On The Genealogy of Knowledge Management & Automated Systems in Engine Manufacturing Industry & Perception of BS III and BS IV Heavy Vehicle Drivers in Pune, Maharashtra: A Qualitative Study

Kshitiz Gupta[1], Prayas Sharma[1,*] and Anukriti Sharma[2]

[1] Department of Decision Sciences, School of Business, University of Petroleum and Energy Studies, Dehradun, India
[2] Department of Economics, School of Business University of Petroleum and Energy Studies, Dehradun, India

Abstract: Knowledge management plays an important role in manufacturing industry, as machinery & other physical equipments are not the main criteria of innovation but the knowledge of employees. In manufacturing industry, there is lack of explicit knowledge, which makes it difficult to utilize the power of data. In this paper, a new feedback approach is used with knowledge dust and pearls approach [1] to solve problems related to time and employee motivation with respect to knowledge management. A questionnaire was designed, and interviews of truck drivers were taken to get a general perspective on sociological factors.

Keywords: Knowledge, management, drivers, manufacturing, heavy vehicles, sociology, organization

1 Introduction

Knowledge management plays a prominent role in knowledge intensive organizations, and the major challenge is to identify, create and share valuable knowledge in the organization [1]. It becomes even more important in micro, small and medium scale enterprises [2]. Manufacturing companies are no exception, and they must aim to continuously improve their performance. Plus, the development and growth of technology rest upon the employees' knowledge of the domain, which is why knowledge management attracts more attention in the manufacturing industry. In these type of industries, innovation is the key to success, which is why retaining, storing and utilising the knowledge of employees are important.

Theory: Knowledge management is a process of acquiring, creating, capturing, sharing and using knowledge to enhance learning and performance in organizations to create an environment in which knowledge exchange can take place [3]. There are two opposing types of organizations: A) exemplary and B) situational. They are differentiated by their fundamentals concerning knowledge type, knowledge creation method, learning type, knowledge retrieval type and knowledge management strategy. Exemplary knowledge organizations create continuous knowledge exploitation as complex organizations are rigid and dependent on set rules, although quite efficient if the input is within bound and rules prescribed while in situational knowledge organisations, work with respect to its surrounding is the key element. In this type of organizations, knowledge is gained by experience and by utilising the employees' capabilities. In these types of organizations, personalization is the key; matching employees to specific tasks with respect to their strengths. It is the most efficient when challenges are hard to categorize and require specialized solutions. In a nutshell, exemplary organizations believe that knowledge can be developed, while situational organizations believe it is difficult to transfer knowledge. There are two kinds of knowledge setting methods in an organization : C) explicit and D) tacit [4]. Explicit deals with organizations settings, and thus prevails knowledge organizational structure for gaining and sharing knowledge. Tacit is a knowledge type revolves around the idea of exposure and belief that knowledge transfer is dependent on the staff. Also, the learning type is either single loop or double loop [5]. In single loop, there is a faster,

---

* Corresponding author e-mail: prayassharma02@gmail.com, prayassharma02@gmail.com

relevant feedback mechanism. It is quick so, there is more feedback, thus faster decision making. This makes it easier to take fast decisions. It is good for organizations based on rules & detailed process. In double loop, a more thorough analysis is required as it questions the underlying assumptions upon which existing knowledge has been. Knowledge retrieval can have two forms : E) automatic and F) controlled. Generally controlled systems have strong feedback loops, which are quicker in response. Finally, the preferred knowledge management strategy can either be a codification or a personalisation strategy. Codification deals with definite data sources, repositories and personalization rely on people as bearers of knowledge [8]. Traditional models revolve around four variables, namely, A) type of organization, B) sociological factors, C) retention and D) type of knowledge.

Type of Organization : There are two types of organizations, exemplary and situational. The former revolves around rigid rules and is best suited if the input is within limits and bounds. The latter is more flexible, best suited for diverse inputs and complex problems. **Sociological Factors :** It revolves around the environment, identity of the organization and how the employees perceive their role, as in traditional knowledge management systems, motivation is an important factor. **Retention :** It refers to the organization's practise of using previously generated information to aid and fasten further projects [4]. In this paper, we have introduced a feedback approach to make retention easier on both intrinsic and extrinsic factors. **Type of Knowledge :** There are two types of knowledge, tacit and exemplary. The former revolves around prevailing knowledge organizational paradigm for gaining and sharing knowledge. The latter expresses the idea of exposure and belief that knowledge is dependent upon employees in the first place.
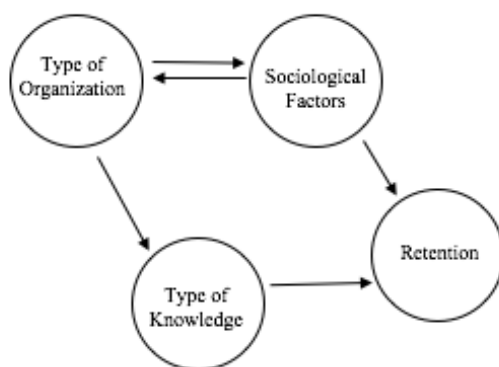

