Information System for Performance Improvement of Small and Medium Scale Enterprises

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Abstract: Indian small and medium scale enterprises (SMEs) have wide scope to improve the efficiency of operations by incorporating Information Technology (IT) tools. Applications of Information technologies in SMEs are comparatively less due to additional investment and low retention of skilled employees. This work is to develop a software tool for automating the process of documentation and report generation in quality management system. Proposed tool will perform ISO 9001:2008 documentation and generate reports. The generated reports will assist decision making for improving the overall performance of the ISO certified SMEs. The developed tool is implemented in a medium scale enterprise and the performance of quality management is compared. Proposed tool doesn't require huge investment as it was developed using open source software. Majority of the departments witnessed 10% of performance improvement when compared to earlier scenario.

Keywords: Quality management system, Small and medium scale enterprise, IT tool, Open source software, ISO9001:2008

I. INTRODUCTION

In Indian economy, SMEs play a vital role. Total production from the Indian SMEs during 2000-01 was Rs.2, 61,297 crores and it increased to Rs 9, 82,919 crores in the year 2009-10. There was an increase of 194.84% of production within 10 years. Similarly, the total employment has increased to 191.28%, export increased by 198.45% within 10 years (Rakesh in 2013). Sanjay Pal 2013 has emphasised on cluster development programmes to SMEs for productivity improvement, technology upgradation, market development, management efficiency and financial discipline. The growths of SMEs are measured in terms of number of working enterprises, employments opportunities and market value on fixed assets (MSME Annual Report 2014-15). SMEs data and statistics from Ministry of Micro, Small & Medium Enterprises, Government of India for the year 2014-15 and 2015-16 indicates that marketing assistance and technology upgradation in Karnataka state, India benefited 21 and 24 SMEs for the two consecutive years. From the report it is observed that many of the states have not utilised the scheme properly and the quality technology tools awareness programmes conducted were also reduced from 6 to 4.

This scenario indicates that SMEs are underutilising the opportunities provided by the Government. Insight of SMEs reveals that it operates in a lean environment with limited resources and IT assistance (U.Jayalakshmi, 2013). SMEs in India like to reap the benefits of smart technologies without a huge investment.It is further recommended that accessing the latest technologies will favour the economic wellbeing of the nation (Sudha Venkatesh, 2012). Indian SMEs face many problems while competing with other largescale industries, due to lack of modernisation in latest technologies, old and traditional designs (Sangita G Patil, 2014). This work is proposed to improve the performance of the SMEs using IT solutions

Contributions

1.   Implementation of IT tool in SMEs is proposed and implemented. The strengths and weakness of the SMEs is analyzed. The performance comparison is done with existing system.In addition to the introduction system there are four more sections in this article. The rest of the paper is organized as follows. The literature survey about SME and IT tools is presented in section 2. Section 3 describes the proposed methodology. Section 4 comprises of results and discussion. The conclusion is presented in section 5.

II. LITERATURE SURVEY

According to the survey made in 2009, the reduction in IT cost by a cloud provider called Net Magic is 25-30% and Microsoft is 10-50%. (Balaram 2014). The survey conducted by Zinnov Management consulting reported that the total cloud market in India was $ 400 million in 2013. It will reach a market value of $ 4.5 billion by 2015. Most of the SMEs focus on web hosting and remotely managed IT Services (Jayalakshmi 2013). Table 1 shows the SWOT (strengths, weakness, opportunities and threats) analysis conducted by Kimia Ghaffari (2015) states that a gradual progress in SMEs can happen through cost reduction in infrastructures and upgradable software. A thorough knowledge about the information and system security is required to safeguard the data. South African SMEs faced challenges interms of marketing factors, economic conditions, management skills and shortage of investment in Information and Communication technology (ICT). The evolution of ICT which affected their buisness growth and resulted in lower profit (Mpho Mohlameane 2014). Employees are having limited knowledge about cloud computing and the services offered by it. and by conducting seminars. A demonstration on how to use the cloud services will also increase the awareness about cloud among the employees. The SMEs have a fear of security risks such as loosing the confidential data and data privacy. The awareness about the cloud computing can be provided through proof of concepts (POC).

