# From Knowledge To Money – An Industrial Perspective Of Knowledge Management

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ABSTRACT:

Any manufacturing business runs on specific procedures that need to be repeated consistently and improved upon continuously. While already known procedures are laid down as ISO documents, each individual learns his own way of doing things, within the framework of the defined procedures. Such learnings happen everyday in shopfloor to various persons under various situations. Only those firms which can constantly capture such intrinsic knowledge that happens every day in the shopfloor, can be competitive and sustainable. The present case study describes methods followed by an Organization to capture these intrinsic learnings of the workforce and to put them to effective use for business gain on a regular basis. Based on the study, a model for identification of expertise and method of delayering the same is also developed.

Keywords: *Knowledge management, Shopfloor knowledge, Expertise identification model, Design methodology*

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## 1. Introduction

Any manufacturing business runs on specific procedures that need to be repeated consistently and improved upon continuously. While already known procedures are laid down as ISO documents, each individual learns his own way of doing things, within the framework of the defined procedures. Such learnings happen everyday in shopfloor to various persons under various situations (Hyttinen, 2005). Every learning is a process that costs money. If it is a learning for correcting a mistake, then not implementing it costs money by way of avoidable rejections in products. If it is a learning that can lead to an improvement in business process or production process, then not implementing it can lead to productivity losses. Therefore, only those firms which can constantly capture such intrinsic knowledge that happens every day in the shopfloor, can be competitive and sustainable (Wickramasinghe, 2006). The present paper describes methods followed by an Organization to capture these intrinsic learnings of the workforce and to put them to effective use for business gain on a regular basis. A model for identifying expertise and delayering the same is developed.

## 2. Expertise: Need Based Learning To Meet Exigencies

Most part of a manufacturing unit's knowledge lies as expertise with various individuals. Experts develop ingenious ways to deal with different situations that they come across when they tend to spend longer periods of time in a specific functional area . Many organisations attempt to capture this knowledge (Rintala & Hyttinen, 2006) but find it very difficult to use it.

Expertise develops because most of the documented specifications (procedures) do not cover all aspects of the process. Most specifications are written for the ideal condition (assuming nothing will go wrong). For example, in a process of furnacing, the specifications will indicate the schedules to be followed but may not cover how to manage if the power goes off at peak temperature and returns after ten minutes. In a process of mixing, the procedure will indicate a recipe but may not cover how to manage if the mix appears wet or dry (even after strictly following the recipe). This may be because of so many reasons like change in the atmospheric condition, altering the surface characteristics of the particulate materials in absorbing moisture. In all such cases, the shopfloor person learns to correct and get back the expected quality of the product. This is valuable knowledge.

Over a period of time, the user encounters many such unexpected situations of reality and learns how to handle such exigencies. When the knowledge of such extreme situations lies only with him, he becomes an expert in that subject area. This is because he knows more than anyone else and can handle any emergency with ease. This is all fine as long as he is available. When he becomes unavailable by way of retirement or otherwise, the organisation suffers (Mitra & Campoy, 2008) , not even knowing what it has been missing. In this manner, expertise is quite detrimental to sustainability of an organization.

In the organisation under study, three different types of expertise were identified.

I. Experts in a process with an untried idea for improvement

II. Experts in a process who have learnt by handling crisis

III. Experts in Design who applied universal solutions to all problems.

This paper deals with how knowledge from these three types of expertise could be put to use.

### 2.1. Experts In A Process With An Untried Idea For Improvement

Knowledge is created in shopfloor (Virkkunen & Ahonen, 2004). The person who handles the product day-in and day-out knows better than anyone else. Involving the user will yield better results (Discenza et al, 2008). Instead of someone else suggesting him how to improve, why not ask him? With this approach, a team was constituted to collect ideas for better ways of doing things, from the shopfloor persons themselves. The person had to describe his issue with the present method and indicate what he thinks would be a better way to do the same activity. There were plenty of interesting suggestions. For the individual, it was a good opportunity to alter and improve his work area. Instead of the normal way of passing experience based judgment (accept/reject) on ideas,all these suggestions were validated through proper experimentation by a dedicated team.

Since the idea was from the shopfloor person handling the job, conducting trials was quite easy. The suggesting person would automatically be the member of the trial experimentation team. Since it is his idea and since he is sufficiently experienced in doing that activity, the suggester came forward to address all issues that cropped up during scaling up and implementation. If the results were not good, he could see it for himself . Now that he is convinced that his idea has been given a serious try, he gets mentally conditioned to receive and try others' idea in his work area. This kind of an involvement created in the workforce resulted in permanent resolution to many issues that were lingering and re-occurring over several years. The process really led to organizational knowledge creation.

What was started as an experiment has stayed back as a permanent department (QISG-Quality Improvement Steering Group), quite distinctly different from Quality Assurance teams. Every time an operator finds an opportunity to improve the procedure, he approaches the QISG team with his suggestion. The QISG team registers the idea in his name, assigns team mates to validate by experiments, tries out and shares the results with the originator. If successful, the corresponding ISO specification (work procedure) is amended. All ISO specification will have a link to the corresponding QISG project number. By this linkage, traceability of basis for certain decisions taken at any point in time can be established. Such history of process changes is a valuable knowledge to process industries.

