellence – a model to implement six sigma in service organizations" used a combination of six sigma and QFD approaches to improve organizational processes. The result showed that the customer satisfaction increased due to correct identification of modified processes. Heavey and Murphy conducted a study entitled "Integrating of Balanced Scorecard with Six Sigma". The ultimate goal of the researchers was to know whether the

combination of the two approaches would be useful to measure and improve the performance or not. In that study, the Balanced Scorecard was introduced as a prerequisite for selecting Six Sigma improvement projects.

2.3. Lean six sigma improvement projects

Lean manufacturing enables the modern organization reach its goal through efficient and value adding processes. Six sigma is a business improvement strategy as well and focuses on reducing defects in the organization processes. Using these two together, brings synergic advantages to the organization through waste elimination and defect reduction (Vinodh & Swarnakar, 2015). Thus selecting lean six sigma project is a very important job. Lean six sigma projects is considered as providing a plan to solve a problem and contains a set of criteria, so that these criteria can be used as project aims and analyzed towards its progress. So implementation of six sigma projects can be useful for the organization in many respects. Process improvement methods such as lean six sigma are being used throughout the world, nevertheless there are some failure reports in this regard (Kornfeld & Kara, 2013).

2.4. Criteria defining toward selecting lean six sigma improvement project

Selecting projects is the primary and the most important activity in the process of deploying lean six sigma and is also the key to success in preliminary and long term acceptance of this method. According to many experts in this field, ranking and selecting lean six sigma improvement projects plays a determining role in implementing them successfully. The advantages that improvement project brings to the business include the effects on the customer, business strategy, major capabilities and also financial impacts. Availability criteria for lean six sigma improvement projects are: resources needed

expertise available, complexity, probability of success, learning and mutual responsibility. Harry and Schroeder (2000) suggest following criteria for selecting improvement projects:

1) Defect per million opportunities
2) Net cost savings
3) Cost of poor quality
4) Cycle time
5) Customer satisfaction
6) Capacity
7) Internal efficiency

Banuelas & Tennant (2006) have defined the following six criteria for selecting a six sigma improvement project:

1) Customer impact
2) Financial impacts
3) Management commitment
4) Measurability and availability
5) Development and learning
6) Correlation with business strategy

Vinodh and Swarnakar (2015), introduced below criteria:

1) Operational feasibility
2) Customer impact
3) Financial impact
4) Management commitment &Employee involvement
5) Learning and growth potential
6) Business strategy & core competence

2.5. Cross-efficiency based on the satisfaction level

Data envelopment analysis (DEA) is a method to measure relative efficiency of equivalent decision making units (DMU) with several input and output indices (Charnes et al, 1978). These DMUs can be bank branches, hospitals, factories etc. (Liang et al., 2008). This method's flexibility in selecting input and output weights and also its self-evaluation nature have been criticized.Cross-efficiency is an extended method in data envelopment analysis (DEA) to rank decision-making units (DMUs) and was proposed for the first time by Sexton et al. (1986). One of the problems of this model

was that this model was not able to provide a cross-efficiency matrix because in the traditional DEA models, there are several optimum solutions. Sexton et al. (1986) proposed a secondary model to solve this problem, which later called as secondary goal model. Many researchers turned to introduce secondary goal models based on cross-efficiency (e.g., Doyle and Green, 1994; Liang et al., 2008; Moini et al., 2015). Recently, Wu et al. (2016) proposed a secondary goal model based on the concept of satisfaction degree. They used two algorithms to solve the model and to obtain a unique solution. In this section, a new concept named "satisfaction level" will be introduced and a secondary objective model will be proposed based on this concept.

