An Analytical Approach to Improve the Effectiveness and to Assess Current Technological Trends & Challenges of Knowledge Management System

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***Abstract*—Today organisations consider Knowledge as an asset. Cambridge Business English Dictionary defines knowledge asset as "information or skills within a business that make it more valuable or competitive." With growing competition and emergence of disruptive technologies, time to market and delivering prompt defect free services to customers are key business drivers. Having a ready-made knowledge repository helps service providers in achieving this.**

This paper presents a case study that resulted in higher productivity gains due to improved usage of Knowledge Management System (KMS). The paper also presents a detailed analysis of current state of KMS availability and its usage in various industries; technology on which KMSs are based and the factors that discourage a user to use the KMS.

Keywords— six sigma; DMAIC; Knowledge Base, Knowledge Management System, KMS, Knowledge Reusability

I. INTRODUCTION

As John Naisbitt has rightly quoted – "We are drowning in information but starved for knowledge." With abundance of information, deriving right knowledge at the right time for the right user is need of the hour. Today 2.7 Zetabytes of structured and unstructured data exist in the digital universe [1]. Every day many more trillions of data are generated. Availability of data is not the challenge that today's organizations face, instead deriving useful insights is what bothers them. Unless data are used as knowledge and helping them in decision making, they are mere numbers or characters [2]. Thus, knowledge is considered as an asset to the organization. [3]

In a Service Organisation, where the job of the service team is to ensure service uptime by troubleshooting and resolving issues faced by users promptly, a knowledge repository of past problems and their resolutions helps. A Knowledge Management System is an automated system that stores, retrieves and supports knowledge reuse for decision making and/or resolving queries or recurring problems [4].

Importance of knowledge management has not only been acknowledged in private or government industries, but education sector and academicians also acknowledge the power of knowledge [5]. Effective utilization of knowledge helps organisation in handling the challenges faced due to attrition, retirement, which adversely impact performance, productivity, quality, customer satisfaction [3][4][6].

II. STRUCTURE OF THE PAPER

This paper first presents a case study of an IT Service Organisation, which is facing the issue of non-optimal usage of Knowledge Management System. After multiple failed attempts to improve KMS utilization, the organisation decides to use Six Sigma DMAIC methodology for sustainable process improvement [7].

Secondly, based on the experience gathered during the execution of this case study, the paper attempts to assess if the problem of ineffective usage of KMS is limited to one organisation or the problem has wider impact [8]. The study considers five research objectives and collects primary data through questionnaire based survey to assess the availability, current usage, challenges and technology used in organisations for KMS. The later part of the paper presents the details and outcome of this survey.

III. ABOUT SIX SIGMA

Six Sigma, conceptualized at Motorola, is a proven process improvement methodology that while helping you improve the process ensures that the improvement is sustained over time. This methodology consists of five phases DMAIC, where D is Define, M is Measure, A is Analyse, I is Improve and C is Control [9]. Each of the phases in DMAIC makes use of some prescribed best practices / tools to achieve desired results. Each phase has a toll gate review that marks the end of the phase and entry to the next phase. Fig. 1 below shows the key activities carried out in each of the phases.

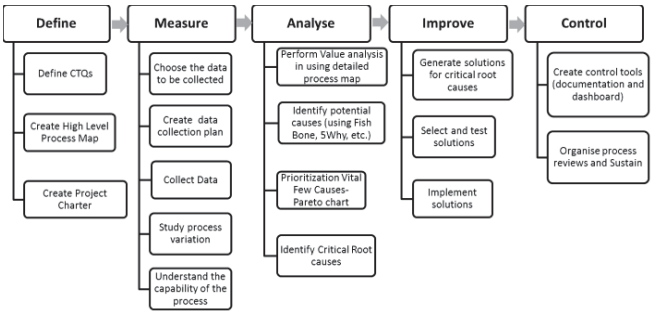

Fig. 1: DMAIC - Five Phases of Six Sigma

The following sections of the paper present application of this methodology to improve the usage of KB.

