FILLING KNOWLEDGE GAPS: KNOWLEDGE SHARING ACROSS INTER-FIRM BOUNDARIES AND OCCUPATIONAL COMMUNITIES

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Abstract

The importance of identifying and filling knowledge gaps has been recognized to be an important factor in the survival and growth of alliances. In filling these knowledge gaps, organizations put in place a series of organizational knowledge processes which lead them to socially interact with their alliance partners. Knowledge is here understood not as an object or as a resource to be packaged and transferred, but it is shared among individuals. Both the deployment of already existing knowledge and the creation of new knowledge are based on processes of interaction which derive from the interplay between alliance actors. In particular, the focus of the paper is on the micro-level processes of interaction across organizational boundaries and occupational communities. By socially interact with their alliance partners, individuals are able to communicate and explain their ideas and to put information together to fill their knowledge gaps.

Keywords: Knowledge sharing, problem-solving, alliances.

Filling knowledge gaps: Knowledge sharing across inter-firm boundaries and occupational communities

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Suggested track: Knowledge creation and innovation

1 Introduction

There is an increasing empirical and theoretical interest in how knowledge is shared and integrated across inter-firm boundaries. While most studies focus on the organizational level mechanisms used to transfer and store knowledge (Cohen and Levinthal, 1990; Hamel, 1991; Lane and Lubatkin, 1998; Larsson et al., 1998), less attention is paid to the micro-level processes which generate knowledge.

Recent studies have put forward a notion of knowledge which departs from previous conceptualizations and takes into consideration its processual and relational nature (Brown and Duguid, 1991; Tsoukas and Valdimirou, 2001; Orlikowski, 2002). According to this view, knowledge is not simply transferred but is generated in action and takes on the character of a process of knowing. The occupational communities perspective applies this notion of knowledge to explain its social and situated character. Social interaction within occupational communities creates a common context in which knowledge creation and sharing take place.

In this paper we report evidence of how alliance partners interact and of the knowledge mechanisms which they devise to fill their knowledge gaps. The social nature of these processes appears to be of fundamental importance in order to understand how people belonging to different occupational communities are able to share and create knowledge, based on the common grounds and understanding they establish while working together both in their own organization and in collaboration with their alliance partners.

2 Theoretical background

Much alliance literature has highlighted the benefits of collaboration and knowledge sharing (Hamel, 1991; Khanna et al., 1998; Inkpen, 1998; Gulati, 1999). As the knowledge base becomes more complex and dispersed (Powell et al., 1996; Powell, 1998), organizations cannot rely exclusively on their internal competencies and capabilities; instead, in order to develop and maintain a competitive position they need to form alliances with external actors. These linkages provide access to complementary

pools of knowledge and organizations participating in alliances can improve their operations, strategy, competences and skills (Mowery et al., 1996; Inkpen and Dinur, 1998). In this case knowledge is not simply accessed but, most importantly, it is transferred and internalized in the recipient firm through several processes. Other than knowledge access, participation in alliances may also foster the creation of new knowledge.

While these studies have emphasized the importance of gaining access to complementary sources of knowledge, they tend to view knowledge as a tangible resource that can be easily transferred, stored and managed. Hence, knowledge is simply conceived as a commodity (Tsoukas, 1996; Tsoukas and Vladimirou, 2001; Orlikowski, 2002). Moreover, little attention is paid to the micro-level processes which lead to the sharing and creation of knowledge.

In this paper we depart from the above conceptualization of knowledge and we adopt a relational and process-based view which is akin to the occupational communities perspective (Van Maanen and Barley, 1984; Brown and Duguid, 1991; Lave and Wenger, 1991; Orr, 1996). The occupational communities perspective sees knowledge as continuously constituted through people's interactions. In this context people learn and share knowledge not simply by demonstration or instruction; instead, they develop their knowledge about a particular practice through a process of socialization and through interaction with 'old-timers'. Lave and Wenger (1991) have termed this process 'legitimate peripheral participation', in that newcomers learn the practice of a community by being situated in it and from its established members. Over time newcomers move from peripheral to full participation in the community.