Fig. 1: Integration of traditional knowledge management systems

Problems in Knowledge Management - Developing and maintaining a definite level of knowledge is an important issue in an organization & is a challenge for software organizations which are dependent on the skills and knowledge of their employees. The software industry is endemic to changes which calls for regular updates on new knowledge. Also, the turnover rate in software organizations is high, which makes the problem more stringent. Examples of some problems:

–Knowledge loss when employees leave the organization or retire.
–Deficiency of knowledge; when new employees or interns are hired, they need to acquire new knowledge, which takes time.
–Time constraint; new experts need to share knowledge to train employees but seldom have time due to heavy load. If they spend time sharing knowledge, it will affect their productivity.
–Unknown location of knowledge; a common dilemma is to find knowledge needed to solve a problem. The knowledge might be present, but the employees are unable to find it.

There are many software packages that aid organizations in knowledge management and can be customized to fit the diverse needs of the organizations. The experience factor model is an example for IT industry as it recognizes the need to learn and act based on past experiences in order to deliver faster and economically viable products. **Question : If knowledge management is the key to solve all the problems of knowledge maintenance then why aren't firms doing it?** The answer is that it is hard to follow, the results take time and it is a difficult sell. When management is approached, they will ask the critical questions:
1. What is the return on the investment?
2. What is the pay off time?
Important points:

–Knowledge management is a long-term investment and is difficult to sell to management and employees. The common question that comes is raised by the employees. What do I get out of it and whether they should be doing additional work?
–Knowledge management is dependent on the contribution of employees and they have to share it with other employees.
–It takes time to see results. In the longer run, the employees will lose motivation and the project will cease to dry work.

The new approach will be more appealing to management and employees, as it is less risky. To improve quality and speed up the process, diverse versions of quality improvement paradigms have been employed. It revolves around the notion of continuous improvement and iterations as the main vehicle for planning, performing and improving the process at hand. It will lead to a system that will make the transition to knowledge management easier for organizations. For short term needs "Answer Garden Approach" [1] was designed to solve simple help desk problems. For example: Organizations receive multiple requests from customers and employees. These can be automated and can help organizations overcome problems encountered within the system. The nature is repetitive and the same requests for help occurs frequently. Briefly:

–Capture the query and response so that solutions can be given easily to employees and customers.
–Design a system that will allow experts to share their tacit and implicit knowledge with employees.
–Make the repository accessible to customers so that they look for queries and solutions themselves.
–Design the system with respect to aesthetics and technology to promote independent work. It is based on the premise that knowledge can easily spread in organizations.

The new system is designed by combing answer garden and experience factory approach. The crux of this approach is to capture data pertaining to query and solutions that employees use and exchange on a daily basis to make it available throughout the organization. It is also designed to support peer to peer activities. Once the distribution is done, the data is synthesized and transformed into information, which is a more sophisticated, refined and clean outcome. Then this information is stored and made available to the whole organization. All this takes time and is risky because employees want quick results. To counter this problem, the collected data goes directly into the system providing a short-term boost so that employees and management stay motivated. This gives the system time to clean, analyze and maintain the data for a long term use. **Experience Factory and New Feedback Approach -** It recognizes that organizations need to learn from the past experiences to deliver products faster, cheaper and with better quality [6]. It takes time and is a hard sell. When management is approached to invest in knowledge management they will ask the critical questions:

1.What is the return on the investment?
2.What is the pay off time?

Important points:

–Knowledge management is a long-term investment. It is also difficult to sell to employees (Common question : What do I get out of changing my work process and doing additional work?)
–It is dependent on the contribution of employee. Plus, they have to share it with the rest of the employees.
–Knowledge management takes time, when people put in effort they want to see results. In the longer run, employees will lose interest and knowledge management will cease to dry work.