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IV. DEFINE PHASE

The Define phase focuses on identification of the problem, firming up the **C**ritical **t**o **Q**uality or CTQ, understanding the viability, performing the cost benefit analysis of the project. This also involves preparation of a SIPOC, which is **S**upplier-**I**nput-**P**rocess-**O**utput-**C**ustomer. The aim of creating SIPOC is to get a high level or bird's eye view of the process.

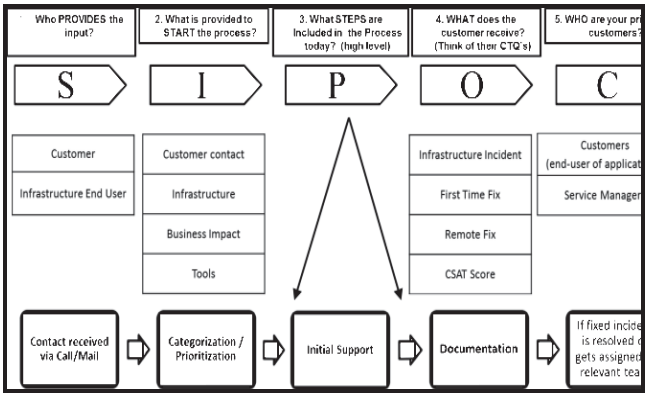

Fig. 2: SIPOC

The performance measure or Critical to Quality (CTQ) for this project is %Knowledge Management Database Hits or %KMDB Hits. This is defined as

$$\%\ KMDB\ hits = \frac{Number\ of\ KB\ articles\ used}{Total\ incidents\ closed * 100} \quad - (1)$$

After identification of CTQ, the improvement goal is agreed and a Project Charter is prepared. The Project Charter is the Project Plan that in addition to Business Case, Problem and Goal Statements, Stakeholders, Expected Benefits, also has planned milestones. The Project Charter is approved from management during the Define Phase toll gate.

V. MEASURE PHASE

Every call is counted to have at least one opportunity of usage of KB. Thus it is decided that non usage of KB to resolve the call will be considered as a defect. To understand the current situation of the problem, the needed measures and metrics are identified and a Data Collection Plan is prepared. This plan details what metrics/measures need to be collected, who will collect them, when will they be collected, what will be the sampling strategy, amongst the few other parameters.

Based on the data collection plan, the data is collected and using (1) %KMDB Hits are calculated and baselined at 17.8%. It is important for every endeavor to justify the cost vs benefits. Thus, along with the CTQ Data, the data for Average Handling Time (AHT) for calls is also captured and baselined at 0:06:45 minutes. This is essential as the effectiveness of KB usage will have direct impact on AHT.

VI. ANALYSE PHASE

In the Analyse phase, a detailed root cause analysis is done to identify the factors resulting in low usage of KB. The technique used here is Ishikawa diagram supported by Structured Brainstorming. Once the causes are identified, related data is collected and by applying Pareto 80:20 principal vital few are identified.

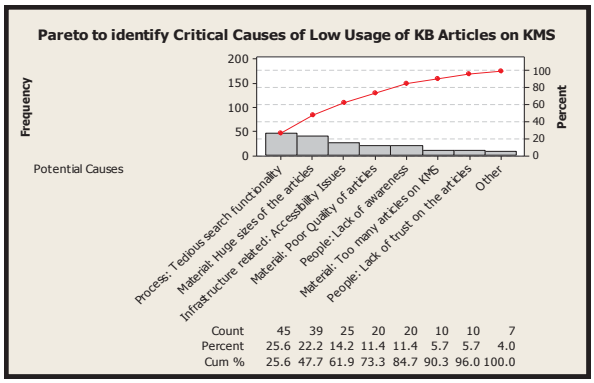

Fig. 3: Applying Pareto to identify Critical Causes

As the next step to derive the root cause, for each of the vital few causes, 5 Why tool is used, refer Table 1.