Wenger (1998) in his recent book advances the work of Lave and Wenger (1991) and focus more on the aspect of 'participation'. For Wenger participation is more than engaging in the activities of a occupational community. Participation is a social process through which actors produce knowledge while sharing it. This is achieved through face-to-face interaction and conversations. Through conversation we articulate 'hunches, insights, misconceptions, and the like, to dissect and augment… understanding' (Brown and Duguid, 1991: 45). For example, knowledge may be shared in the form of story-telling where working experiences are described. Orr's (1996) 'war

stories' provide a good example of how Xerox technicians socially constituted their knowledge through interactions and story-telling. Moreover, social interactions provide also a ground for the development of a common identity which allows actors to better understand each other and to share knowledge. Xerox technicians shared a strong work context within their community of practice, providing them with a common understanding which facilitated knowledge sharing. Thus, the development of such a strong community is conducive to the development of an environment characterized by high levels of trust, shared behavioural norms, mutual respect and reciprocity. Such environment has been identified as being high in social capital and has been linked directly with the processes of knowledge exchange and creation (Nahapiet and Ghoshal, 1998).

In line with Wenger (1998), recent writings on organizational knowledge have recognized the social and processual nature of knowledge (Blackler, 1995; Cook and Brown, 1999; Tsoukas and Vladimirou, 2001; Orlikwoski, 2002). For example, Orlikowski (2002: 252-253) writes,

> Knowledge is an ongoing social accomplishment, constituted and reconstituted in everyday practice. As such knowing cannot be understood as stable or enduring. Because it is enacted in the moment, its existence is virtual, its status provisional.

Hence, knowledge is better understood as informed by action (Tsoukas and Vladimirou, 2001) and can be thought in terms of 'knowing'. As Cook and Brown (1999: 388) explain,

> We act within a social and physical world and since knowing is an aspect of action it is about interaction with that world. We can act, we either give shape to the physical world of both. Thus 'knowing' does not focus on what we possess in our heads, it focuses on our interactions with the things of the social and physical world.

Other than highlighting the social and action-oriented nature of knowledge, the occupational communities perspective offers insights of the processes of knowledge sharing at inter-personal level. The focus on micro-level interactions seems to be particularly important in advancing our understanding of knowledge processes in

alliances. As Lofstrom (2000) noted, research on alliances has tended to analyze knowledge processes at the organizational level and has paid scant attention to inter-personal connections between alliance partners. However, while recognizing the value of formal linkages at the organizational level, other researchers have found that most knowledge processes are likely to take place at the inter-personal level. For example, Kreiner and Schultz (1993) found that informal contacts, such as between friends, were beneficial in obtaining scarce resources and know-how. In the same way, Von Hippel (1987) showed that the trading of know-how and tacit knowledge between organizations was achieved primarily through personal contacts.

Building on the relational and processual view of knowledge, our aim in this paper is to look specifically at the micro-level interactions across organizational boundaries and communities of practice and the way these personal linkages sustain several knowledge sharing and creation processes. Central to our analysis is the concept of 'knowledge gaps' (Haider, 2003). Knowledge gap is essentially defined as 'organizational knowledge which a company currently lacks but is identified to be critically important for its survival and growth and, hence, needs to be filled'. By forming and developing inter-personal linkages between alliance partners, organizations are able to fill these knowledge gaps. The social interaction between workers, engineers, and managers within their respective organizations and with colleagues in partner companies creates a common ground which facilitates the sharing of knowledge across organizational boundaries.

In order to make sense of the knowledge processes used to fill the knowledge gaps, we use the concept of 'boundary objects' (Star, 1989; Carlile, 2002). Boundary objects are artefacts which embed experiences and know-how of an organization and can be shared across different problem solving contexts. Boundary objects can be thought in terms of repositories (e.g. databases; CAD/CAM), standardized forms and methods (production standards; problem solving methods) and objects or models (e.g. drawings, parts, prototypes). The sharing of these objects between alliance partners fosters interaction between different occupational communities and promotes the development of a common ground and shared understanding. As Star (1989: 47) noted, boundary objects work to establish a shared context that 'sits in the middle'. The social interaction between people from different occupational communities allows them to share their experiences and know-how and in doing this they constitute the knowledge

needed to fill the knowledge gaps. Examples of these interactions include mechanisms such as training courses, plant visits, resident engineers, and on the job training.

