THE ECONOMIC BENEFITS OF KNOWLEDGE VALIDATION OF ERP TO LOW TECH SMES

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Abstract:

Knowledge Validation is a challenge in Small to Medium Sized Enterprises (SMEs), as most of the available information is held in people's minds as tacit knowledge, or saved on each employees PC without sharing or common validation. This case study is based on a company in Leicester who installed an enterprise resource planning (ERP) system after two previous failed trials with different type of software. The underlying reasons for the problems were due to the distributed and tacitly held knowledge where the assumptions in one part of the company were inconsistent with other parts. The research goes through three years of ERP implementation and analyses the main problem of validating knowledge in more detail and identifies the consequences of failing to do this. It also describes the potential economic benefits for installing enterprise resource planning system in SMEs and investigates the claim of ERP vendors that their ERP solutions increase the performance of their customers, increase profitability and efficiency of work processes. It discusses the effects of ERP on the company's overall performance, what the benefits are, and where there could be an enhancement to SMEs from the ERP system. The major benefits accrue from the more accurate estimates the system is able to provide and the resulting improvement in quotes. Challenges are discussed and highlighted in the paper, which concludes at the end the importance of Knowledge Validation and identifies benefits of doing it.

Keywords: Knowledge Validation, ERP, SME

INTRODUCTION

Implementation of an ERP system has always been a hassle, where communication between employees and the system is a very complicated process. The difficulties in transferring the tacit and explicit knowledge into the ERP system, the validation of this knowledge and the process of putting all of this together into a knowledge management (KM) system has been a challenge due to the barriers of installing KM in SMEs.

The transitions from paper work and excel sheets to an ERP system has been causing a lot of issues to employees in SMEs and have been causing delays to companies when they start to use ERP. The most important benefit that ERP would bring to the organization is the improvement in internal communications and the increase in efficiency of the information flow. ERP "allows seamless integration of information flows and business process across functional areas within a company" [1], which is an extension of the benefits listed by Bocij [2]. The view was further extended

[3] "As ERP improved on access of information, it will make possible more agile decision making for better negotiating with customers and suppliers".

This research discus a case study, which has adopted an ERP system after two previous trials with different software, it starts by describing the advantages and disadvantages of SMEs in terms of culture, human resources, employees and the acceptance of the system. Describing the Common mistakes SME's do when installing the system, focusing on the knowledge validation process, barriers and what are the steps applied in this case study to overcome them. Followed by the potential economic benefits the system would bring to the case study used in the research. Findings and a summary are drawn at the end.

LITERATURE REVIEW

SMEs

Small to medium enterprises usually have a few numbers of employees between 20-250, and usually in most of the

organisations in UK SMEs are companies that have around 50 employees and this has its advantages where it will be much easier to spread knowledge between employees [4]. This is due to the less formal strategies, which increase communication of knowledge, speed of decision making and improve informality, which improve employee's commitment and their receptiveness of knowledge management changes. This will also increase the ability to react faster to the market changes requirements and knowledge changing to satisfy the market needs [5].

SMEs have fewer layers of management, which means that decision making takes less time but at the same time it means less thinking, less searching and less use of knowledge management strategies. SMEs have a structural advantage over other enterprises [6], as they are less complex, which makes the ability to change much easier than larger organizations, and also increase cross-functional exchange, which makes decision making more efficient, SMEs also tend to have a more flexible culture than other organisations, small numbers of people with same beliefs and values, which makes it easier for smaller organisations to change and spread knowledge management. SMEs usually have a small number of staff [7] which makes training almost impossible and longer as training means stopping daily work activities, and training individuals is very expensive for SMEs and usually cannot afford it. Large enterprises usually have more funds than small enterprises so they can afford a better ERP system, hardware and give employees more training which helps in the implementation phase of the ERP system.

