Australian Journal of Basic and Applied Sciences, 5(12): 1917-1922, 2011
ISSN 1991-8178

Selection Six Sigma Project Use Gahp-Lp

[1]P. Nourpanah, [2]N. Ansary, [3]R. Nourpanah and [4]S. Amini

[1,2,3,4]Islamic Azad University, Salmas Branch, Salmas, Iran.

Abstract: Successful Six Sigma implementation is related to proper six sigma project prioritisation and selection. The project selection is the early stage of implementation for a Six-Sigma intervention .The project selection decision, under a resources constraint, is importance and play great role in the successful deployment of Six Sigma within organizations. A review of the literature is presented, highlighting the importance of project selection in Six Sigma deployment, which is an area of extreme importance that has been less researched in the past. The objective of this paper is to develop a mathematical model to select one or more six sigma projects that result in the maximum benefit to the organization, with propose a novel approach by integrating the Group Analytical Hierarchy Process and Linear Programming (GAHP-LP) method for Six Sigma project selection.

Key words: Six Sigma, Group Analytical Hierarchy Process, Linear Programming .Project Selecting.

INTRODUCTION

Continuous improvement towards business performance excellence is the competitive edge for commercial firms to survive in highly competitive markets (Deming, 1986). Over the past few years Six Sigma has become a popular approach in many organizations to drive out variability and reduce waste in processes using powerful statistical tools and techniques (Coronado, R.B. and J. Antony, 2002). six sigma originated in the manufacturing industry to reduce the wastes due to manufacturing process deficiencies, it is now used by almost all industries including service industries such as health care management (Krupar, 2003; Antony, 2004; Antony and Fergusson, 2004; Moorman, 2005). Contrary to this wide application potential, none of the other quality improvement initiatives received such high application outside the manufacturing industry. Among all, the process improvement techniques used in the last five decades, six sigma has clearly emerged as the most effective quality improvement technique as pointed out in a survey conducted by DynCorp (Dusharme, 2003). In essence, six sigma is an extension of other quality initiatives such as Deming's statistical quality control and total quality management (TQM).

The benefits of six sigma are extensively reported in the literature (Hendricks and Kelbaugh, 1998; Harry, 1998; Hahn *et al*., 1999; Lanyon, 2003; Robinson, 2005).

Since different potential areas of improvement compete for scare resources, organisation should select six sigma projects in such as way that they are closely tied to the business goals and strategy (Ingle and Roe, 2001).

Project selection is the process of evaluating individual projects or groups of projects, and then choosing to implement some set of them so that the objectives of the organisation will be achieved (Meredith and Mantel, 2003). The project selection-decision, to maximize the benefits, is often challenging for a company. Projects are the core activity driving changes in Six Sigma organizations. It can be best reflected in the following quote from Jack Welch (Chief Executive Officer, General Electric):

The best Six Sigma projects begin not inside the business but outside it, focused on answering the question: How can we make the customer more competitive? What is critical to the customer's success? Learning the answer to that question and learning how to provide the solution is the only focus we need

A clear and accurate definition of a project is the first step towards ensuring a project's success. The clearer the project goal, the more likely you are to achieve it. According to BS 6079 (2000), a project is defined as:

[. . .] a unique set of co-ordinated activities, with defining starting and finishing points, undertaken by an individual or organization to meet specific performance objectives within defined schedule, cost and performance parameters.

Selecting the right project in a Six Sigma program is a major factor in the early success and long-term acceptance within any organization (Antony, 2004). A review of literature facilitated in identifying the guidelines suggested by the authors for selecting any Six Sigma project (Antony, 2004; Davies-Catalani and Vieth, 2000; Pande´ *et al*., 2000; Pyzdek, 2003; Goldstein, 2001; Chaki, 2004; Snee and Rodebaugh, 2002; Harry and Schroeder, 2000; Jackenthal, 2004)

Methods used for selection of six sigma projects defined by different authors are shown below in Table 1

A project chosen for Six Sigma implementation can be the right project for the organization to work on and still be a failure because the wrong people were assigned to the project (Snee, 2001). The personnel assigned the job of project identification and selection should include managers who have been trained as Six Sigma champions, as well as other key Six Sigma knowledge resources, such as master black belts (MBBs), BBs, GBs,

Corresponding Author: Peyman Nourpanah, Islamic Azad University, Salmas Branch, Salmas, Iran.
E-mail: Nourpanah.P@gmail.com

and yellow belts, who bring experience in determining the feasibility and management of projects under consideration (Pyzdek, 2003; Pande´ *et al*., 2000; Snee, 2001).