3 Research context and method

This study has adopted a processual approach to investigate the micro-processes of filling organisational knowledge gaps. There has been a growing interest in research that pays attention to the classic issue of time as a theoretically important aspect to understand social action (Pettigrew, 1997; Ropo et al., 1997; Van de Ven, 1992). The basic tenet of the processual research is to unfold the events over time. According to Pettigrew (1997) time and history are at the centre of any process analysis. The fundamental aspect of processual research that most clearly differentiates it from other types of research is – temporality. The driving assumption behind process thinking is that social reality is not a steady state. It is a dynamic process and occurs rather than merely exists. Within the context of organisation studies, processual analysis emphasises the dual quality of agents and context. In other words, contexts are shaping and shaped and actors are producers and products. Actions drive processes but processes cannot be explained just by reference to individual or collective agency. Actions are embedded in contexts which limit their information, insight and influence. This interchange between agents and contexts occurs over time and is cumulative.

Pettigrew (1997: 338) has defined process as a sequence of individual and collective events, actions, and activities unfolding over time in context. Orton (1997: 420), on the other hand, suggested the definition of process researcher as “one who place primary emphasis on a complex organisational phenomenon which occurs over time, such as organisational learning, structural change, decision making, cultural changes, and strategy formation”. Although the focus of any processual analysis is on time and history, it does not stop by just reporting events in time. Rather the aim of a processual analyst is to describe, conceptualise, analyse, measures, and explain the events or issues over time in the shape of a case study, not of a case history.

There is not a set format on conducting processual research as the field of processual research is still emerging and its boundaries are debatable (Orton, 1997). Most studies use comparative case studies focusing on the exploration of issues or events. In this

study in order to explore the micro-processes of filling the organisational knowledge gaps, 97 in-depth semi-structured interviews were carried out in two Pakistani companies operating in the automotive industrial sector. The companies are Millat Tractors Limited (MTL) and Atlas Honda Limited (AHL). Respondents were asked to reflect upon the critical events which took place in the history of the companies. These critical events were identified from the analysis of the secondary data and were also reported by the top management during the first phase of interviews. Particular attention was paid towards unfolding the processes over time through which workers transfer, disseminate and internalise knowledge acquired from alliance partners. Interviews were carried out with respondents occupying different organisational positions/levels, and in three different languages.

4 Types of knowledge gaps

The concept of organisational knowledge gaps, which emerged from the analysis of both empirical and the secondary data is discussed in detail elsewhere (Haider, 2003). In this paper organizational knowledge gaps are used to explain how workers socially interact with alliance partner's workers to acquire, transfer, disseminate and, more importantly, transform new knowledge to meet company needs. As noted earlier, from the historical and retrospective analysis of the two case study companies a number of critical events were identified. These events were either the result of the organisations' efforts to meet existing organisational knowledge requirements or they led to the identification of future knowledge requirements. We termed these knowledge requirements as organisational 'knowledge gaps'. The analysis shows that the case study companies over the course of their development identified and filled a number of organisational knowledge gaps by adopting different strategies. The results indicate that the identification of knowledge gaps and the strategies adopted to effectively fill these gaps are critical for the survival and growth of the companies.

The retrospective processual analysis shows that organisations over the course of their development identified five different types of knowledge gaps. These different types of knowledge gaps correspond to different types of knowledge requirements in the firms. We defined these knowledge as follows: physical capital related knowledge gaps, intellectual capital related knowledge gaps, relationship management related

knowledge gaps, social capital related knowledge gaps, and cultural capital related knowledge gaps.