Table 1: 5 WHY Analysis to identify potential causes

	Why 1	Why 2	Why 3	Why 4	Why 5
Low %KMDB Hits	People: Lack of awareness	Lack of re-enforcement of the process Lack of understanding of benefits of KB Assumption that this will take more time	Regular feedback not provided to the analysts on usage of articles Lack of training Difficult to search the relevant document	No Monitoring mechanism Not planned as routine refreshers trainings	No KRAs / objective set around usage of KB
	Infrastructure related - Accessibility Issues	KB Articles and Customer Provided tool to handle incidents are hosted on different platforms	KMS containing KB was hosted on internal tool		
	Process - Tedious search functionality	KMDB was a web based tool, multiple documents were to be opened and searched	Advanced search functionality not available		
	Material - Huge sizes of the articles	Not to the point articles	Lot of non-relevant information	The approach was to cover the entire topic not issue resolution	
	Material Poor Quality of articles	No review by Subject Matter Expert / No cleansing of the	Unavailability of standard process to upload the articles		

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Lo	Why 1	Why 2	Why 3	Why 4	Why 5
		document before uploading			

A Detailed Process Map is also created to analyse the current process of resolving the incident and usage of Knowledge Base articles for the same. This gives more insight into the process and helps to identify the process gaps.

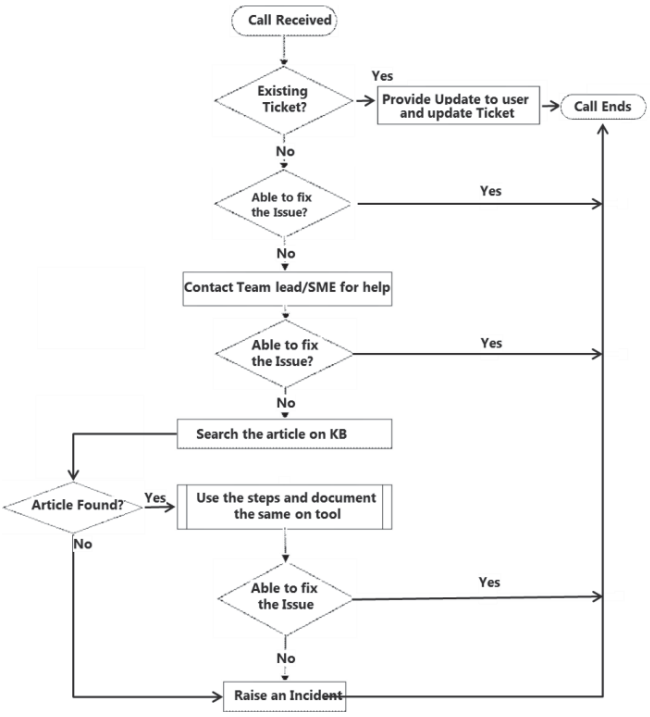

Fig. 4: Sample Detailed Process Map

VII. IMPROVE PHASE

In the Improve phase, the solution for the root causes, identified in the Analyse Phase, is derived. Team identified various potential solutions for the root causes, a hybrid model using Pugh Matrix and Weighted Averages was used for objective decision making. Few key actions implemented are:

- Customization of call logging tool to work as KMS and host the KB
- Creation of to the point and concise documents, by using searchable keywords
- Standardization of processes to upload / modify / archive / audit the knowledge articles
- Conducting awareness training on usage of KB
- Regular monitoring to Institutionalise the usage

These actions are implemented that led to improved KB usage; using (1) it is observed that %KMDB Hits increased from 17% to 62%. A stage wise control chart is used to see the improvement trend on KB Usage.

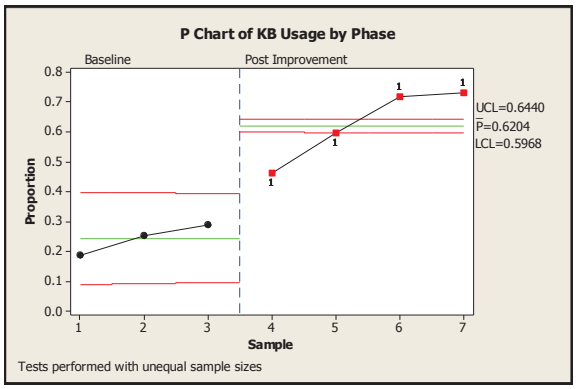

Fig. 5: p Chart to Compare Pre & Post Improvement

Additionally to validate the outcome statistically, hypothesis testing using 2 p test is done at 95% confidence level. The two samples considered are baselined data during Measue phase and post improvement data. The following hypothesis statements are tested.