Assume that we have *n* DMUs which produce *s* outputs by getting *m* inputs. Also assume that ith input and rth output of DMU_j are x_{ij} and y_{rj} respectively. Charens et al. (1978) proposed the following multiplier CCR model to evaluate performance of DMU_d.

$$E^*_{dd} = \max \sum_{r=1}^{s} u_r y_{rd}$$
(1)

$$S\,t$$

$$\sum_{i=1}^{m} v_i x_{id} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \qquad j = 1,...,n$$

$$u_r \ge 0, \quad v_i \ge 0, \qquad \forall r, i$$

The optimal value of the model (1) is less than or equals to 1. DMU_d is efficient if the optimal value of the model (1) is equal to 1, otherwise the DMU_d is inefficient. Suppose that (u^d, v^d) are optimal weights for DMU_d using the CRR model. Then, cross-efficiency of DMU_j by using optimum weights of DMU_d will be calculated as follow:

$$E_{dj} = \frac{\sum_{r=1}^{s} u_r^d y_{rj}}{\sum_{i=1}^{m} v_i^d x_{ij}}$$
(2)

Model 1 has multiple optimal solutions. Therefore, the values of E_{dj} as well as the cross-efficiency matrix are not unique (Sexton et al., 1986). To overcome this problem, secondary goal models are proposed.

In the following, we introduce a concept, named "satisfaction level", for decision-making units, and thereby provide a secondary goal model for cross-efficiency.

The following model, an ideal value for efficiency of $DMU_j(j=1,...,n \; ; \; j \ne d)$ is calculated using DMU_d weights:

$$\overline{E_{dj}} = \max \sum_{r=1}^{s} u_{rd} y_{rj}$$
(3)

$$S\,t$$

$$\sum_{i=1}^{m} v_{id} x_{ij} = 1$$

$$\sum_{i=1}^{m} v_{id} x_{id} = 1$$

$$\sum_{r=1}^{s} u_{rd} y_{rd} = E^*_{dd}$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \qquad j = 1,...,n$$

$$u_r \ge 0, \quad v_i \ge 0, \qquad \forall r, i \;,$$

where E^*_{dd} is the efficiency value of DMU_d by model (1). Similarly, the anti-ideal value for DMU_j (j = 1, ..., n; j ≠ d) of the DMU_d weights can be calculated as follows:

$$\underline{E_{dj}} = \min \sum_{r=1}^{s} u_{rd} y_{rj}$$
(4)

$$S\,t$$

$$\sum_{i=1}^{m} v_{id} x_{ij} = 1$$

$$\sum_{i=1}^{m} v_{id} x_{id} = 1$$

$$\sum_{r=1}^{s} u_{rd} y_{rd} = E_{dd}$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \qquad j = 1, ..., n$$

$$u_r \geq 0, \quad v_i \geq 0, \quad \forall r, i$$

$S\,t$

$$\sum_{r=1}^{s} u_{rd} y_{rd} - E_{dd}^{*} \sum_{i=1}^{m} v_{id} x_{id} = 0$$

(5)

$$\sum_{r=1}^{s} u_{rd} y_{rj} - E_{dj} \sum_{i=1}^{m} v_{id} x_{ij} = 0 \; j = 1, ..., n; j \neq d$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \qquad j = 1, ..., n$$

$$u_r \geq 0, \quad v_i \geq 0, \quad \forall r, i$$

DMU_j (j = 1, ..., n; j ≠ d) is always trying to achieve the efficiency value $\overline{E_{dj}}$. But it is not possible for all DMU_j (j = 1, .., n; j ≠ d) to get this value. Also, DMU_j (j = 1, ..., n; j ≠ d) diverges from the $\underline{E}_{dj}$ value. Thus, the following definition is provided.

