Enhancement of Indian Software Quality Management Using Multi Criteria Objects and Six Sigma Methodology

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Abstract: The objective of this article is to classify the software serious success factors of six sigma execution, as well as the lean six sigma tools methods that it uses in all the phases of the DMAIC structured methodology.A literature survey of six sigma software serious success factor has been realized and also an attempt to connect them with the enablers of Indian software quality management. A literature survey of the lean six sigma tools and methods used to follows and a classify them according to the phase of the DMAIC.This article has to collect a list of 6 software serious factors which were classified according to the five Indian software quality management enablers and the IMF,EMF,ESF,ISF differentiation. A list of various methods utilized in the different phases of sixsigma and the ISO suggestions has also been referred.Finally the classification of software serious success factors and methods of six sigma technology could be a valuable lean six sigma tools for academics and professionals to understand and execute the methodology in the appropriate way.

Keywords:*six sigma, serious success factors, Indian software quality management.*

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Introduction

Software serious success factors (Reorganization)

In order to develop software serious success factors emergent theory. We followed asoftware qualitative and quantitative research approach by using concepts from grounded theory (GT). The use of GT is especially beneficial where there is a limited amount of literature to draw from and/or the subject of study is often greatly influenced by organizational aspects and social interaction. The later assertion is confirmed by both the results of respective software serious success factors studies in English speaking countries as well as our own results presented here. We follow the approach from straws where literature plays a key role in sensitizing the researcher before developing a theory in GT.

CS1-→ Software top management involvement(Delivery Manger)

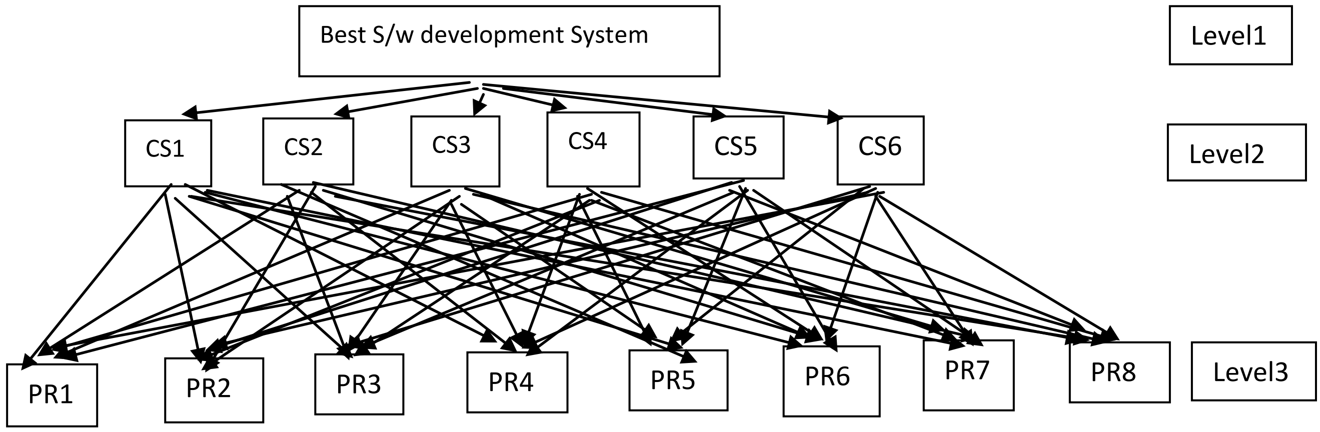
CS2→ Staff Knowledge, tool skills and team skills.

CS3→ Time bound followed.

CS4→ Software analysis and requirement (Quality , efficiency, Installation, volatility).

CS5→ Software development environment adequacy.

CS6→ Software logical complexity.



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The above diagram represents the hierarchical structure. 1st level corresponds to the objective of the best software system 2nd level corresponds to the s/w critical factors (s/w criteria) c1 to c6 and 3 level corresponds to the s/w projects or s/w development system p1 to p8.