(Ho): There is no change in KB usage before and after the improvement
(Ha): There is a significant change (increase) in KMDB usage.

Alternatively it can also be stated as

Ho: Proportion of KB usage before improvement = Proportion of KB usage after improvement

Ha: Proportion of KB usage before improvement < *Proportion of KB usage after improvement*

The P-Value of the test is 0.000. Thus at 5% level significance, we conclude that there are insufficient evidences to accept Ho. Thus a significant change in the before and after usage of KB is proved statistically.

VIII. CONTROL PHASE

The Control phase is initiated after the successful implementation of improvement actions and validation of improvement. The focus is to ensure identification and implementation of controls needed to sustain KB usage. An FMEA (Failure Mode Effect Analysis) is created to preempt the failure modes and make the new system fool proof. A Control Plan is also created; the snapshot of same is available in Table below.

Table 2: Control Plan

Month		Month 1		Month 2		Month 3	
Action	Responsibility	Closure Date	Status	Closure Date	Status	Closure Date	Status
Weekly KB Usage report to be shared with team	Level 1 Team Leader						
Training and awareness sessions	Level 1 Team Leader						

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Month		Month 1		Month 2		Month 3	
Action	Responsibility	Closure Date	Status	Closure Date	Status	Closure Date	Status
for new joiners							
Monthly Feedback	Level 1 Team Leader						
SPC	Level 1 Team Leader						

IX. CURRENT TRENDS OF KNOWLEDGE REUSE

After the successful conclusion of Six Sigma case to assess if this problem of non-optimized usage of KMS is limited to one organisation, a survey is conducted. Various subject matter experts from different industries are consulted and the following research objectives are identified.

- Objective 1: To identify the availability of KMS
- Objective 2: To identify the frequency of usage of KMS
- Objective 3: To identify the factors hindering the usage of KMS
- Objective 4: To identify the current technological trends for KMS
- Objective 5: To understand the process of updating and maintaining knowledge on the KMS

The following table details the survey methodology.

Table 3: Research / Survey Methodology

RESEARCH / SURVEY METHODOLOGY	
Type of research	Exploratory and Descriptive Research
Design of Survey Questionnaire	Close ended
Sampling	Non Probabilistic
Data collection	Primary data collection
Data Collection Tool	Google form
Data Analysis Techniques	Descriptive
Graphical Tool used	Pie Chart

The mapping of research objectives with the survey questions is depicted in the following table.

Table 4: Research Objective and Survey Questions Mapping

Objective	Question
Objective 1: To identify the availability of KMS	Question 1: Does your organization/project/service have a Knowledge Management System?
	Question 2: The Knowledge Management System is defined at what level?
Objective 2: To identify the frequency of usage of KMS	Question 3: How frequently do you refer to the Knowledge Management System to reuse the information?
Objective 3: To identify the factor hindering the usage of KMS	Question 4: In your view what are the factors that stop you / your colleagues to refer to the Knowledge Management System?
Objective 4: To identify the current technological trends for KMS	Question 5: Which technology your KMS uses?
Objective 5: To. understand the process of updating and maintaining knowledge on the KMS	Question 6: How do you contribute to KMS? (uploading / sharing any knowledge article)

X. DATA ANALYSIS

Based on five objectives, researchers used Descriptive analysis (Pie Chart) and the inferences drawn from the data and pie chart are mentioned below.

A. *Profile of Respondents*

Average professional experience of respondents is 12.67 years, with a minimum of 7 years and maximum of 20 years.