SMEs also have part time IT person who is responsible for IT support along with the ERP installation, implementation, maintenance, training and everything, which can lead to project delays, or sometimes abandoning the system in case of IT person leaving the company as it will be hard to find a replacement [8] which was illustrated at the case study when replacing two different ERP systems with the change of the developer working on them.

However, SMEs also has some disadvantages that make it difficult to use computer based knowledge management systems, Egbu has discussed the disadvantages are the inability to fund long-term and risky knowledge management programmes, weaknesses in technological competencies, which make use of knowledge difficult, as it needs an IT system to spread knowledge easier, faster, and more cost effectively, and a weakness in giving training and education to employees [9].

One more disadvantage that has been identified by [5] is that "SMEs have little management experience", and that applies because usually the manager of an SME is the owner of the organisation, this was also described in a study [10], were their study on 30 different SMEs indicates that more than half of them were managed by owners, founder or closed relative, which makes decision making less formal and less professional.

One of the problems employees at SMEs have is being unable to refer to each other's work, if information was transferred effectively from one employee to another through an organized system, then problems would be solved easier, and learning will be in a better place in the organisation. Most of this work is tacit knowledge; knowledge that has been gained from project experience that needs to be transferred from one employee to another and here is where the conversion techniques need to be used, as this problem is sorted in bigger organization and need to be converted to suit smaller ones, and it's important to investigate the correlation between ERP and the size of the organization.

ERP

Enterprise Resource Planning, or ERP Systems, is a complex process in practice. In theory ERP could solve a lot of problems, by centralising the knowledge into a database [11]. The difficulties in transferring this knowledge between the different departments and actors have shown an interest in how KM may support an ERP system [12]. KM is defined according to the Knowledge Board in 2004 as planned activities and processes for managing knowledge to enhance the competitiveness through better use and creation of individual and collective knowledge resources. KM often relies on the information technology available which relies on capturing employee's knowledge and filtering it according to the job needs.

After this and after gathering all of this tacit and explicit knowledge and transferring it to the database of the system, comes the importance of the knowledge validation process. Without the validation process [13], ERP system loses its credibility with employees and this is one of the things that happened at the case study, where employees no longer believe in the importance of the system. Failure of the knowledge validation process, not understanding what is happening with the system and not contributing in the work usually leads to rejection of the system from employees.

According to other research [14], ERP System must be implemented with care in order to encourage contributors to go for this challenge and provide valuable points to get the desired results from knowledge management system. They have also noted in their hypothesis that contributing in the implementation can enhance employee's perception of knowledge quality and their faith in the system. It was found

[11] that some of the barriers to knowledge validation and knowledge transfer between different work departments are caused by system unreliability and lack of training as well as the information overload, and how this might be solved by following a knowledge management communication process between the implementer and the people involved in the system. The role of knowledge management is very important in a business environment as it increase the interaction and share of knowledge between people which enhances the organization's overall knowledge base. ERP system integrates work between all functional departments from purchasing, employee's management, scheduling, inventory management, production to shipping, and payroll management.

METHODOLOGY

This research at the case study started by undertaking business process analysis then interviews, formal and in formal was done with management, administration employees and with shop floor workers, reviewing official and unofficial documents as well. Interviews were repeated from time to time, and lasted between 10 minutes to an hour with different employees, and all information was gathered studied and a working plan was set in order. This research also went through a study of different ERP systems and why the case study has chosen this product for solving their business problems. Many factors have affected the choosing of the product and one of the main factors was the financial issues along with the requirements of the business. Further study was done about how the processes in the case study are done, the orders, purchases, certification, door making, and how all of these are done manually by employees and how it can be customised into the ERP system.

According to previous research on the same case study, problems that led to the need of an ERP system, barriers to installing and using it have been listed as follow, **Problems:**

- Losses of information, documents are not filed and a lot of paper work flows through the organisation, which makes it easy to mislay or lose.
- Sales enquiries are not tracked, so finding a job needs to be done manually, which takes time.
- Staff retirement or attrition - when employees leave or are off on holiday, it becomes near impossible for employees to take over their work.
- When a customer enquires about a new job pricing and product details are calculated manually, taking long time, especially for big orders.
- Data is entered manually into spread sheets, which increases the risk of incorrect information.