#### 2.1.1. Benefits Derived

Number of specification revisions and projects conducted indicated the level of improvement. Around 200 suggestions came up for review, within a year.

There was a direct linkage to cost savings. Over a period of three years, rejection levels came down sixfold and remained sustained at that level for the past four years.

The non recurrence of rejections is an indication that there has been a permanent resolution. This is a direct benefit to cost by the effective utilization of data that was lying with individuals in shopfloor by virtue of their experience in a particular line of activity.

### 2.2. Experts In A Process Who Have Learnt By Handling Crisis

Many shopfloor experts learn by trial and error, the hard way. For example, in a furnacing operation, the procedures will indicate what temperatures to use and what schedules to use to reach those temperatures. In ceramic industries, kiln operations may take as long as three days. What happens if there is a power cut in between? Let us say that before reaching the peak temperature, the power goes off. The kiln temperature starts dropping. If after ten minutes, power returns, what schedule to follow? Most specifications do not consider such situations. If he discards the items in the kiln, it would be a huge loss to the company. If he does not correct the firing, the products may be under-fired and may lead to safety issues in user end. Literally, there is no time for consulting any other person. How to manage the kiln schedule in such a situation becomes a question of experience.

In such an emergency, the operator tries many corrections by intuition and learns a few methods that work well to overcome the emergency, without affecting the product quality. In the example cited, the operator learns to study the cone (a ceramic product in the shape of a slender pyramid that bends with temperature and the extent of bending is a rough measure of temperature in the kiln) behaviour which is a real representation of the heat work that has gone into the product. From the appearance of the cone bending he assesses how much faster he can operate the schedule to get back to the approved schedule as closely as possible. His expertise tells him that he can rely more on cones than digital indicators as far as quantum of heat in the product is concerned.

The organisation under study had one such operator who was in service for about thirty five years. He had joined very young and stayed in for all these years. In a year he was about to retire. He was running the show very well but was feeling that he did not possess any special knowledge and that he was just following the instructions laid down in the procedures. He had been in the same line for such a long time that he was not able to distinguish between his skills and the existing procedures. The company was sure that when he retires, no one would even know what we have missed to learn. It would be a costly learning- to learn everything again by repeating all the exigencies he might have encountered.

The first issue was to evaluate whether there was any tacit knowledge or not. The best way was to create his absence well before his retirement. He was shifted to R&D as a Specialist in kilns and replaced by freshers in the shopfloor. The new persons would try to follow the written instructions and whenever stuck with issues of non clarity, would call up R&D and talk to the specialist. Whatever they asked became the syllabus for training anyone in kiln operations.

Meanwhile, the R&D team invited the specialist to make a presentation about his work in their weekly meetings. This was one form of Community learning (Agarwal & Poo, 2008). While he presented, the team would take notes and ask for more clarification and this would form the topic for the next lecture. Documenting tacit knowledge minimizes knowledge loss (Gotthart & Haghi, 2009). By repeated probing, clarifying and documenting , the team was able to derive around twenty discussions from this person. In due course, he was quite clear what kind of information from his internal database is considered knowledge in the external world around him. Continuous conversation could delayer the expertise (Asllani et al, 2008).Then he resorted to documenting his remaining thoughts all by himself. When the expert himself starts documenting his ideas, that becomes the ideal situation for knowledge transfer (Visuri, 2007).

### 2.2.1. Benefits Derived

At the end of a one year period, we had three training manuals written out of his expertise:

- how to operate a kiln

- how to construct a kiln
- how to trouble shoot a kiln.

Kiln was no more an area of concern. By training youngsters in the simulated absence of the expert, the life of the useful knowledge has been extended infinitely. The youngsters could run the show equally well.

The expert who thought he had nothing to disclose discovered the value of his experience and learnt the art of documenting knowledge. His skill in documenting and understanding of what is knowledge, has lead him to document what he additionally knew- how to construct a kiln. This became his expertise. He rose from a kiln operator to a kiln consultant who could independently design and construct a kiln. He has continued to serve as a Consultant for kiln building in many of our group companies. Perhaps this was the first incident in that company, wherein an operator came back as a respectable consultant in a niche area.

### 2.3. Experts In Design Who Applied Universal Solutions To All Problems

In R&D, if there are six persons in a team, a problem will have six different answers because each person is different. Every knowledge worker has unique perceptions (Defazio, 2008), and it is difficult to understand how the decision making happens in such intellectuals (Dorst, 2004). Even the same individual may use different principles at different points in time. Perhaps it is a question of not knowing which idea is really suitable in which context. To study this pattern, the decision making pattern of twenty members of the R& D team was studied by a simple format. The format would ask for the required change in the product, the concept used, the reason for selecting the concept and the result of product performance after using the concept.

By continuously repeating this process over a period of one year, we were able to filter all the thumb rules into ideas that worked well and ideas that did not work. This was a useful refinement of data quality (Li et al, 2009). All the ideas that worked were compiled into a design guideline- indicating which concept can improve which product by what aspect. This was rearranged product wise. Any fresher can now use this design guideline and choose the right concept based on earlier successes of the same concept. This became a foolproof method to improve the success rate of the products. This empowers the fresher who joins the team with all the knowledge and wisdom of the team mates.