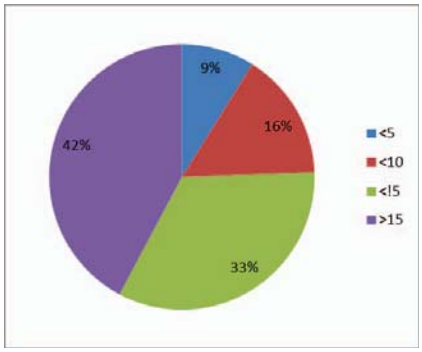

Fig. 6: Pie Chart for Respondents' Profile: Experience

B. *Availability of KMS*

Only 2% of the respondents confirmed that their organisations do not have a Knowledge Management System. However, 98% of respondents said the availability of KMS. This infers that the organisations acknowledge the importance of having a Knowledge Management System.

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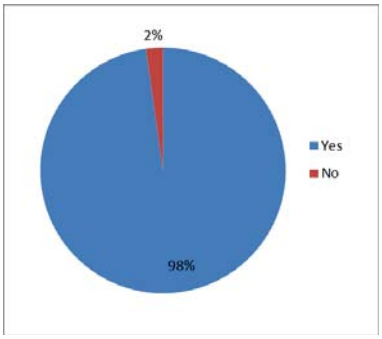

Fig. 7: Pie Chart for KMS Availability in Organisations

- 60% of the respondents having KMS say that the KMS is established at Organization Level. This further strengthens that organisations not only acknowledge the importance of KMS, but also they define KMS at organisation level and consider this as a key infrastructure component.
- 31% of the respondents having KMS say that the KMS is established at Individual Project/ Service Level
- 9% respondents are not aware
- 0% respondents say that the KMS is established together with client.

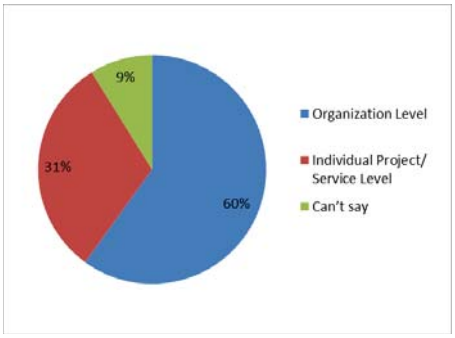

Fig. 8: Pie Chart for Level of KMS

C. *Frequency of usage of KMS:*

- 31% of the respondents say that they refer to KMS every time they resolve a problem/issue.
- 60% of the respondents say that they refer to KMS when they are unable to resolve an issue after investigation
- 9% of the respondents say that they NEVER refer to the KMS.

The above statistics help us to infer that 91% of respondents use KMS and reuse the knowledge. This strengthens the belief regarding the usability of KMS.

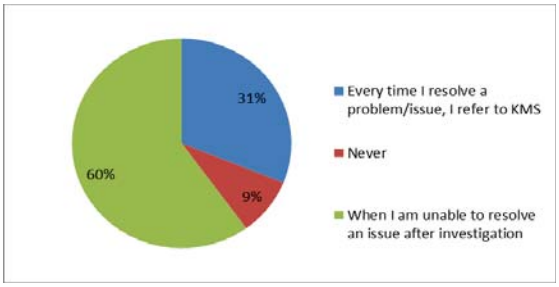

Fig. 9: Pie Chart for KMS Usage in Organisations

D. *Process of updating the Knowledge on KMS*

- 13% respondents say that only Subject Matter Expert can upload the KMS with new knowledge.
- 60% say that everyone can contribute, however SME reviews and uploads the article.
- 18% respondents say that anyone can upload the knowledge article on KMS.
- 9% respondents are not aware about the process.

This helps us to infer that 73% of cases have a standardized process to upload the knowledge on the KMS. This suggests the maturity of knowledge management process.