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The effective implementation of cloud solutions in SMEs mainly rely on the clear definition of service requestby the enterprise to the service provider. It may be difficul to integrate the legacy system with the cloud computing because of the old technologies in those systems. Since the cloud data are stored in various geographical locations on different servers. Big data analytics is also desirable in cloud computing for processing huge amount of data (Ahmad Azarnik 2012). cloud data are stored in various geographical locations on different servers. Big data analytics is also desirable in cloud computing for processing huge amount of data (Ahmad Azarnik 2012). Oxford economics survey (2013) mentioned technology and innovation as necessary factors to be considered for the growth of SME and one of the key drivers is considered as bigdata analytics. Main aim of SMEs is to analyze data, predict market expectations and customer satisfaction which are fulfilled by bigdata analytics. It results in correct implementation, anticipation, customer response to identify loop holes and make better decisions (DorukSenaet al, 2016).softwares, which are available in the market for implementing bigdata analytics (King &Magoulas, 2014). SMEs should strongly consider information governance which contains set of rules and guidelines of how to handle data in an organization. Bigdata analytics to a SME are flexible where dynamic solutions are indicate that rejection was rate gradually declining from the first to the last week. Aldowaisan & Youssef (2006), indicated that the real business attains gains when the production department assure that total rejection rate shall be reduced.

The quality assurance measure in the supply chain process study was presented. This study extends the five decision areas (Plan, Source, Make, Deliver, and Return) of the SCOR model. The study concluded that each decision area has a positive impact on both customer-facing supply chain quality performance and internal-facing firm level business performance (Li et al 2011).Mjema et al (2005) showed that the introduction of IT on quality management has contributed greatly to the enhancement of quality awareness, in the improvement of product quality and in the reduction of quality costs. A study about three information technology resources electronic data interchange, computer-aided design and manufacturing and enterprise resource planning was presented and quality management capabilities such as product and process management, customer and supplier relations, and quality data and workforce management also discussed (Rodriguez &Lorento 2011).The association between organizational differences and its implementation was discussed (Al-Rawahi& Bashir 2011). An integrated model for performance management (PM) of manufacturing industries was proposed. Brown Gibson model was used for performance measurement and analytic hierarchy process used for performance evaluation involved from time to time. Bigdata solutions are easy to deploy and use, where charges are based on the usage (Ogbuokiri et al 2015). Due to large number of devices connected over internet, collection of large volume of data and processing is increasing day to day, that leads to new challenges in terms of information security (Reena Singh and Ripuranjan Sinha, 2016).

(Parthiban& Goh 2011). An innovative approach was proposed to offer small to medium sized organizations (SMOs) with global business aspirations Gomes &Yasin (2011).Most of the SMEs focus on web hosting and emotely managed IT Services (Jayalakshmi2013). Table 1 shows the SWOT (strengths, weakness, opportunities and threats) analysis conducted by Kimia Ghaffari (2015) states Due to the frequent changes in market conditions, SMEs can happen through cost reduction in infrastructures and upgradable software. A thorough knowledge about the information and system security is required to safeguard the data. South Affrican SMEs faced challenges in terms of marketing factors, economic conditions, management skills and shortage of investment in Information and Communication technology (ICT). The evolution of ICT which affected their buisness growth and resulted in lower profit (Mpho Mohlameane 2014)

III.PROPOSED METHODOLOGY

The significant impact of information technology on the operations of SMEs has transformed them to undergo computerization for dealing large volume of data. The traditional practices for storing and retrieving those data are time consuming and SMEs has an option to make use of the advanced information technology tools for processing data. SMEs may rely on software solutions for documenting, accounting, billing, and project management. EC2, Google, IBM, and Amazon offer cloud services for data storage and retrieval. To justify the benefits of application of software tool for SME, a software application has been developed, implemented and analyzed. The developed application replaced the manual practice for documenting ISO 9001:2008 forms in a medium scale enterprise. All ISO 9001:2008 documents were interlinked for automatic update and report generation. Generated reports assist the management for decision making and help to control the activities of enterprise. The following hypothesis were set and tested (Maheshprabhu et al 2015).

H_{10}:No improvement in enterprise due to software tool support.

H_{1A}: Software solution will improve the productivity of the enterprise.