Priority for each of the six software critical factors at the level 2 with respect to the overall target or goal of selecting the best s/w system(1st level) are represented in table1. This requires fifteen (15) pair wise comparison depends on the scale. This is based on the size of the pair wise comparison matrix n*n(i.e n(n-1)/2 where n=6). Among 36 elements/represents (6*6 matrix). The primary diagonal six elements value as 1. Among the other available 30 elements the value of the 15 elements is simply reciprocal of the other 15, based on reciprocal theorem similarly, preferences of 8 software systems at the 3rd level with respect to each s/w criteria at the 2nd level require 28 pair wise comparison. This is based on the size of the pair wise comparison matrix n*n i.en(n-1)/2 where among 64 elements/represents (8*8 matrix) 8 primary diagonal elements values 1. Among the other available 56 elements the value of the 28 elements is simply reciprocal of the other 28(table 2 to table 6). More information on AHP is (page 25 and 26) nine-point scale of the relative importance.

This will solve by following three steps.

Step(1): Solving pair wise comparison matrix of s/w criteria in table1 for consistency ratio and weights of criteria.

Step(2): Solving pair wise comparison matrix of s/w system for each criterion.[(Table 2 to table 6 for consistency ratio (CR) and weights of s/w system for each s/w criteria)]

Step (3): Overall / global utility of s/w systems

Table 1 S/w criteria pair wise comparison matrix.

S/w Criteria	CS1	CS2	CS3	CS4	CS5	CS6
CS1	1.00	3.00	2.00	0.50	0.50	0.33
CS2	0.33	1.00	3.00	0.50	0.33	0.33
CS3	0.50	0.33	1.00	0.33	0.33	0.20
CS4	2.00	2.00	3.00	1.00	1.00	0.50
CS5	2.00	3.00	3.00	1.00	1.00	0.50
CS6	3.00	3.00	5.00	2.00	2.00	1.00

The primary diagonals are having value of 1 as the comparison is for the same criteria consistency under CI= $(\lambda_{max} - n)/n-1=6.243-6/6-1= 0.243/5= 0.049$

Random Indian RI for matrix size 6 =1.24, Consistency ratio (CR) = CI/RI =0.049/1.24=0.04

Table 2: S/w top management impact on s/w system

S/w Projects	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PR8
PR1	1	0.333	2	1	0.333	1	0.11	0.25
PR2	3	1	2	1	0.166	2	0.111	0.166
PR3	0.5	0.5	1	1	0.2	0.5	0.111	0.166
PR4	1	1	1	1	0.25	1	0.25	0.166
PR5	3	6	5	4	1	3	0.111	1
PR6	1	0.5	2	1	0.333	1	0.111	0.333
PR7	9	9	9	4	9	9	1	2
PR8	4	6	6	6	1	3	0.5	1

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Nine –points scale for relative importance

Stage of Scale	Definition	Characteristics
1(1,2,3)	Equally Importance	Two activities contribute equally.
3(2,3,4)	Moderately Importance of one after another	Experience and judgment moderately favor one activity over another
5(4,5,5)	Strongly Importance or most essentials	Experience and judgment strongly favor one activity over another
7(5,6,7)	Very strong Importance	An activity is strongly favored and its dominance demonstrated in practice.
9(7,8,9)	Extremely Importance	The witness favoring one activity over another is of the highest possible order of affirmation

2,4,6,8 Intermediate values b/w the adjacent judgments

Reciprocals when compared with activity 1. Thus, the lowest limit in the scale is 1/9 being reciprocal of 9 of activity 1 has one of the above numbers assigned to it when compared with activity 2, then activity 2 has its reciprocal value of ½

Pair method is employed to solve s/w product λ_{max}=8.674 corresponding eigenvector=[0.0913,0.1225,0.0659,0.1018, 0.3355,0.0977,1.000,0.4224]

CI =0.096, RI=1.395, CR=0.06904<0.1(judgments and satisfactory); Weights of software system (normalized eigenvector) with reference to environmental impact are [0.0408, 0.0547, 0.0295, 0.0455, 0.1500, 0.0437, 0.4470, 0.1888]

Table 3: Impact of staff knowledge(team skill, tool skills)on s/w system (s/w productivity)