The new approach is less risky, more appealing to management and employees. Quality improvement paradigm is a model for process improvement in software organizations. It engulfs the notion of continuous improvement and iterations as the main vehicle for planning, executing, evaluating and improving process. It will lead to an approach that leads the organization steadily towards knowledge management. For short term needs, Answer Garden (AG) [1] approach was made to resolve help desk problems. For example, organizations receive requests from customers and users. The organization helps them overcome the problems encountered with that system. The nature is highly repetitive and the same requests for help occurs frequently and the same help strategy can be used many times. In a nutshell:

–Capture the knowledge so that answers can be given easily to customers.
–Establish a process that allows experts to share their knowledge with each other and with novices in an efficient way.
–AG approaches to promote independent work by letting employees store and organize questions and answers. It is based in the premise that knowledge can easily spread throughout the organization.
–Make the repository open to customers so they try to find the solutions.

The new approach combines Answer Garden (AG) and experience factory [1]. This approach captures that employees use and exchange daily and immediately consumable data with minimum modifications and make it available throughout the organization. This process is accomplished by creating a system that supports peer to peer activities. In parallel, data is synthesized and transformed into information which represents more sophisticated, refined and valuable knowledge. The experience factory group collects data produced by project organization. Analysis is done, and it is synthesised into higher

levels of knowledge. Lastly, it is stored and made available to the project organization, mainly, in the form of business support. This will take time and employees will lose interest, to counter this, the paper has proposed a minor tweak. To counter this, the data goes directly into the project organization for providing a short-term boost so that the employees and management stay motivated for the long-term effects.
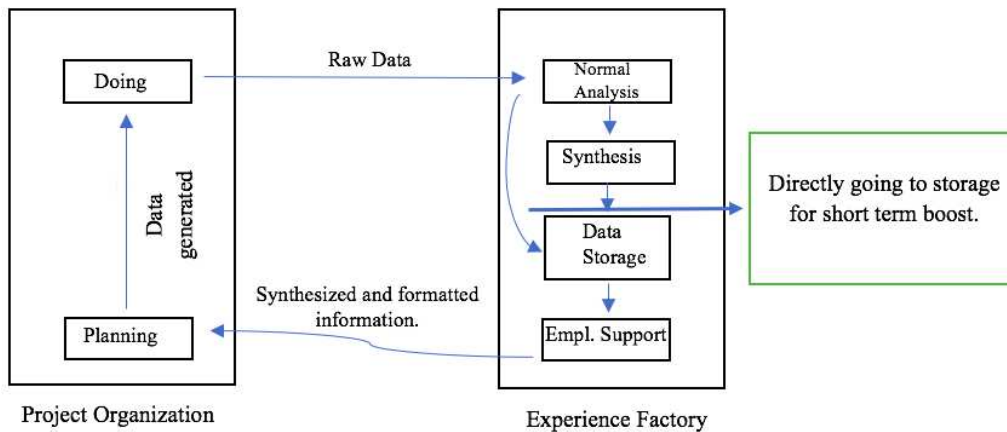
Interview Questionnaire :

1. Basic Information

Name			
Contact Number			
Vehicle Type			
Vehicle Manufacturer	BS Type		
Material Transported			
Route/Starting Point ? Ending Point		STARTING	ENDING

2. Sociological Variables

SALARY VARIABLES	CHECK BOX	SCORE ALLOTTED
FIXED MONTLY + ADDITION/ON KMS + DAILY ALLOWANCES		4
FIXED MONTLY + DAILY ALLOWANCES		3
COMPLETELY FIXED		2
LINKED WITH RESPECT TO TRIPS/KMS		1

2 (B). Open Ended Questions

1.1. Is bulk amount given to drivers? If yes, how it is calculated for the journey?
2.2. What are the views on increasing in salary over the past 5 years?
3.3. How trained and novice drivers are differentiated, is there salary difference between the two?
4.4. How has GST affected the salaries?

2 (C). Driver Demands

VARIABLES	CHECK BOX	SPECIFIC DETAIL
SAFETY IN VEHICLES		
AGE/CONDITION OF VEHICLE		
COMFORT		
AIR CONDITIONING AND HEATING		
EARNING POTENTIAL OTHER THAN SALARY		
TRAINING		
INSURANCE		

2 (D). Open Ended Questions

1.1. Are there any other aspects that the driver pleases even if the money is lower?

2 (E). OEM Ratings 1) Lowest, 3) Moderate and 5) Excellent

VARIABLES	TATA	ALL	BB	VECV	MAHINDRA
FUEL EFFICIENCY					
OVERLOAD CAPABILITY					
MAINTENANCE COST					
MAINTENANCE EASE					
BREAKDOWN RELIABILITY					
TECHNOLOGY					
COMFORT					
DRIVING EASE					
PICKUP					
SOCIAL RESONANCE					
ENGINE NOISE					
HEATING UP/ENGINE					