Definition 1: satisfaction level for DMU_j (j = 1, …, n; j ≠ d) with regard to the DMU_d weights is defined as follows:

$$\varphi_j = w_1(E_{dj} - \underline{E}_{dj}) - w_1(\overline{E}_{dj} - E_{dj})$$

Here, φ_j is called satisfaction level and if this value is the much value it shows that the satisfaction is high. w_1 and w_2 are the weights determined by decision maker and represent the difference between the value of efficiency and its ideal or anti-ideal value. E_{dj} is the calculated value of DMU_j efficiency with regard to the DMU_d weights. Here, a given satisfaction level defined above, we provide the following secondary model to obtain the optimal DMU_d weights.

$$\underset{\substack{1 \leq j \leq n \\ d \neq j}}{\text{Max}} \; \varphi_j = w_1(E_{dj} - \underline{E}_{dj}) - w_1(\overline{E}_{dj} - E_{dj})$$

Here, the goal is to obtain the maximum satisfaction level for DMU_j (j = 1, ..., n; j ≠ d), so that the efficiency of DMU_d remains constant. The above model is a multi-objective model. However, it can be transformed into a single-objective programming model using scalarization methods, and then we can solve it (Ehrgott, 2000). One of the methods which is used in this paper is the weighted sum method. Model (5) is converted to the following single-objective model using the weighted sum method:

$$\max \sum_{\substack{j=1 \\ j \neq d}}^{n} \lambda_j \varphi_j$$

$S\,t$

$$\varphi_j = w_1(E_{dj} - \underline{E}_{dj}) - w_1(\overline{E}_{dj} - E_{dj})$$

$$\sum_{r=1}^{s} u_{rd} y_{rd} - E_{dd}^{*} \sum_{i=1}^{m} v_{id} x_{id} = 0$$

(6)

$$\sum_{r=1}^{s} u_{rd} y_{rj} - E_{dj} \sum_{i=1}^{m} v_{id} x_{ij} = 0 \; j = 1, ..., n; j \neq d$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \qquad j = 1, ..., n$$

$$u_r \geq \circ, \quad v_i \geq \circ, \qquad \forall r, i$$

$\lambda_j \geq 0$ is the weight corresponding to DMU_j (j=1,..,n ; j≠ d). Outputs of this model are the satisfaction level φ_j and efficiency value E_{dj} (j=1,..,n ; j≠ d) which can be placed in dth row of cross-efficiency matrix. Cross-efficiency matrix is constructed by solving the above model *n* times. The cross-efficiency score is calculated as follows:

$$E_d = \frac{\sum_{j=1} E_{dj}}{n} \qquad (7)$$

According to the above, the following algorithm is provided for ranking DMUs based on the satisfaction level.

An algorithm for ranking DMUs based on the satisfaction level:

1) The efficiency values of E_{dd} (d = 1, ..., n) are computed using model (1).
2) Using model (3), the ideal values of $\overline{E_{dj}}$ (j = 1, ..., n; j ≠ d and d = 1, ..., n) are computed.
3) Using model (4), the anti-ideal values of $\underline{E_{dj}}$ (j = 1, ..., n; j ≠ d and d = 1, ..., n) are computed.
4) Using model (6), the values of E_{dj} (j=1,…,n , j≠ d) are computed and the cross-efficiency matrix is constructed.
5) Using eq. (7), cross-efficiency score is computed.
6) Decision making units (processes) are ranked based on the cross-efficiency scores.

3. Research methodology

This research is a descriptive-survey study. The purpose of this study is to provide a framework for selecting the strategic process among the bank facility processes in order to improve process performance and efficiency of bank services. For this purpose, after reviewing the six measures of Balanced Scorecard and reviewing the previous studies, and considering the processes under study in the bank, the 12 sub-criteria were assessed based on the 6 main measures with the help of the nominal group technique and interviews with 10 experts of the bank. In order to use the satisfaction level in cross-efficiency model to rank the processes and select the strategic process to use in Six Sigma methodology, the sub-criteria were divided into two groups of inputs and outputs.

Information and data of processes and criteria are presented in table 2, according to the types of inputs and outputs. In this table, each of the 10 processes selected among the bank facility processes was defined as a decision-making unit (DMU), and the information about each of these processes and criteria were collected from the databases of statistics, human resources, office of organization and methods, and also through distribution of questionnaires among the managers of the bank. It should be noted that according to the viewpoint of experts and managers of the bank, the Likert scale was used to collect information about two qualitative criteria (compliance with environmental laws and alignment with society macro strategies).