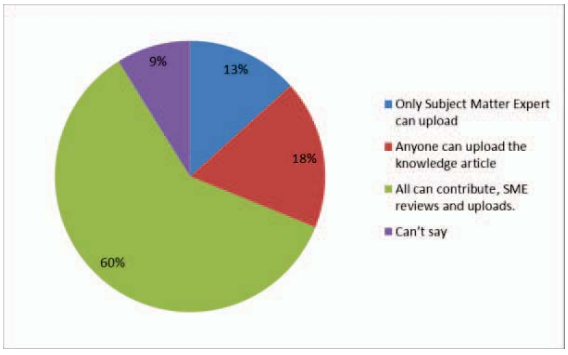

Fig. 10: Pie Chart for KMS Updates Process

E. *Factors hindering the usage of KMS*

In the questionnaire, the respondents are given a list of causes identified from the Analyse phase of Six Sigma project. They are also asked to provide any other cause not listed in the list. The challenges shared by the respondents are presented below.

- 6% of the respondents answered that they do not know how to access KMS and search for required information.
- 18% of the respondents answered that they don't get required information/resolution from the KM.
- 8% of the respondents answered that they were using it but now they don't have need to access it as they now know the solutions to most of the issues/problems.

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- 19% of the respondents answered that searching information on the KMS is time consuming.
- 13% of the respondents answered that as KMS is hosted on a different tool and they need to toggle between applications to use KMS.
- 2% of the respondents marked this as Not Applicable as their organisations do have KMS.
- 20% of the respondents answered that the available artifacts do not contain to the point and concise information
- 13% of the respondents answered that the knowledge posted on KMS is obsolete

The above responses point to the challenges faced by people for non-optimum usage as unavailability of required information, time consuming due to lack of proper search options / indexing, not to the point and concise information, lack of integration of service request management tool and KMS.

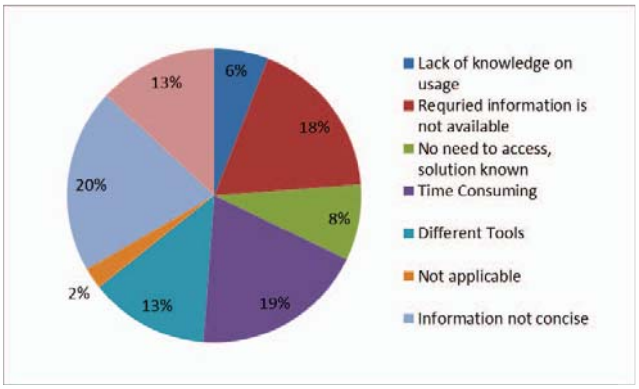

Fig. 11: Pie Chart for causes for non-optimum usage of KMS in Organisations

F. *Usage of Technology*

- Only 3% of respondents say that the KMS uses AI enabled techniques like Machine Learning, Ontologies, Expert Systems, etc. This helps us to infer that though lot of work is going on in making knowledge reusable and deriving insights however, industries have still not fully explored the usage of latest technologies for KMS.

XI. CONCLUSION

This paper presented a case study using Six Sigma DMAIC methodology done in an IT Service organisation to improve usage of Knowledge Management System. This case study presented that improving the usage of KB from 17% to 62% has resulted in improved Call Average Handling Time (AHT) and Call Wait Time by 20% and 50%, respectively. Reduction in Average Handling Time led to equivalent amount of productivity saving and efficiency gain, making service more cost effective and competitive.

The paper also presented a survey to assess the availability of KMS, frequency of usage, process to update the KMS and the usage of technology. The findings suggest that there is a need to improve the quality of knowledge, the process to upload the KMS, search facility to ensure quick response to queries. Additionally, the usage of latest technological tools is very minimal. Automation of KMS using AI enabled techniques can be a solution to these challenges [5] [10] [11] [12] [13].

The outcome of this study can be used by service organisations to improve the KMS effectiveness and by the researchers working on automation of KMS. This study can be enhanced by deriving the correlation between usage of KMS and the productivity gains. Also, the organisations where new technology enabled KMS are used, can be studied further to understand the benefits of technology. The study has highlighted the factors that discourage people from using the KMS. Currently the survey presented these factors for AI based and non-AI based KMS together. However, separate studies and analysis can be performed.

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