The first type of organisational knowledge gaps are ‘physical capital related knowledge gaps’ which include knowledge relating to plants, buildings and departments, machinery and equipment, departmental and production plant layouts, production infrastructures, standards and critical tests, and production technology. Besides these, the physical capital related knowledge gaps also include knowledge concerning the operations of the machines, the understanding of drawings, and the understanding and making use of the standards and critical tests mentioned above.

The second type of organisational knowledge gaps are ‘intellectual capital related knowledge gaps’. The intellectual capital related knowledge gaps include knowledge relating to the organisational skills relevant to management know-how, operational know-how, decision-making know-how, and problem solving know-how from the top to the lower levels of the company. The most important aspect in intellectual capital related knowledge gap is that it also includes knowledge regarding the ability to identify that a knowledge gap exists.

The third type of organisational knowledge gaps are ‘relationship management related knowledge gaps’. The relationship management related knowledge gaps include knowledge regarding the management of relations with customers, markets, and most importantly contractors and sub-contractors. It was noted that this type of knowledge gaps includes not only the knowledge in regards to the maintenance of good relationships with existing customers but also the knowledge on how to develop such relationships with new customers.

The fourth type of knowledge gap found in the organisations are the ‘social capital related knowledge gaps’. The social capital related knowledge gaps include knowledge regarding the building of trust and trustworthiness, the management of dependence, obligations, and expectations, avoiding opportunistic behaviour, and the embeddedness of companies’ relationships with their partners. This type of organisational knowledge gap is identified by organisations which are currently dealing

with a number of partners or which intend to form more alliances in future. The most significant aspect of this type of knowledge gaps is that it also includes the acquisition of knowledge on how to learn from its social network. Gulati (1998) has mentioned this type of knowledge in his study on alliances and he suggested that companies learn from their prior alliances and this learning shapes companies' decision on future alliances.

The fifth and final type of knowledge gaps which have been identified in the organisations are 'cultural capital related knowledge gaps'. The cultural capital related knowledge gaps include knowledge regarding the improvements of work practices, especially those aimed at changing the organisational culture. These gaps include the knowledge about the different techniques of kaizen like cleanliness, teamwork, problem solving, communication, job rotation etc.

It was noted that companies fill their knowledge gaps by going through different processes which we called knowledge processes. These processes include initiation process, acquisition process, dissemination process, inter-firm knowledge transfer process, intra-firm knowledge transfer process, and internalisation process. Most of these processes are discussed in the literature in detail. Notwithstanding the importance of knowledge transfer and dissemination, here we want to focus on the micro-processes through which individuals transform knowledge in order to accommodate it to their local contexts. The different mechanisms used by indivduals to transform knowledge and fill organisational knowledge gaps are discussed next.

5 Mechanisms to fill knowledge gaps

The analysis of the data shows that workers, engineers and managers from the case study company constantly interact with their alliance partners in their efforts to fill their organisational knowledge gaps. The different mechanisms used in this effort include on-the-job training at partners' premises, training courses and lectures, plant visits, in-house on-the-job training and an in-house training school. The salient feature of these mechanisms is that individuals acquire knowledge which their company lacks and transform it in order to fill existing organisational knowledge gaps. The evidence for these mechanisms is presented below.

5.1 On-the-job training at partners' premises

It was found that workers on any training course work alongside partners' workers on the assembly lines at the partners' premises so that the required knowledge (which ranges from simple information regarding the operation of machinery to complex know-how regarding ways to improve existing practices) can be fully acquired. These training exercises were reported by respondents to be one of the most frequently used knowledge acquisition strategies. In the training courses on the job training started with a three months long language course which was not only meant to improve basic language skills but it also aimed at educating workers about the Japanese culture and work philosophy. In particular, during these courses workers spent time on the shop floor to work with their counterpart colleagues. One of the respondents explains his experience as follows,