Table 2. Information of the criteria and bank facility processes with regard to Balanced Scorecard

DMUs (processes)	Financial aspect		Customer aspect		Internal processes aspect	
	Direct cost	Direct income	Number of customers	Service repeat rate	Labor rate	Response time to customer
	input	output	input	output	input	output
1	6167400	7500000	750	1.093	0.0012	6180
2	6843250	1875000	1250	1.12	0.0007	6400
3	5326000	25000000	500	1.50	0.002	5500
4	557160	810000	90	1.66	0.0066	600

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Table 2. Information of the criteria and bank facility processes with regard to Balanced Scorecard (continued)

DMUs (processes)	Financial aspect		Customer aspect		Internal processes aspect	
	Direct cost	Direct income	Number of customers		Direct cost	Direct income
	input	output	input		input	output
5	53632	100000	4	2.25	0.11	58
6	1116200	750000	50	1.9	0.021	1250
7	1005000	1500000	250	1.2	0.033	1050
8	8469000	1250000	2500	1.12	0.0003	7800
9	1614000	20000000	500	1.25	0.0015	1650
10	7382000	1500000	3000	1.066	0.0003	6200

DMUs (processes)	Learning and growth aspect		Employee satisfaction aspect		Environment and society (communication) aspect	
	Labor training hours	Number of employees with high academic degree	Employees' turnover rate	Number of employees' complaints	Compliance with environmental laws	Alignment with society macro strategies
	input	output	input	output	input	output
1	2	5	0.13	0.17	5	3
2	1	5	0.13	0.17	5	3
3	1	5	0.13	0.5	4	4
4	2	5	0.13	0.5	3	2
5	1	5	0.13	0.66	1	2
6	1	5	0.13	0.33	5	1
7	0.5	5	0.13	0.33	3	3
8	1	5	0.13	0.17	3	3
9	0.5	5	0.13	0.17	4	4
10	0.5	5	0.13	0.5	3	3

4. Data analysis

In this section, we rank the bank facility processes using the algorithm presented in the previous section. Note that the mathematical programs of all models in this algorithm are solved using Lingo 14 software. In order to ranking the desired processes using the proposed algorithm, we first use the model 1, which is one of the traditional models of data envelopment analysis. It is worth that the efficiency score of all the processes examined using this model which is equal to 1. In fact, all processes are efficient, and no distinction can be made between the processes using this model. Then, models 3 and 4 must be executed in order to calculate $\overline{E_{dj}}$ and $\underline{E}_{dj}$

$(j = 1, ..., n; j \neq d$ and $d = 1, ..., n)$ and corresponding matrices. Finally, the secondary model 6 will be applied and the cross-efficiency matrix will be obtained, which is provided in table 3. Also, equation 7 which is used to compute the average of each column of the cross-efficiency matrix provides the cross-efficiency score corresponding to each process, which is presented in the last row of the table 3.

As seen in the previous section, cross-efficiency score is the base for ranking the processes under study. According to the results presented in the last row of table 3, the processes examined are ranked without any interference. The ranking is presented in Table 4.

Table 3. Cross-efficiency matrix for the bank facility processes

	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1
2	0.982	1	1	0.546	0.504	0.597	0.582	1	0.628	1
3	1	1	1	1	1	1	1	1	1	1
4	0.894	0.828	0.951	1	0.554	1	0.932	0.814	1	0.821
5	0.628	0.628	0.833	0.868	1	0.75	0.75	0.628	0.628	0.736
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	0.792	0.723	0.667	1	0.994	0.765	0.949
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
10	0.799	0.967	1	0.548	0.504	0.6	0.681	1	0.832	1
E_d	0.9303	0.9423	0.9784	0.8754	0.8285	0.8614	0.8945	0.9436	0.8853	0.9506