An analysis of the pattern of decision making revealed that every person had a few “universal” solutions. For example a grinding wheel can be improved by changing the grain or the bond or the fillers (grinding aids). A person who has developed some improvement in grains tended to always use grain modification as his first idea for product improvement. A person who had developed grinding aid, always tended to use grinding aid as his first choice for product improvement. Similarly one who had developed bonds attempted to always take the bond route to product improvement. Perhaps it could be the urge to have “my idea” to improve the product.

The analysis had three effects- 1)it was clear how many concepts were in use ,person wise. 2)it was clear how often new concepts (really useful ideas) are getting added. 3)it demonstrated the possibility of “additive” concepts-two or more ideas that could simultaneously enhance the product performance (Roach et al, 2005). For example, if grain modification would improve performance by 15% and bond modification by 10%, there were instances where if introduced simultaneously, one could get a 25% enhancement in product performance. These served to improve the performance measurement of R&D (Soderquist & Godener, 2004).

### 2.3.1. Benefits Derived

- Freshers could be empowered by Design Guidelines.
- Individuals learnt to differentiate between their thumb rules and workable concepts.
- New performance measures for R&D personnel were possible.
- The success rate of new products was raised (from 32% to 72% over a period of six years).

## 3. A Possible Model For Capturing Tacit Knowledge And Expertise

The experiences of the company could be summarized in a two by two matrix of 'experience' versus 'authority to experiment', as shown in Table 1 below:

| | | | |
|---|---|---|---|
| **ExperIence** | **High** | 1.Skilled worker<br><br>Data management through QISG(quality improvement steering group) | 2.Expert<br><br>Data management through Simulated Absence of expert |
| | **Low** | 4.User<br><br>Data management through Implementing generated knowledge output | 3.Designer<br><br>Data management through Validation of thumb rules |
| | | **No** | **Yes** |
| | | **Authority to experiment** | |

**Table 1: Summary of Company Experience**

The first quadrant is characterized by skilled workers who have gained experience in repeatedly doing a work and having an urge to improve the work method but not having the authority to do so. The data management approach was to empower the skilled worker by giving him the first right to suggest for his work area and systematically validating the idea by experiments through a dedicated QISG team. The contribution to knowledge was improved work procedures and reduced rejections.

The second quadrant is characterized by Experts who learn a lot by handling exigencies and unusual situations that normally do not form part of the work procedures. Normally such people never feel they have anything to teach. The organisation may not know what they are actually contributing and hence does not develop a second line for this person. The data management approach was to create a Simulated Absence of the expert and delayer the expertise by continuous efforts to probe, learn and document through discussion forums. The inadequacy of the instructions became obvious when freshers tried to operate without the presence of the expert. It was possible to delayer and discover the true expertise of the person, which was also documented and made usable.

The third quadrant is characterized by the "Designer" who, by virtue of joining R&D gets the authority to experiment and change things irrespective of his experience level. Such persons intuitively develop certain thumb rules and use them as universal solutions for most problems. The data management approach was to enable them to examine their thumb rules by demanding a documentation of the reasoning for selection of a concept and then verifying whether that concept worked. This helped to segregate the working concepts from the non working perceptions.

The fourth quadrant is characterized by inexperienced freshers who join the system. They are the "Users" who have a constant need to look for useful information to do their jobs better. In fact, this is the knowledge application area. Hence , this quadrant creates the pull for what is required from the other links of the data chain. The output of quadrant 1 (skilled worker) serves to provide improved working procedure and trouble shooting manuals for the user . The output of quadrant 2 (Experts) gives him the training manual for operation of niche areas . The output of quadrant 3 (Designer) provides design guidelines for the fresher who joins the design dept. Thus, it can be seen that whenever the data management culminates in a document usable by quadrant 4 persons, there is a business gain by way of reduced rejections in production, shorter lead times and better success in new products etc.

From this model, it can be understood that, to locate useful data from a heap of knowledge -whether explicit or tacit- it is enough to check whether the data will finally be useful to the quadrant 4 person.

## 4. Learnings

From the experience gained with the organisation, the following learnings emerge:

- When the user gets the first right to suggestion, the solutions are permanent.
- When the expert does not realize his expertise, simulated absence, followed by probing, clarifying and documenting helps in dissecting and discovering the

expertise.

- When the perceptive ideas of R&D team can be converted to "Design Guidelines", it will pave the way to identify "mutually additive" for hitherto unexplored levels of improvements.

- When list of ideas by R&D team are documented, the team gets a better urge to generate new ideas. This helps in performance analysis and improvement.

## 5. Conclusions

Any organisation has most of its knowledge in its individuals. By enabling individuals to document and analyze their own decision making process, supported by experimental validations, useful concepts can be mined and segregated from perceived thumb rules. Compiling such useful concepts into function specific "operation guidelines", data can be converted to procedures that lead to business gain. The concept of converting Knowledge to money has been illustrated with some examples.

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