∗ **ALL ? Ashok Leyland, BB ? Bharat Benz, VECV ? Volvo Eicher**
2 (E). Open Ended Question

1.1. What is the best OEM with respect to terrain (Hilly, Plains) and why?

3. Technological Variables
3 (A). Open Ended Questions

1.1. Do you think new technologies will be introduced in the products that you are using today?
2.2. Which areas do you feel will experience new technologies?
3.3. Which OEMs will give you more confidence on the road while trying out new technologies?
4.Are there any ideas about improving current product?
5.Are there any noticeable differences between BS -III AND BS ? IV vehicles?

Method : In this qualitative descriptive study, 17 heavy vehicle drivers working in the transportation system of Kondhwa region, Pune chose to participate with their approval. Inclusion criteria : (a) at least 1-year experience driving heavy vehicles (Truck, Bus or Tipper), (b) interest in participating in the study. The corresponding researcher was referred to the Excel Motors Service Station located in Pune, to have the permission to use their office when approaching potential applicants and as a suitable place for conducting interviews. If those approached were willing and eligible to participate, consent was asked and then interview was arranged [7]. Purposeful sampling was done to include diversity until saturation (i.e., no new themes). Individual 15-20-minute semi structured interviews were used to collect data. The interview pattern followed the questionnaire's scheme. All interviews were recorded using a digital recorder application in a mobile phone.

Age	22-50 years, M (30)
Work Experience	1-30 years, M (5)
Sample	Truck 15, Bus 8, Dumper 3, Tanker 2, Owner 2
Route	All India : 20 Drivers, Local : 10 Drivers
BS Type	Sample was experienced with BS III & BS IV

Several methods were used to confirm the trustworthiness of the results. Dubious answers were framed in another simpler version of the question and the same was asked to other participants until final consensus was reached.

Findings : All drivers (30) who participated in this study were male. The main theme, dissatisfaction from income, comparison between different OEMs and poor organization of the job [7].

Poor Organization of Job : The working conditions were not clearly defined, and no clear planning of routes or arrangements was done by their employer. The drivers emphasised that these situations existed because of poor management by the employer.

Comfort Factor in Vehicles : Most of the drivers didn't want air conditioning on their regular routes but complained about the driver seat and steering wheel and the inability to adjust it. 15 drivers preferred BS IV vehicles over BS III vehicles.

"I don't want air conditioning when driving as it reduces the average speed, but I would like adjustable seat. In summer, the seat material gets damaged and the springs come out" .

"The steering wheel is not adjustable, and it makes long journeys tedious" .

Salary Dissatisfaction : Majority (20) of drivers were dissatisfied from their current salaries, their response to GST (Goods and Service tax) was negative. They admitted that the salary difference between trained and novice driver is negligible, until the hiring is for a big firm. The majority were hesitant when asked about something they wanted at little expense of their salary. Two drivers chose insurance. Only the driver from Purple Busses was satisfied from the salary, he was the only candidate that received PF.

"Our salaries have remained the same, things are the way they were before. Because of GST, the employer often delays in giving monthly salary" .

Salary Pattern : 17 drivers received a fixed salary at the end of the month (Median, along with trip wise expenses (300- 500). One driver received 5% extra for on time delivery along with monthly salary and trip wise expense. The highest salary was 17,000, received by the driver of Purple Busses.

OEM (Original Equipment Manufacturer) Choice : Novice drivers preferred Ashok Leyland vehicles for hilly areas and Tata vehicles for plains. Experienced drivers were comfortable with Tata vehicles on hilly terrain. On further investigation, the experienced drivers admitted that Leyland vehicles have a smoother gearbox. Volvo and Bharat Benz vehicles were described as costly and luxurious. Tata and Leyland vehicles were preferred in terms of spare part costs and availability. Drivers preferred Benz and Volvo vehicles when asked on characteristics relating to engine noise, heat, driver ease and technology."Leyland vehicles glide on hilly areas. Bharat Benz and Volvo vehicles are comfortable, but it is obvious since they are costly" .

Unsafe Vehicles : The majority of drivers mentioned improperly maintained vehicles. Lack of safety is a stress factor for drivers [7]. Unhealthy practises for example, not changing engine oil on time led to serious problems. Majority of drivers were concerned about the safety aspect in vehicles but only one admitted using seat belt. On further investigation, truck drivers admitted that seat belts were not provided in the first place as the owners buy the frame of the truck and send it to local customising shops. Our sample included the owner of fleets of trucks and he was concerned about the safety of his trucks on long routes. "A security system where owners could monitor the locations of trucks would be helpful. This way we can be sure of security, and drivers can rest properly instead of sleeping inside the vehicles."