- Accounting problems - if an invoice is lost, long term funding problems occur.

Barriers:
- Unskilled employees make it difficult to implement an ERP system, as they require many hours of training.
- No motivation for employees to use the new system.
- Lack of training due to financial costs and lack of time.
- Lack of process mapping, a map should define every activity at the organisation. It must include a step-by-step process for information flow.

At the case study this system had been installed, three years ago, and until now had not been used properly, employees still use spread sheets to make orders, customer quotes, and even when printing orders, they use a customised template in a word document where everything is written manually.

Work process flow: One of the main processes has been studied by one the researchers which is the Production process of a door, and here is a brief description of how things are being done:

- A customer makes an order by email or by the phone.
- A quote is created by the estimator using spread sheet and sent back to customer.
- The customer is asked to verify that the details are correct.
- If the quote is verified a pricing list is produced using another spread sheet and then sent back to the customer for approval.
- The design and quote are then changed if they are unacceptable.
- If the quote and design are agreed it goes a detailed design is made.
- The design is then sent back to customer to sign off the order.
- Once the signed copy has been received this is then passed on to the floor for production.

This process takes days to complete at the case study, and if the order is a big one, for a new building with different kind of doors, indoors, outdoors, security doors, mobility doors, then this would take longer. When a door is ordered a pricing spread sheet is used to calculate the price of the door. With time the estimator memorised the prices in it, and it has been found that these have not been revised for the last two years and not updated according to the purchasing orders, which led to losing money.

This is one of the main problems which are happening due to manual processes, and the errors occurring because of it is huge. For that the Configurator was proposed, in order to be able to reduce the number of hours this is taking, number of errors as all information will be pulled from a database, plus that every quote will be saved into the system, no need for paper work.

WHAT THE NEWSYSTEM WILL PROVIDE
FOR THISPROBLEM (CONFIGURATOR)

For the past few months a researcher have been working on a Configurator, and there was a lot of challenges in customising it, some of these are related to the barriers mentioned below, which was caused of lack of employees knowledge in IT basic tools, and some others was due to the lack of encouragement of using the ERP system. Employees no longer have faith, and don't believe in the change it would make. One of the mistakes when doing the Configurator was its complexity as it was two pages, with more than 100 boxes to fill and pick, and that was confusing to employees not knowing much about computers, they refused to use it, as it was complicated and not user friendly. So with interviews and tests including employees in the steps, we have eliminated boxes and made it simpler. In the Configurator, which is an aid to design and produce doors, one for an FD30 door, a standard door for 30 minutes fire rating, was changed about 4 times. The first one didn't have all requirements for the door, and the second was too complicated for employees, with showing and hiding fields facilities, and then after sitting with the estimator and discussing things thoroughly it was found that these are the only requirements for the FD30 door unless there was special cases which we will not go through at this stage of the implementation. After showing this to employees at case study it was discussed that going through this might take longer time than required and the best idea if we can set defaults for making this door. Once you open it, you have all defaults for an FD30 door and then you just check and do any changes if required, this will minimise the number of errors and reduce the time required for making any quote. Defaults were all set, and the final Configurator for this door was ready to be used. In this Configurator there were some requirements to choose from first, things like Mobility, Secure by design, Chain of Custody, fire rating and location. Then the structural opening, which will be allocating the height and width, and finishing with the glass and hardware attached to the door. All of these boxes are attached to the database, where all parts used in

Configurators are listed, and connected to purchasing orders to be able to pull prices and to calculate the door price when doing the quote. Another problem was with validating the knowledge in the Configurator. Employees were saving prices differently into their excel sheets, using what they have or memorise which wasn't up to date and prices were very different from what they purchase from suppliers.