Software was implemented and used for 24 weeks. Selected 32 orders and recorded data. Total of 794000 units of components were considered for this analysis. Percentage of rejection was fixed as 1.5. Rejection data was used to calculated mean and standard deviation. Data collected fits into normal distribution curve, hence a T test was conducted to predict whether to accept or reject hypothesis. Calculated value was greater than the table value and thus the alternate hypothesis H_{1A} was accepted. It confirms that the software solution for automation improved the productivity. It was possible by reduced rejection rate, overcoming bottle necks, instant alert and reports for decision making. The results were compared with the previous records and indicated in the Table 2. Table 3 highlights that there exists reduction in rejection percentage for the consecutive two years.

Table 1. SWOT analysis for SMEs

Order number	Mean	Std. deviation	Test statistics
1	12.8	3.7	4.9
2	9.9	5.5	0.8
3	13.2	7.6	2.6
4	15.4	7.3	4.2

Strength
- Cost effective
- Flexible and innovative
- Simplified cost and consumptional
- Faster provisioning of systems and applications
- Secured infrastructure
- Compliant facility
- Resilient in disaster recovery
- Maintenance cost protection
- Convenient level of accessibility
- Better control of the resources
- Independence of time and location
- Energy saving, environmental protection
- Friendly utilization and expandability

Opportunities
- Pay for use licenses
- A good chance for SMEs for making progress without upfront investments
- Invent scalable store
- Market place enhancement in terms of functionality, innovation and price
- Adaptive to future needs
- Standardized process, quick solution to the problem, high-tech work environment
- Offering modern information solutions according to the latest technology

Weakness
- Development of applications
- Increased dependency
- High speed internet connection requirement
- Difficulty of integration with local softwares.
- Data transfer bottle necks
- Lack of physical control of data
- Lack of committment to the high quality of service
- Inability of providers to guarantee the location of company information
- Post training is required

Threats
- Security concerns
- Lack of specific standard regulations
- Difficulty from migration
- Hidden cost(backup, problem solving and recovery)
- Compatibility reduction
- Possibility of backlash from entrenched incumbents

5	12.8	1.2	15.8
6	21.3	10.3	5.7
7	20.3	6	9.1
8	14.1	5.1	4.8
9	17.2	5.5	7.1
10	13.8	4.6	5
11	18.7	9.7	4.8
12	19	5.8	8.3

13	13.5	3.3	6.6
14	10.2	16.8	0.3
15	7.9	6.1	0.9
16	5.7	1.1	15
17	6.6	0.7	15.9
18	6.3	0.7	18.4
19	7.2	0.9	10.1
20	8.2	0.7	5.5
21	8.1	0.8	5.5
22	8.1	2	2.1
23	5.5	0.6	29
24	5.7	0.8	20.7
25	6.3	1.4	9.3
26	6.7	0.6	19.8
27	6.6	0.6	19.7
28	6.8	0.8	13.4
29	3.9	0.9	26.8
30	0.9	1	38.9
31	2.3	1.4	22.8
32	2.3	1.1	30.2

Table.2. T - Test calculation for 32 orders

Rejection Percentage															
Before IS	8	10	11	12	5	13	7	7.7	9.3	7	13	9.3	7	3.7	9.3	2.7
After IS	2.7	1.6	2.7	2.7	3.6	3	2.7	2.3	2.7	2.3	2.6	3	3.3	1.3	2	2.3

Rejection Percentage															
Before IS	2.7	2	2.7	3	3	4	1.3	1.7	2.7	2.7	2.7	2.7	1.7	1	2.7
After IS	2	2.3	1.3	2.7	2.3	2	2	1.7	2.7	2	2.3	1.7	2	0	0.7

Table.3. Rejection percentage comparison before and after IS implementation
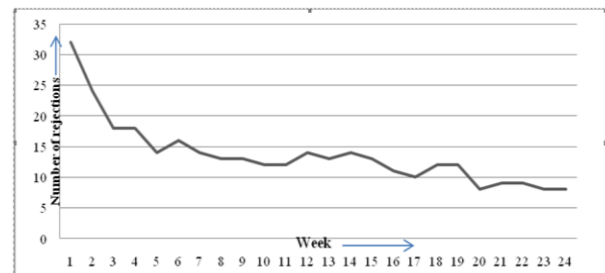