There are noticeable cases where six sigma failed to deliver the desired results. An organization becomes frustrated with the Six Sigma initiatives if the projects do not deliver the expected bottom-line results. This causes management to shift their attention and resources on other initiatives (Snee, 2001). Surprisingly, poor project selection continues to happen even in the best-managed and best-performing organizations that can have a huge impact and undermine the success and credibility of the Six Sigma program (Noble, 2004). The reasons for project failure are extensively reported in the literature (Brice, 2002; Davies-Catalani and Vieth, 2000; Pande´ *et al*., 2000).

This paper proposes a novel MCDM approach by integrating the Group Analytical Hierarchy Process (GAHP) and Linear Programming (LP) in selecting Six Sigma projects. The numerical example is presented that the proposed approach for selecting appropriate projects for Six Sigma is effectiveness and practicality.

Proposed Methodology:

Selections Of Decision-Making Team Members:

Hunt proposed that key characteristics in three areas (member, group and task) must be present for group work to be successful (Hunt, J.W 1992). Group effectiveness demands members who work together cooperatively rather than competitively, who are committed to the project, and who trust each other (Cohen, S.G. & Bailey, D.E 1997). The six sigma members fulfilled these requirements. They were organization and staff members with different perspectives (e.g. assessment, computing, education, instructional technology) and from different disciplines. Furthermore, there was not a competitive work environment, and members felt comfortable offering opinions, asking questions, and working toward a mutual understanding.

The group was adequately resourced and had an effective leader with broad knowledge of the six sigma and the academic institution as a whole. The task of selecting six sigma projects needs and performing a preliminary evaluation of current systems in the organization was clear to all the group members.

Provide List Of Six Sigma Projects:

In this step, master black belt and black belts of six sigma team provide list of six sigma projects considering the organization's goals. Projects should be mentioned in the list such that their information can be used or can be gathered. They also should provide all the required information for modeling of project such as costs, time, human resource, and etc.

Define The Qualitative And Quantitative Criteria:

The next step in the Group AHP approach consists of structuring the decision-making problem as a hierarchy. The hierarchy starts at the top with a goal (first level) and is followed by decision criteria (and if needed, sub-criteria) in the subsequent lower level. The bottom level is constituted by the alternatives to be evaluated. One important consideration for developing the model is to first make explicit all the assumptions that are being made for the decision. The work group initially determined that the six sigma projects selection model could be represented as a hierarchy of three levels: goal, criteria (qualitative and quantitative), and other considerations.

Determine The Criteria Weights:

In this step, prioritizing or weighting the criteria, all the criteria are compared pairwise (e.g. what is more important) with respect to the goal at hand (i.e. selecting the most suitable projects). The intensity of these judgments are represented with a value in a numerical scale (e.g. 1-equally important, 5- more strongly important, 9-extremely important) in a criteria comparison matrix.

Modelling:

This step presents an integrated analytical hierarchy process (AHP) and linear programming (LP) formulation of selecting Six Sigma projects. In this formulation, select the best six sigma projects is object and the criteria are implementation cost, implementation time, human resource and reliability improvement.

Numerical Example:

In this section, we will demonstrate how the proposed approach may support the project selection process for Six Sigma implementation. Following example, has performed in the Azer Tecno company and the results are show in This section. The company has some projects to implement Six Sigma. But due to some restrictions not able to do them all.

Selections Of Decision-Making Team Members:

Company's senior management wants organize team establish production manager, quality manager, sales manager and finance director, They want earn maximum profits from the project went to the company with limits on company

Provide List Of Six Sigma Projects:

After the team organized, team members must prepare a list of projects. At this stage each of the team members expressed their views on the potential project. Finally, the team members came consensus to selected five projects.

Define The Qualitative And Quantitative Criteria:

This stage is very important, at this stage the team member discus about decision-making criteria. Team members after much discussion select following four criteria as the decision-making criteria in this case.

A. Information Availability
B. Increase efficiency
C. Ease of implementation
D. Cooperation of workers

After setting criteria, team members collected Data for five selected project in the stage 2. This information is shown in Table 1. Also, the hierarchical diagram is shown in Figure 1.

The maximum fee that the company can spend is $ 2 million, all projects should be implemented in 9 months (maximum a project is done in the time), 0.12 is the maximum acceptable risk, The project 2 can be select if project 1 selected, Maximum one of the project 1 or 5 should be selected and at least one of the projects 2 and 3 should be selected.

Table 1: information of projects.

Project	Benefit(million $)	Cost (million $)	Duration (month)	Risk
Project1	1	0.7	3	0.05
Project2	1.20	.8	4	0.08
Project3	.65	.4	2	0.03
Project4	1.05	.75	3	0.02
Project5	.85	.6	3	0.04

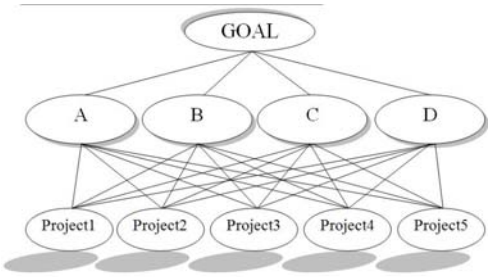

Fig. 1: Hierarchical Diagram.