For this, researchers started gathering receipts, talking to the employee doing all the purchasing, and trying to verify prices, and do all the mathematical equations to get the right door price, and while going through this process, another problem was found which was with the different names of the parts used in the door making. Employees know different ways of naming the products and were refusing to change to the new names which were required by the ERP system, and which are used when purchasing. Some were saying how hard it is to use this format of names, for that it was crucial to find a way to write them differently were employees can use them on the system. All part names were printed out from the ERP system, and there was around 3000 parts available there, and have decided on one person who would take the time to do this job, remove un used parts which were added two years ago, rename the parts with the help of the researcher and go through the prices, and trying to verify them with the purchasing order. Some were named with the manufacturer first, others with the kind of hardware, some was depending on the height and width of the door. Rules had to be set for the name and how to deal with them in the Configurator. Working on this along with the ERP system provider Company and the researcher, verification of prices have been done and the testing process is in progress.

Hypothesis (1):
Configurator may work, solving all the validation problems in case study and will eliminate errors.

Hypothesis (2):
Configurator may work faster than the excel sheets used in the quotes orders.

Hypothesis (3):
When Configurator works properly this will affect the quality of work positively and make the business flow easier.

SMEs are less disciplined when it comes to process definition and improving practices, this would lead to big number of customizations that will take the entire project budget.

Benefits of ERP and what are the economic benefits found at case study are discussed in the next section.

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BENEFITS OF AN ERP SYSTEM

[2], stated that the benefits an information system brings to the company are often harder to quantify as these benefits are often intangible in nature, like improving customer services, improving management of information, internal and external communication in the company. It will also support core business function and improve product quality. However the quantifiable benefit is the reduction in cost. Operating cost will be reduced [3], which will lead to the increase of return on investment. [15], have also stated the benefits from implementing an ERP would include the elimination of redundant or unnecessary processes to improve resources allocation and system wide standardizations.

Other research, [16], [17] indicated that the adoption of ERP will reduce the number of employees needed for manual processes as the ERP system will help manage these processes automatically, which will reduce the cost for each year following the ERP implementation.

Potential Benefits of implementing ERP system in SMEs

The MD of the company's main concern is the financial status of the company, how much they gain, loses, ROI, etc. For that a study of the financial benefit of ERP to assure the MD was needed in order to prove how the system is more accurate than the manual estimates.

For this reason some comparisons were needed to take place, such as:

The number of hours actually quoted for a door (Job tracker), recording hours to the system through the ERP from the shop floor work, live hours were collected, and the results were gathered after a test phase that lasted for more than a year. It was found that out of 60 jobs tracked, 41 were quoted wrong, underestimating how long it actually takes on the shop floor to be made. Products have been taking more time in manufacturing than the charge to customers.
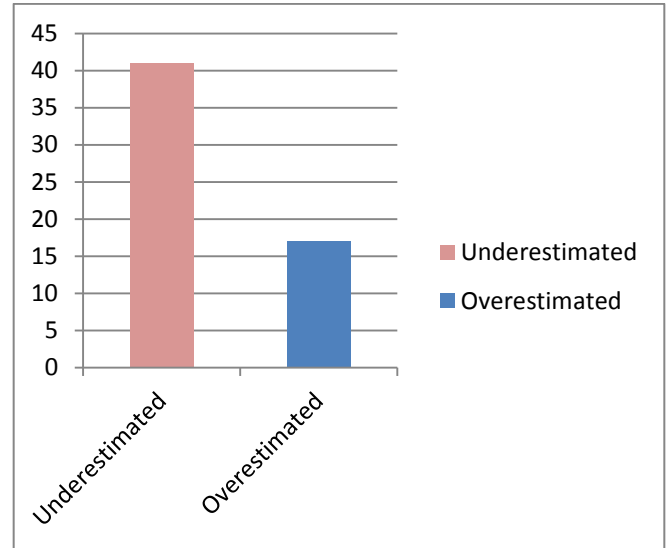

Figure 1: 41 jobs, 70.6% of the tracked jobs were underestimated at the quote stage. 16 or 29, 4% of the jobs were overestimated at the quote stage.