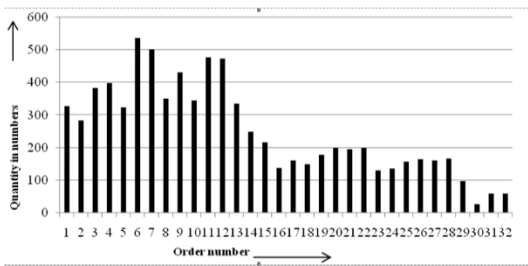**Fig.1.Decrease in rejection quantity for a period of 24 weeks**

Fig.2.Decrease in day - wise rejection quantity

Fig.3. Decrease in order-wise rejection quantity

Table 4 compared the status of 10 departments before and after the implementation of developed software solution to record ISO 9001:2008 data and also shows the improvements in departments.

Department objectives were set for					
Monitoring and reduction of customer complaints					
Monitoring and reduction of product rejection					
Monitoring and improvement of productivity					
Continuous reduction of waste and cost					
Monitoring and improvement of delivery schedule adherence					
Providing effective and need based training					

S. No	Department	Department objectives	Unit	Before	After
1.	Marketing	Enquiry conversion ratio	%	87%	95%
2.	Purchase	Cost reduction	%	5%	10%
3.	HR	Training man hours	Hours/Month	4hours	6hours
		Absenteeism	%	3.5%	3%
4.	Stores	Raw material stock turnover ratio	Nil	7%	3.5%
5.	Maintenance	Machine break down	%	4.2%	2.5%
		Machine preventive maintenance	%	100%	100%
6.	Tool room	Tool development time	Days	30	25
		Turn over for 6 months	Rupees in Lakhs	50	55
		Rework/rejection	%	2.1%	1.0%
7.	Production	Machine utilization	%	86%	90%
		Delivery schedule adherence	%	92%	100%
		Rejection allowance	%	3%	1%
		Cost of poor quality	%	4.5%	2.5%
8.	Quality	Number of customer complaint per month (average)	Numbers	2	0
		Customer rejection per month (average)	PPM	545	100

		Internal rejection per month (average)	PPM	12472	7988
9.	Metrology	Calibration plan vs. actual plan	%	100%	100%
10.	MR	Internal audit plan vs. Actual plan	%	100%	100%

Table .4. Outcome Of the Research

Due to multiple products run in production line, it was essential to track each order by dividing total target into individual day target and it was further sub divided into individual machine target. From the first day production data were entered in the information system. It gets recorded in a common data base and compared for actual target and achieved production. At the end of shift, the efficiency percentage calculated, pictures whether set target was achieved or not? If target was not achieved, then provisions were given to predict the reason with suitable solution. This computerized procedure followed the instruction as per ISO and fetch the hourly input data from the sources and ERP. Hence it is web based; management team can monitor and control the industrial performance, from any point in the world. As a result, implementation of developed information system rejection rate was decreased as shown in the table 5 below

Sl no	Month	Quantity inspected	Quantity rejected	Rejection in percentage
1	April	164778	2163	1.31
2	May	149842	1473	0.98
3	June	130266	1294	0.99
4	July	120124	1203	1.00
5	August	114351	996	0.87
6	September	114639	859	0.74
Total		794000	7988	0.98 (average)

Table.5. Monthly internal rejections

This proves that a software solution governs the ISO documentation process along with improved production efficiency and low rejection rate. ISO is a set of co-ordinated activities to direct and control an organisation in order to continually improve the effectiveness and efficiency of its performance. The results of the study indicated that ISO resulted in the production of quality products and services, rather than detecting defective products or services after they have been produced, which had been observed from the decrease in the rate of rejection.

IV.CONCLUSION

The software system has been implemented in a medium scale enterprise and employees were trained to use the information system. Data of 32 different orders were recorded in information system from the initial stage of order. Cloud storage has been used to store and retrieve the data in the required format. The reports generated have supported the enterprise to reduce rejection rate.

After implementing the software, the rejection rate is reduced by 35%, when compared to manual documentation procedures followed earlier. The objectives set by marketing, purchase, human resource, stores, maintenance, tool room, production, quality departments objectives have been improved achievement by the actions taken using report generated by the information system. Department wise improvements were discussed in outcome of the research. Information system supported the enterprise in achieving the department objectives in a better way when compared to previous practices.

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