> "Their style of training is that you learn a lot. They provide you training on the spot (job). I was trained by one of their Heat Treatment Shops. They scheduled my training in such a way that I started with [understanding] the processes involved i.e. from the first process to the last one in that section. It was just like as the first process is jigs setting, so you will learn about jigs setting first, then, you will learn how to run the machines, all different machines. Then, the dumping (tempering) process, the next step, as heat treatment is one thing with many things in it. Then dumping, quality inspection, etc. Then, for inspection procedures there was another schedule i.e. that you will be trained for this many number of days for quality inspection. So overall it was on the spot practical training i.e. no classes or everything like that. They appointed a person, who was in charge there and I used to get all the guidance from him. While observing and learning I usually took notes, especially of those things which I could understand or were complex and than asked him about that i.e. what is that!! Please tell me about this."
>
> (In-charge Crankshaft Section)

Another respondent explains further the training process where the training focus was on improving the quality of the parts produced locally through vendors as follows,

> "…..first of all, training was in relation to parts which we used to receive from vendors regarding how to make samples, how to make an inspection and how to prepare feedback. Secondly, on the assembly line, how to build the quality during each process and not to inspect the quality later on, as

only then you can get a quality finish good. Otherwise, quality would not be ok as rejections would be high.

Then we were doing sampling at the production line. Especially first ten units in the morning after lunch and especially on Mondays we used to pick around 20 pieces. We used to perform many different tests to ensure quality. Secondly, it was quality related market feedback information. Warranty or other technical reports were looked after and problems were divided into different categories as 'A' level problem, 'B' level problems and 'C' level problems. All these were issues related to quality. It was very nicely discussed."

(National Sales Manager)

5.2 Plant visits and observations

The trainees at the partners' premises were also taken to visit companies or plants of other companies who were in the same business. The trainees visited these companies to see and observe how these companies were implementing different systems, of course relevant to the training course. The main purpose behind sending trainees to visit other plants was to ensure that they knew the working system very well. According to the resident engineer stationed at MTL,

"What we tend to do is send people to UK every year. We will send them on the training program within the factory to look at our system i.e. how we adopt our systems in UK. They would go through, with Bill from our licensee development. He will take them to the factory and possibly to the local vendors/suppliers and they would go to Perkins engines as well to see how their systems are implemented and then depending on which course they need to go depends on person to person."

(Resident Engineer)

He gives an example of a more recent training course arranged by Massy Ferguson as follows,

"At the moment we are also helping on the marketing and the sales side. We also give product training with service so we have service engineer to come. We just have a training instructor, who is currently here, to show people on the service side, how to maintain, strip down and build the tractors correctly. Some of the local dealership has also been offered this training. We take them to agricultural shows and machinery shows, to show to them what actually is going on in the UK. We will take them to local dealerships in UK so that they can see what and how they exercise their on

> the job training and how they deal with maintenance problems even as far as how their computer systems are set-up for sales and how they order parts. So training is a whole thing right from the product, production, then production people coming over as well. Obviously, not so much now. But in the early stages people used to come here to help set up the production area which is very, very similar to MF."
>
> (Stationed Engineer)

In the case of AHL, trainees study other companies as a case study in order to learn how they develop a particular product or specialise a particular skill. One of the respondents mentioned:

> "My training consisted of three main phases according to its nature. First, Japanese language course and lectures on management and culture of Japan. Secondly, quality control activities in Suzuki/Kumamoto plant, and thirdly, sub-contracting system at Honda plant, on- the-job training at various shops, and safety systems at Honda."
>
> (Deputy Manager Development)

Furthermore, the analysis of the report submitted by the above employee after the completion of his training course shows that he studied quality control activities at Nippondenso Company and compared those activities with the quality control activities going on in his own company. The main focus of his training was on studying quality control history at Nippondenso, the quality control system, control for the early-stage production, the management method for safety products and emission control products, quality control audit by top management, quality control in Pakistan production processes, and Quality control Circle Activities in Pakistan.