Table 4. Ranking of the processes based on the cross-efficiency score

Process number	cross-efficiency score	Rank of the process
1	0.9303	5
2	0.9423	4
3	0.9784	1
4	0.8754	8
5	0.8285	10
6	0.8614	9
7	0.8945	6
8	0.9436	3
9	0.8853	7
10	0.9506	2

With regard to the results, it can be concluded that the process 3, i.e. the process of "payment of facilities for bank employees" can be considered as the strategic process among the bank facility processes to use in lean six sigma methodology for continuous improvement of process. Also, considering the application of six measures of balanced scorecard, it can be concluded that the selection of this process will be in line with the strategic alignment of processes with the macro-strategic plans of the bank.

5. Conclusion and suggestions

This paper has proposed a combined approach to identify and to select a strategic process among the bank facility processes. The proposed combined approach is related to the cross-efficiency in data envelopment analysis and balanced scorecard. The balanced scorecard technique is used in this paper, unlike previous studies, includes 6 measures. In addition to financial, customer, internal processes, learning and growth measures, this technique also covers two additional measures: employee satisfaction, and the environment and society (communications). Using the two later measures is important because these measures integrate the main factors in the balanced scorecard and provide more accurate analysis of the organization's current situation. In the cross-efficiency method used in this paper, a secondary goal is proposed which is based on customer satisfaction. One of the features of the proposed model is that it ranks 10 decision making units (bank facility processes) with 12 input and output indicators without any interference, which is not possible in the traditional models of data envelopment analysis. Other satisfaction level and other satisfaction-based models can be proposed and assessed in future studies. The results of the research showed that the proposed combination approach can be very effective for managers in decision making and in choosing the most efficient decision making unit in the service and production industries. Managers can be confident in aligning strategies and improving performance in their decision making. This approach contributes to increasing efficiency and profitability in implementing the organization's strategies.

Wu et al. (2016) proposed a cross-efficiency model based on concept of satisfaction

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degree. The satisfaction level expressed in this paper is completely different from the concept of satisfaction degree defined by Wu et al. (2016). In a future study, the outputs of these two methods can be compared with some real-world examples.

References:

Antony, J. (2005). Six sigma for service processes. *Business Process Management Journal*, *12*, (2), 234-48.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, *17*(1), 99-120.

Banuelas, R., & Tennant, C. (2006). Selection of six sigma projects in UK, *The TQM Magazine*, *18*(5), 514-527.

Brady, J. E., & Allen, T. T. (2006). Six sigma literature: a review and agenda for future research. *Quality and Reliability Engineering International*, *22*(3), 335-367.

Byrne, G., Lubowe, D., & Blitz, A. (2007). Using a Lean Six Sigma approach to drive innovation. *Journal of Strategy and Leadership*, *35*(2), 5-10.

Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, *2*(6), 429-444.

Chen, L. (2010). Business-IT alignment maturing of companies in china. *Journal of information& management*, *11*(1), 109-132.

Das, A., Paul, H., & Swierczek, F.W. (2008). Developing and validating total quality management (TQM) constructs in the context of Thailand's manufacturing industry. *Benchmarking: An International Journal*, *15*(1), 52-72.

Doyle, J., & Green, R. (1994). Efficiency and cross efficiency in DEA: Derivations, meanings and the uses. *Journal of the Operational Research Society*, *45*(5), 567-578.

Harry, M. J., & Schroeder, R. (2000). *Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations*. Sydney: Currency Publishers.

Gomes, J., & Romão, M. (2015, March . achieving project success through alignment with organizational strategy: Balanced Scorecard approach. *Paper presented at the 8th IADIS International Conference - Information's Systems*. Funchal, Portugal .

Gutierezz, A., Orozco, J., Serrano, A., & Serrano, A. E. (2006, July). Using tactical and operational factors to assess strategic alignment: an SME study, *Paper presented at the European and Mediterranean Conference on Information Systems (EMCIS)*, Costa Blanca, Alicante, Spain, July 6-7.