Determine The Criteria Weights:

In this step, prioritizing or weighting the criteria, all the criteria are compared pairwise (e.g. what is more important) with respect to the goal. Result of project weight for each team member are shown in figure2,3,4,5 and 6 we use integrating the Group Analytical Hierarchy Process (GAHP) to project selecting. The final weight off each project is shown in figure 7.

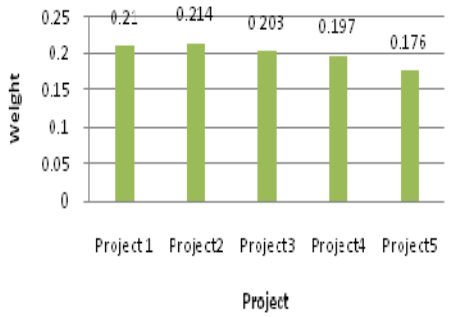

Fig. 2: Production manager weight.

Fig. 3: Quality manager weight.

Fig. 4: Sales manager weight.

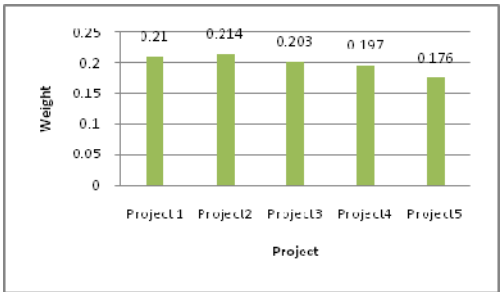

Fig. 5: Finance director weight.

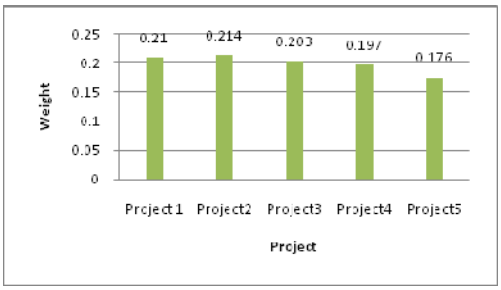

Fig. 6: Senior management weight.

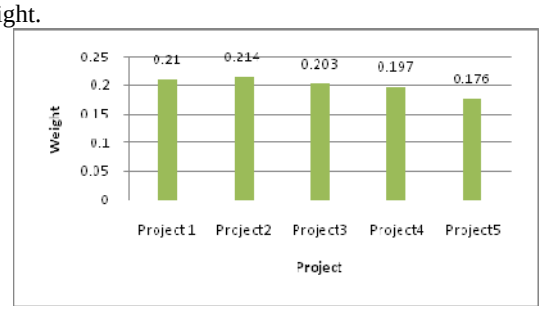

Fig. 7: Team weight.

Modelling:

This step presents an integrated analytical hierarchy process (AHP) and linear programming (LP) formulation of selecting Six Sigma projects. In this formulation, select the best six sigma projects is object. The linear programming are as following

max= .210*100*x1+.214*120*x2+.203*65*x3+.197*105*x4+.176*85*x5 (1)
70*x1+80*x2+40*x3+75*x4+60*x5<=200 (2)
3*x1+4*x2+2*x3+3*x4+3*x5<=9 (3)
.05*x1+.08*x2+.03*x3+.02*x4+.04*x5<=.12 (4)
x1 is 0 or 1 (5)
x2 is 0 or 1 (6)
x3 is 0 or 1 (7)
x4 is 0 or 1 (8)
x5 is 0 or 1 (9)
x2<=x1 (10)
x1+x5<=1 (11)
x2+x3>=1 (12)

The final result of selected project is shown in Table 2. As show in table 2 project 1, 3 and 4 selected.

Table 2: Final selected projects.

Project	1	2	3	4	5
Select	Yes	No	Yes	Yes	No

Conclusion:

Six Sigma is a process improvement method used to increase business profitability and achieve operational excellence through effective application of statistical tools. As Six Sigma is a project driven method, it is necessary to prioritize projects, which provide maximum benefits to the organization and satisfy customers' needs. Identifying and selecting the right project within the Six Sigma initiative still remains a challenge and many businesses still continue to struggle. Poor project selection continues to happen surprisingly often even in the best-managed and best-performing organizations and this can undermine the success and credibility of the Six Sigma program. However, the project selection process is complex multiple criteria decision-making problem, which includes both qualitative and quantitative criteria. The objective of project selection is to target the best projects to fit the organizational specific needs, and the goals of the Six Sigma effort. The proposed MCDM model by integrating GAHP and LP developed in this paper can be used as a basis for implementing Six Sigma project selection. The main contribution of this paper is that we propose a novel approach by using the GAHP and LP in selecting the Six Sigma project. The use of the proposed model can help company facilitating the decision-making and using a systematic approach to select the appropriate projects. The proposed methodology was successfully applied in solving the project selection problem in Azer Tecno Company and the final results was good and most off team member goals was satisfied.