5.3 In-house on-the-job training

In-house on the job training means 'on the job training arranged at company's own premises (in-house) provided by partners to fill the knowledge gap'. In-house on the job training seems to be carried out by many different actors. The case study data show that in-house on the job training is provided by alliance engineers visiting the company, by resident engineers stationed at the company, and by the people from local industry. In the case of in-house on the job training by the representatives of the alliance partners, it has been observed that engineers visited the local company and stayed for a short period. During their stay, they trained the local staff by working with them on the

assembly lines. One of the workers from the Engine division of MTL explains how alliance engineers provided them training, as follows:

> "…..other than [training on] ISO we also received training regarding the new engine and now it is almost six months that we are assembling that engine as well. In that training, we were told how to assemble the new engine. A guy (from partner company) was here and he told us everything on how to assemble the engine.
>
> …..yes he trained us here on the line. He was explaining us what to do and how to do by showing us or doing by himself…..I understood everything and now I can assemble a full engine."
>
> (Worker, Engine Division)

The Resident engineer of MTL explains how people from Massy Ferguson came at MTL to train workers,

> "What they would do is that they would come here and we would give them the layout plans and show them how we assemble sub-assemblies in UK and how sub-assembly areas are set-up and then how they evolve on to the track, go around through the spray and than back up and down for all the auxiliary parts that are put on afterwards. It is very similar to the UK set-up. When you go there you would see that the production line is actually very similar. Although our is on the larger scale and is probably spread over several buildings. So what have been good is that the support started from day one and it basically evolved from a very small assembly area into a larger one and the main production area which is at the end of the building.
>
> When they got the new product here like we had a new engine, a 441 engine, we had the quality engineer; he came here and advised them on assembly and assembly procedures and what tooling and fixtures they would need. They will all be incorporated into the line and also the testing and collaborization of the engine as well and how to do the latest testing for the engine. He was here for about ten days again, to see how they built the engine, how they settled the tool settings and all the information regarding that was provided as well. All the literature on setting new tooling etc would be required. This was provided from UK, obviously at a cost but it is all brought from UK so that they can have at least one set of original tools and then they can make copies of it, if they wish. In this way, all the original tooling and procedures came from UK."
>
> (Resident Engineer)

5.4 In-house training school

Another strategy used by the companies to transfer the required knowledge was to establish training schools in the companies. The companies established training schools in-house and most of the training courses were arranged there. Usually the training courses arranged in the in-house training were directed at a group of people from the same or different department depending on the nature of the knowledge to be acquired. The school also arranged trainings courses in which alliance partner provided training. According to one of the respondent,

> "Just recently we had trainers here from the UK, who covered seven different departments on the training course. They came in the training centre down in Millat. They have been training staff on the program and they were also going to visit all the local dealerships and train them. A big training program was set-up for the areas of Multan, which is a very low key MTL area. What they were doing is that they were going out there and making people aware of our products, giving them the basic overhaul of the whole tractor so that they saw what our tractor is all about. How it works, how easily it is maintained and from there they were going to be some more in-depth courses, which some will be held here at MTL in the training school and another would be held in local dealerships to give local mechanics a better knowledge about how they should be servicing the tractors."
>
> (Stationed Engineer)

According to the in-charge engine division MTL:

> "….they provided us equipment, drawings, specifications and training in UK and they also came here to train us. Those were basically specialized trainings regarding the assembly of the engine, because we were using two engines here so we were provided complete training on these two types of engines. How to assemble them, what are the procedures, what are the checks, what are the quality checks, type of tests required and facilities required to carryout those tests. What equipment was required and in what phase and how to produce them."
>
> (In-Charge Engine Division)

From some of the examples, discussed above, we can see how workers from the case study companies acquire the required knowledge from alliance partners' workers to fill their organisational knowledge gaps. Above discussion shows that mechanisms such as on-the job training (in-house and at the partner's premises), training school and

plant visits were used as a mean of social interaction with partners workers. While the above discussion shows that workers acquire knowledge from alliance partners to fill their knowledge gaps, it was noted that in most of circumstances the knowledge acquired was considered suitable to meet the requirements of the companies. However, on the other hand, analysis of the data also provide evidence that on many occasions knowledge acquired from the alliance partners was transformed, with the help of alliance partners and associate workers in order to fill knowledge gaps. That was especially true in cases when alliance partner's knowledge was considered not appropriate for local circumstances. These practices lead to innovation and knowledge creation among alliance partners.