Job Number	Cus tom	Door Type	Quantity	Actual Hours recorded though the ERP system					Estimated Time from Tacit information				Diff Hours	Time / Door
				CNC	Mach Total	Assembly Total	Spraying	Total Hours	Mach Quote inc CNC	A'bly Quote	Spray Quote	Total		
2098-SPIR B		Solar	7.00	13.50	15.00	39.25	17.50	85.25	21.00	42.00	14.00	77.00	-8.25	12.18
2144-SPIR		Timka + si	1.00	0.00	10.50	20.25	2.50	33.25	5.50	11.00	2.00	18.50	-14.75	33.25
2136-MISC		Rosette st	1.00	0.00	11.50	19.00	2.50	33.00	4.67	9.33	2.00	16.00	-17.00	33.00
2141-MISC A		1VP Comb	6.00	10.50	16.00	46.00	13.00	85.50	28.00	56.00	12.00	96.00	10.50	14.25
2175-SBD		3XGGG (x:	4.00	3.00	18.50	22.50	3.00	47.00	18.00	36.00	3.50	57.50	10.50	11.75
2176-SBD		Solid core	7.00	8.50	7.00	2.00	3.00	20.50	32.00	66.00	7.00	105.00	84.50	2.93
2153-MISC		Vairous	4.00	0.00	63.00	96.75	16.50	176.25	27.00	55.00	5.00	87.00	-89.25	44.06
2141-MISC B		S-C 1VP	9.00	12.50	24.50	139.50	17.00	193.50	36.00	74.00	9.00	119.00	-74.50	21.50
2172 MISC		57mm 4XG	1.00	0.00	9.50	24.00	1.50	35.00	5.00	10.00	2.00	17.00	-18.00	35.00
2163 SBD		9 4XG, 1D4	12.00	0.00	37.00	120.50	8.00	165.50	47.00	95.00	16.50	158.50	-7.00	13.79
2174 SPIR		Mock Zara	7.00	0.00	14.50	48.75	13.25	76.50	25.00	57.00	14.00	96.00	19.50	10.93
2188 SBD		FD30 6 par	4.00	1.00	3.00	25.00	2.00	31.00	8.00	12.00	4.00	24.00	-7.00	7.75
2166 MISC		D12RF 12 p	1.00	0.00	4.00	23.00	3.00	30.00	7.00	14.00	4.00	25.00	-5.00	30.00
2157 MISC		Flat entrar	47.00	14.50	22.00	174.50	4.00	215.00	117.50	164.50	47.00	329.00	114.00	4.57
2170 MISC		2XGG	3.00	0.00	8.50	10.00	3.50	22.00	5.00	10.00	4.00	19.00	-3.00	7.33
2169 MISC		2XGG	2.00	0.00	3.50	21.25	3.50	28.25	11.00	27.00	4.00	42.00	13.75	14.13
2164 SBD		3XG-H Arc	1.00	0.00	4.75	12.25	1.50	18.50	3.00	8.00	2.00	13.00	-5.50	18.50
2146 SBD		FD30 5VP	5.00	2.00	3.00	17.00	2.00	24.00	7.50	15.00	2.50	25.00	1.00	4.80
2120 SDB		FD30 5VPC	3.00	1.00	5.50	15.25	0.75	22.50	5.00	10.00	1.50	16.50	-6.00	7.50
2177 SPIR		Dina + Slav	1.00	0.00	12.00	12.50	1.00	25.50	6.00	12.00	2.00	20.00	-5.50	25.50
2192 SPIR		Satini	6.00	0.00	14.50	81.00	7.00	102.50	30.00	60.00	12.00	102.00	-0.50	17.08
2186 DRS		Patt 10	1.00	0.00	2.50	5.50	0.50	8.50	2.00	4.00	1.00	7.00	-1.50	8.50

Figure 2: Job tracker comparison between ERP recorded hours and estimated hours

Material updates (Purchase orders), as the MD uses prices from his own tacit knowledge, the company lost money on some jobs because they were using old prices, or losing customers because they were overpricing a number of quotes due to incorrect estimation.