Jun, M., CAI, S., & Peterson, R. T. (2004). Obstacles to TQM Implementation in Mexico's Maquiladora Industry. *Total Quality Management*, *15*(1), 59-72.

Kaplan, R. S., & Norton, D. P. (2001). *The Strategy Focused Organizations: How Balanced Scorecard Companies Thrive in the New Business Environment*. Boston: Harvard University Press.

Kaplan, R. S., & Norton, D. P. (2004). *Strategy-focused organization*. Translated by Bakhtiyari, P .First edition.Tehran: Management industry organization.

Kornfeld, B., & Kara, S. (2013). Selection of Lean and Six Sigma projects in industry. *International Journal of Lean Six Sigma*, *4*(1), 4-16.

Kwak, Y. H., & Anbari, F. T. (2004). Benefits, obstacles and future of six sigma approach. *Tec novation*, *20*(5-6), 1-8.

Liang, L. J., Wu, W., & Cook, J. (2008). Alternative secondary goals in DEA cross efficiency evaluation. *International Journal of Production Economics*, *35*(1), 1025-1030.

Luftman, J., & Kempaiah, R. (2007). An update on business-IT alignment: a line has been drawn. *MIS Quarterly Executive*, *6*(3), 77-165.

Luftman, J., & Brier, A. (1999). Achieving and sustaining Business- IT alignment. *California management Review*, *42*(1), 109-122.

Ehrgott, M. (2000). Multi criteria Optimization, *volume 491 of Lecture Notes in Economics and Mathematical Systems*. Berlin: Springer-Verlag.

Moeini, M., Karimi, B., & Khorram, E. (2015). A Cross-Efficiency Approach for Evaluating Decision Making Units in Presence of Undesirable Outputs. *In book: Modeling, Computation and Optimization in Information Systems and Management Sciences*, 487-498, Berlin, Publisher: Springer.

Niven, P. R. (2002). *Balanced Scorecard Step-by-step: Maximizing Performance and Maintaining Results*. New York: John Wiley & Sons, Inc.

Rezaee, Gh., & Agha Seyed Hosseini, S. M. (2011). *Twelve Steps to develop and implement Balanced Scorecard and determining the performance indicators*. Tehran: Berga publication.

Rompho, N. (2011). Why the Balanced Scorecard Fails in SMEs: A Case Study. *International Journal of Business and Management*, *6*(11), 39-46.

Sexton, T. R., Silkman, R. H., & Hogan, A. J. (1986). Data envelopment analysis: Critique and extensions. *New Directions for Evaluation Journal*, *1986*(32), 73-105.

Shah, A., Chandrasekaran, K., & Linderman, M. (2008). In pursuit of implementation patterns: The context of Lean and Six Sigma. *International Journal of Production Research*, 46(23), 6679-6699.

Shanmugaraja, M., Nataraj, M., & Gunasekaran, N. (2012). Total performance excellence - a model to implement Six Sigma in service organizations. *International Journal of Six Sigma and Competitive Advantage*, 7(2/3/4), 209-242.

Snee, R. D., William, F., & Rodebaugh, J. R. (2002). The project selection process. *Quality Progress*, *35*(9), 78-80.

Sok, P., o'Cass, A., & Momy, S. K. (2013). Achieving superior SME performance: overarching role of marketing, innovation and learning capabilities. *Australian marketing journal*, *21*, 161-167.

Vinodh, S., & Swarnakar, V. (2015). Lean Six Sigma project selection using hybrid approach based on fuzzy DEMATEL–ANP–TOPSIS. *International Journal of Lean Six Sigma*, 6(4), 313-338.

Wang, F. K., & Chen, K. S. (2010). Applying Lean Six Sigma and TRIZ methodology in banking services. *Total Quality Management*, *21*(3), 301-315.

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