It was observed that workers from both case study companies transformed knowledge acquired from alliance partners to fill the knowledge gaps which were related often to their existing work practices. In most cases, these types of knowledge gaps were identified by the employees and were often a result of the different working environments in these companies. According to one manager at AHL,

> 'Products and parts are designed by Japanese for the Japanese environment and in some cases due to temperature differences, different humidity levels, and different building structures we need to introduce some changes in the product specifications."

Most of these changes resulted into a kind of knowledge gap. Although the companies representatives from both sides discuss these issues before the start of any new project and try to fill this gap through their early meetings, still many cases were reported in which workers on the shop floor filled these gaps through brainstorming, and by working on the broader concepts of 'quality circles' and 'Ayla Mayar (constant improvement) circles'. A respondent from AHL quoted one such example, as follows,

> "Basically, that is what we have to manage i.e. that there should not be problems or rejection, and production should also be ok. For example, if we are producing a part on a particular machine and we start having a problem the thing is that I can leave it and wait for days for replacements from Japan. However, what I have done is that I have developed programs in one machine so that in case of a problem in one machine any other machine can perform a similar function. There [Japan] they have all these programmes but here we have to develop this software. So in this way, I

> have standardised few parts i.e. which can be commonly produced by most of the machines and for this we have to change process standards as given by Japanese and we do it by developing new software programs. That is how we work."
>
> (Shift In-charge, Gear Manufacturing)

Not only is the concept of quality circles well known in both case study companies, but it has also been understood even at the lowest level i.e. worker's level. The manager, Quality Assurance at AHL explains the knowledge creation at AHL as below,

> "…… we are working on quality circles and in those we are trying to adopt automatic technologies. We are running small QC in an effort to bring in the new technology. We all sit together, we plan something and then we see how to execute it with the help of workers so that they can own it i.e. they can feel that they have also participated in this circle. We then present that at the forum and [in the forum] we present what was going on and what we have done [changed]. We present even very minor improvements and we try to do the small changes here [in-house]. And, who stood first in these QC competition, is sent to compete at the QC competition at Asian level arranged by Honda Japan.
>
> In this way, their [workers] spectrum is also broadened as they come to know what others are doing i.e. internationally. Then, there they even learn by seeing. So, that is where our people are also going. They manage to communicate with them somehow in these platforms. In this way, our learning process is progressing.
>
> Initially we were conducting these QC in-house. Now we are also asking vendors to participate in these circles. Now around 15-16 circles at vendor level are going on. People from our vendors have also travelled abroad on these circles at gross root level."
>
> (Manager Quality Assurance Department)

The process of making improvements and the thinking behind that, is exemplified by the Supervisor Heat Treatment at AHL as follows,

> "……..its [machine] efficiency was not that good compared to our work requirements. It was taking much longer time to pick the oil from the surface. So what we did was to introduce some changes. First of all, we started using 10 inch belt instead of 4 inches which increases its efficiency. With this it started to pick more oil in less time compared to four inches but still it was not good enough.

> Then, what we observed was that the thick layer was removed quickly but the thin layer remained there as the tank is very big and it took a lot of time to remove all the oil as the skimmer is located in the corner. The oil has to come to that corner.
>
> Then we started thinking that, we should do something so that the oil should move towards the skimmer. What we decided was that as the oil is lighter than water and always stays at the top of the water, so what we did was we manually tried to blow the oil surface toward the skimmer and check it. This idea worked. So we adjusted the air pipes at the boundaries of the tank. For that, we drilled small holes on the three sides of the tank and put the air pressure pipes in them. They were put in such a way that the oil from all three directions should move towards the skimmer. Then the skimmer started picking the oil more quickly, even the thin layer as well, so it worked very well."
>
> (Supervisor Heat Treatment)

Another example of interacting with workers to fill knowledge gaps was quoted by one of the respondent as follow,