Some of the results found were at the quotation stage, the ones sent to the customer, and it was found that in 2011 the case study has won 266 (39.87%) quotes and lost 379 (60.13%) quotes, 82 of them were due to overpriced products.

Out of the (60.13%) 2011 lost quotes (31%) from them are lost due to prices, (3%) for long lead times and (3%) for changing needed specifications, (20%) due to high delivery charges and the other (43%) were lost due to customers changing their minds some for needing a third party to do all measurements, or for fittings, and sometimes just because they lost a site contract or other reason.

In money terms, they have won £1,210,698.84 worth of quotes this year and lost £6,443,682.82 worth of quotes, £1,438,105.66 of them due to inaccurate pricing, which were taken over by our competitors'.

Analysing the lost quotes due to prices, and redoing them again through the ERP system, a number of errors were found, but most importantly out of 82 quotes lost due to prices, 56 were estimated with lower prices on the ERP system from what the estimator sent to customer, 17 were underestimated due to un tracking the price changes, and 9 quotes files were unfound.

No patterns were found for the results because of the un-systematic approach the estimator use, and asking the estimator about the results, we found that some of the quotes were raised in price to make a balance in some other lost jobs or mistakes done in jobs, the exact example was:

"I was quoting a customer's quote and I received a phone call telling me that a door at a customer site started bending meaning we have to remake the door from scratch, for this reason and to make it up for the loss I've added around £200 to this quote", Company MD. This unsystematic approach has been causing the company a huge loss in both quotes stage and job stage of the company work process.

FINDINGS FROM CASE STUDY

There are few questions to be asked in order to verify the results of the implementation:

Can you observe productivity in your planning area a few months later after ERP implementation? Do things which have been assumed as complex before implementation seem very simple after implementation? Can you now control your budget, stocks etc? Have you not stopped your and customer's production lines because of material shortage due to better planning system? Can you feel the financial benefit or the ERP system?

A successful ERP implementation in any case study needs to fulfil these arguments. At the case study, live prices are used for quotes, which if accepted are then turned into the sales orders, transferring them easily into a job that can automatically alert the purchasing department of what needs to be purchased for this jobs, updating quantities, scheduling a job for the shop floor, tracking it through the work, being able to determine job stages and update customers, has been accomplished, and made creating a job file much easier than previously as each file use to be typed manually into excel sheets, paper work.

The case study was able to overcome a number of barriers to the implementation and can feel a financial difference in the quotes sent to customers, which help in losing fewer customers and with increasing the productivity of the company.

CONCLUSION

Knowledge Validation is an important aspect to any organization and this case study has presented the problems, solutions and barriers to these solutions. This paper has identified and analysed problems and barriers, in particular resistance to change. Some limited conclusions may be drawn, first is that even though the user gives a thorough specification there is a mismatch between what the user claims to want and what they actually want? Secondly, there is an internal resistance to change evidenced by the number of Configurators offered to the user and the persistent complaint that they were too complex. The system of spread sheets used at the case study was no more complex than the Configurators offered but it was familiar. The newest Configurator has many of the properties of the old Configurators but is becoming accepted. A great deal of training is required. This research's next step was to prove the changes made to the Configurator would identify effective ways for improving the business. The barriers and problems have been identified and went through a validation process, many of which were not predicted. Bani-Hani et al. described these focusing on the difficulty of persuading many of the employees that the ERP system could make their job easier and more successful.

This paper was able to identify the costs and benefits from the ERP system, and what difference it can make to the financial status of the company if used properly. In fact the improvement in accuracy played a major part in convincing the management of the value of the system. It was also clear that there is a critical mass of support that is necessary to persuade management to adopt the improved procedures.

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