Projects	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PR8
PR1	1	0.5	2	1	0.5	2	0.166	0.5
PR2	2	1	2	3	0.5	2	0.333	0.166
PR3	0.5	0.5	1	0.5	0.25	1	0.166	0.333
PR4	1	0.333	2	1	0.333	3	0.333	0.5
PR5	2	2	4	3	1	3	0.50	2
PR6	0.5	0.5	1	0.333	0.333	1	0.166	0.333
PR7	6	3	6	3	2	6	1	3
PR8	2	6	3	2	0.5	3	0.333	1

Applied power method for s/w productivity λ_{max}=8.570 and corresponding eigenvector=[0.237,0.3923,0.1365,0.2496, 0.5835,0.1374,1.000,0.5706]; CI=0.081, RI=1.395, CR=0.05834<0.1 judgment are satisfactory)

Weights of s/w systems(normalized eigenvector) with reference to skills of software developers are [0.0696,0.1002,0.0425,0.0751,0.01815,0.0427,0.3110,0.1774]

Table4 Impact of time bound for s/w system

Projects	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PR8
PR1	1	0.333	2	0.333	0.2	2	0.143	0.166
PR2	3	1	3	2	0.5	2	0.166	0.2
PR3	0.5	0.333	1	1	0.5	1	0.111	0.111
PR4	3	0.5	1	1	0.2	2	0.166	0.111
PR5	5	2	2	5	1	2	0.111	0.333
PR6	0.5	0.5	1	0.5	0.5	1	0.166	0.143
PR7	7	6	9	6	9	6	1	0.333
PR8	6	5	9	9	3	7	3	1

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Solving by power method yields λ_{max}=8.68 & corresponding eigenvector=[0.1058,0.1951,0.0895,0.1292,0.3009,0.0951,0.9045,1.000]; CI=0.124; RI=1.395, CR=0.08889<0.1 (Judgements are satisfactory).

Weights of s/w systems (normalizes eigenvector)

With reference to participation of developers are [0.0375,0.0692,0.0317,0.0458,0.1067,0.0337,0.3208,0.3546]

Table 5: Impact of analysis and requirements on s/w system

Projects	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PR8
PR1	1	2	1	1	0.125	1	0.333	0.25
PR2	0.5	1	1	1	0.125	2	0.166	0.2
PR3	1	1	1	1	0.2	2	0.125	0.166
PR4	1	1	1	1	0.333	1	0.166	0.166
PR5	8	8	5	3	1	3	0.333	0.333
PR6	1	0.5	0.5	1	0.333	1	0.166	0.5
PR7	3	6	8	6	3	6	1	3
PR8	4	5	6	6	3	2	0.333	1

Solving by power method yields λmax=8.768 and corresponding eigenvector=[0.1607,0.1302,0.1370,0.1338,0.5671,0.1443,1.000,0.6758]; CI=0.110; RI=1.395; CR=0.07864<0.1(Judgements are satisfactory)

weights of s/w systems (normalized eigenvector) with reference to analysis and requirements impact are[0.0545,0.0442,0.0464,0.0454,0.1923,0.0489,0.3391,0.2292]

Table 6: Software development environment requirements for s/w productivity

Projects	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PR8
PR1	1	1	3	1	1	2	0.333	0.5
PR2	1	1	1	1	0.166	2	0.333	0.5
PR3	0.333	1	1	0.5	0.25	1	0.2	0.333
PR4	1	1	2	1	0.1666	2	0.166	0.333
PR5	1	6	4	6	1	2	0.5	1
PR6	0.5	0.5	1	0.5	0.5	1	0.143	0.166
PR7	3	3	5	6	2	7	1	2
PR8	2	2	3	3	1	6	0.5	1

Average random Indian for each size of matrix

Matrix of size (n)	1	2	3	4	5	6	7	8	9
Average random Indian(RI)	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

Conclusion

In this paper we classified the software serious success factors of sixsigma implementation as well as the tools and techniques utilizes in all the phases of DMAIC Structured methodology and this paper collects a lists of six software serious factors which were classified according to the software quality management. A list of different methods used in the several phases of six sigma and ISO suggestions are also used. A final classifications of software critical factors of six sigma methodology could be available tool for six sigma academics and professional to understand and executed the methodology in the suitable way.

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