> "Now as our production is increasing everyday, we have to think how to manage it. Just like in the case of that machine [pointing to a machine] we were facing some problem at the tip of that machine. Because of this [problem] we had to change the tip again and again and consequently the production was effected whereas we were supposed to produce more because of high demand. So we decided to take this problem into an Ayla Mayar circle (try to solve problem by brain storming) and we tried to find the solution to this problem. We designed many tips and tried them. One of our designs worked and we managed to get more than double production. The old tip was producing 100 units, but we managed to get 500 units using the newly produced tip. It saved time and we achieved maximum production. By tip replacement, time was saved and a better tip was produced. This is an example of Ayla Mayar circle…….these are our own ideas….and when world convention was held (which is held every year) we presented our ideas. Our team who worked on that Ayla Mayar circle went to Thailand to present it. There they told the participants what changes we made and how it increased the production. They really appreciate it and also give us a certificate as an encouragement."
>
> (Supervisor)

The knowledge creation due to the quality circles is more related to the systems and the changes taking place to make those systems more effective. Besides quality circles, knowledge creation was also taking place through a Projects Department, especially at MTL. The projects department was established with the aim of

understanding how products can be produced locally according to the required standards. Over time, the role of this department has changed, and now this department looks more into diversification projects. The department looks into the existing organisational capabilities and suggests products or technologies which can be produced using those capabilities. In other words, in this department knowledge creation is taking place in sense of producing new products for new or existing markets and by changing the existing configurations. According to the manager projects,

> "You know over the time, we have developed certain production capabilities. Starting from simply importing tractors in CBU form, we have come a long way and now we are producing 85% of the parts in Pakistan. So, in other words we are capable of producing almost a complete tractor in Pakistan.
>
> In order to maximize the utilization of the existing capabilities, we explore other products as well. For example, now we are producing some multi-application products. We are working on a light commercial vehicle project and we are also negotiating with a Korean firm to manufacture jeeps and small passenger cars in Pakistan. So, here we are thinking and exploring the opportunities all the time."
>
> (Manager Projects)

6 Discussion and conclusion

This study has illustrated how knowledge sharing processes across inter-firm boundaries and occupational communities have contributed to the knowledge needs of two Pakistani companies in the automotive sector. We termed these knowledge needs 'organizational knowledge gaps'. The empirical evidence has indicated that the filling of knowledge gaps is critical for the companies' survival and growth. In analyzing the knowledge processes that the two companies have used to fill their knowledge gaps, we directed our attention to the micro-level interactions between people belonging to different occupational communities. Inter-personal interactions between alliance partners have facilitated the emergence of shared understandings and the sharing of relevant knowledge.

Knowledge exchange with alliance partners has mainly taken the form of tangible objects and definitions such as machinery, production processes, quality inspection

guidelines, drawings and specifications. These tangible objects and definitions can be thought in terms of boundary objects. The use of boundary objects allowed the two companies to create common ground and establish a platform for social interaction to develop. The empirical evidence has shown that multiple mechanisms has been used in order to encourage social interaction and knowledge sharing across occupational and firm boundaries. The mechanisms adopted were on-the-job training courses, plant visits and observations and the use of resident engineers.

While examining knowledge transfer and acquisition processes has been helpful in drawing attention to the knowledge needs of the companies researched, it has also allowed us to enrich our conception of knowledge sharing by considering the processual and relational aspects of knowledge itself. As some scholars have recently noted, knowledge is not simply a commodity to be transferred and stored but is a social accomplishment (Brown and Duguid, 1991: Cook and Brown, 1999; Tsoukas and Vladimirou, 2001; Orlikowski, 2002). The findings have indicated that the knowledge acquired by the two Pakistani companies in the form of tangible objects often required transformation and problem solving activities. The relocation of these tangible objects in different physical settings provoked the emergence of problems and interruptions to everyday activities. At the same time, the operation of these objects in the new settings also provided clues for problem solving activities. Tyre and von Hippel (1997) have found that problem solving frequently benefits from exposure to a particular physical setting. Thus, the knowledge objects imported from alliance partners provided a concrete point of reference that individuals could manipulate to adapt them to their local needs.

7 References

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