ACKNOWLEDGMENTS

The authors would like to thank the Islamic Azad University, Salmas Branch,Salmas Iran for financially supporting this research.

REFERENCES

Antony, J., 2004. "Six sigma in the UK service organisations: results from a pilot survey", Managerial Auditing Journal, 19(8): 1006-12.

Antony, J. and C. Fergusson, 2004. "Six Sigma in the software industry: results from a pilot study", Managerial Auditing Journal, 19(8): 1025-32.

Brice, Z., 2002. "The importance of project selection: why Six Sigma project falters, how to assure success and sustainability", White Paper, Six Sigma Qualtec, Princeton, N.J, available at: www.ssqi.com/breakthroughs/whitepaper-pdfs/Project_selection_WP.pdf (accessed October 26, 2009).

Chaki, A., 2004. Three Steps to Successful Six Sigma Project Selections, available at: www.isixs igma.com/library/content/c041213a.asp? (accessed October 29, 2009).

Cohen, S.G. and D.E. Bailey, 1997. What makes teams work: Group effectiveness research from the shop floor to the executive suite. Journal of Management, 23(3): 239-290.

Coronado, R.B. and J. Antony, 2002. Critical success factors for the successful implementation of six sigma projects in organizations, The TQM Magazine, 14(2): 92-99.

Davies-Catalani, W. and C. Vieth, 2000. Guidelines for Six Sigma Healthcare Project Selection, available at: http://healthcare.isixsigma.com/library/content/c040218a.asp (accessed October 25, 2009).

Deming, W.E., 1986. Out of the crisis (2nd ed.). Cambridge, MA: MIT Press. Eckes, G. (2006). Six Sigma execution. New York: McGraw-Hill.

Dusharme, D., 2003. “Six sigma survey: big success ... what about other 98 percent?”, Quality Digest, February.

Hahn, G.J., W.J. Hill, R.W. Hoerl and S.A. Zinkgraf, 1999. “The impact of six sigma improvement – a glimpse into the future of statistics”, The American Statistician, 53(3): 208-15.

Harry, M. and R. Schroeder, 2000. Six Sigma: The Breakthrough Management Strategy Revolutionizing the World’s Top Companies, Currency/Doubleday, New York, NY.

Harry, M.J., 1998. “Six sigma: a breakthrough strategy for profitability”, Quality Progress, 31(5): 60-4.

Hendricks, C.A. and R.L. Kelbaugh, 1998. “Implementing six sigma at GE”, The Journal of Quality and Participation, 21(4): 43-8.

Hunt, J.W., 1992. Groups in organizations. In Managing people at work. New York: McGraw-Hill.

Ingle, S. and W. Roe, 2001. Six sigma black belt implementation. TQ M Magazine, 13(4): 273-80.

Jackenthal, E., 2004. Six Sigma Project Selection: Don’t Follow – “Ready, Fire, Aim!”, available at: www.staffing.org/articles/edjackenthal_arco0007ej.asp (accessed October 27, 2009)...

Krupar, J., 2003. “Yes six sigma can work for financial institutions”, ABA Banking Journal, 95(9): 93-4.

Lanyon, S., 2003. “At Raytheon six sigma works, too, to improve HR management processes”, Journal of Organizational Excellence, 22(4): 29-42.

Meredith, J. and S. Mantel, 2003. Project Management: A Managerial Approach. New York. Wiley.

Moorman, D.W., 2005. “On the quest for six sigma”, The American Journal of Surgery, 189: 253-8.

Noble, A., 2004. “Selecting the right projects first time”, Six Sigma Today, February/March, pp: 42-3.

Pande, P.S., R.P. Neuman and R.R. Cavanagh, 2000. The Six Sigma Way, McGraw-Hill,New York, NY.

Pyzdek, T. (2003), The Six Sigma Handbook, McGraw-Hill, New York, NY.

Robinson, B., 2005. “Build a management system based on six sigma”, ASQ Six Sigma Forum Magazine, 5(1): 28-34.

Snee, R.D., 2001. “Dealing with the Achilles heel of Six Sigma initiatives”, Quality Progress, 34(3): 66-72.

Snee, R.D. and W.F. Jr. Rodebaugh, 2002. “The project selection process”, Quality Progress, 35(9): 78-80.