Limitations : The samples were purposely sampled to encourage diversity, but the lack of female drivers in this field was a limitation as female drivers may have different problems. This study was only focused on the experiences of drivers from Maharashtra; further studies in other cultures are needed to expand knowledge.

2 Perspective

In engine manufacturing firms there is a lack of defined data driven schematics, especially in-service sector. To implement knowledge management and to by pass common problems such as employee motivation and financial support, short term effects must be taken into consideration so that knowledge management system can synthesize data in the background for stringent analysis, which takes time. The general prospective of drivers in Maharashtra is negative towards management, safety and salary factors. No single factor explained the negative sentiments of the drivers, but all the factors contributed to it. Drivers, families, employers and the community at large should be engaged to develop a better system.

(a)   (b)

Fig. 2: Ball Busting in Bharat Stage Emission Standard - IV engine.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

[1] D. Panagiotou, Semantic Knowledge Management in Software Development, National Technical University of Athens, Greece, (2011). www.researchgate.net/publication/316917550_SEMANTIC_KNOWLEDGE_MANAGEMENT_IN_SOFTWARE_DEVELOPMENT. DOI 10.13140/RG.2.2.32766.18247.

[2] U. Hamzani & D. Achmad, The Performance of Micro, Small and Medium Enterprises (MSMEs): Indigenous ethnic versus non-indigenous ethnic, *Procedia-Social and Behavioral Sciences*, 219, 265-271 (2016).

[3] F. Alipour, Khairuddin Idris & R. Karimi, Knowledge creation and transfer: role of learning organization, *International Journal of Business Administration*, 2(3), 61-67 (2011).

[4] H. K. Mohajan, Sharing of tacit knowledge in organizations: A review, *American Journal of Computer Science and Engineering*, 3(2), 6-19 (2016).

[5] C. Argyris, Single-loop and double-loop models in research on decision making, *Administrative Science Quarterly*,21(3), 363-375 (1976).

[6] N. Radjou, J. Prabhu and S. Ahuja, "Use Jugaad to innovate faster, cheaper, better," *HBR Blog Network*, (2011). http://blogs.hbr.org/cs/2011/12/think_like_an_indian_entrepren.html.

[7] H. K. Moonaghi, H. Ranjbar, A. Heydari & L. Scurlock-Evans, Truck Drivers: Experiences and perspectives regarding factors influencing traffic accidents: A Qualitative Study. *Workplace Health & Safety, Sage Publications*, 63(8), 342-349 (2015). doi:https://doi.org/10.1177/2165079915576934.

[8] P. Brusilovsky, A. Kobsa, W. Nejdl, The adaptive web: methods and strategies of web personalization, Lecture Notes in Computer Science, Vol. 4321. Springer-Verlag, Berlin Heidelberg New York (2007).

[9] H. O. Demirel, C. Bachle, A. M. Rodriguez, J. Siegler, Cummins midrange engine plant - defining new training standards for new product launches, *IE431 Senior Design Project Purdue University*, (2006).

[10] A. Pennathur, A. Mital, V. Rajan, D. Kaber, P. Ray, R. Huston, D. Thompson, G. Markle, M. A. Pitman, R. Bishu, L. Crumpton, S. Deivanayagam, J. Fernandez, M. Mcelwee, M. Mcmulkin,D. Sule, A framework for training workers in contemporary manufacturing environments, *International Journal of Computer Integrated Manufacturing*, 12(4), 291-310 (1999).

[11] G. R. Sisson, Development of training for a new manufacturing process, *Training and Development Journal*, 22-31 (1972).

[12] A. P. Gill, Design choices for 1990's low emission diesel engines, *SAE Paper No. 880350. society of Automotive Engineers, Warrendale, PA*, (1988).

[13] D. B. Kittelson, M. J. Pipho, J. L. Ambs and L. Luo, In-cylinder measurements of soot production in a direct injection diesel engine, *SAE Paper NO. 880344. Society of Automotive Engineers, Warrendale, PA*, (1988).

[14] J. Dyer, C. Dong Sung, W. Shu, "Strategic Supplier Segmentation" , *California Management Review, Winter*, 57-77(1998).

[15] S. Helper, "How much has really changed between US automakers and their suppliers" , *Sloan Management Review, Summer*, 15-28 (1991).