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Obstacles to performance in the South African auto-components industry

A firm level perspective on internal learning and organisational behaviour

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ABSTRACT

The auto-components industry has improved its performance significantly in South Africa during the second half of the 1990's. However, it has not yet reached the level of the international competitors. The present paper suggests that a focus on the firms' internal conditions is a way to identify obstacles preventing further improvement of performance and competitiveness. Organisational behaviour has increasingly become important internationally in the understanding of firm development and learning in the recent years. This paper argues that it is crucial to take into account the behaviour of the organisation in the perception of the problems connected to the development of technology and capabilities in South African SMEs. The paper builds on the immediate findings of a qualitative case study on technological learning in two auto-components enterprises in Greater Durban, where the organisational behaviour in different ways hinders internal learning. These findings are contrasted with a third firm within the metal sector, which has a very different learning environment. The paper emphasises the importance of including the informal organisational behaviour in the understanding of how to develop the technological resources. The study investigates the physical resources, and the human and organisational resources, and relates these to the routines in the organisational behaviour, including formal and informal work practices and social relations at the shop floor in the understanding of what influence technological learning in these firms.

INTRODUCTION

The present paper is broadly concerned with the widespread problems facing Small and Medium Enterprises (SMEs) in South Africa which need to improve their performance in response to the increasingly liberalised market and international production standards, by a focus on the auto-components and related industry. International research shows that competition among firms is increasingly connected to the firms' ability to learn (B-A Lundvall, 2000). The present paper argues that to create continuous improvements it is necessary to understand how internal firm technology learning occurs¹. Improvement in firms in developing countries, including South Africa, is still often perceived as a response to macro level changes or a technical problem, a question of investment in more technical training and machinery². In particular, technology is often reduced to a question of technical equipment³.

The present paper argues that technological development is complicated and involves more areas than technique and equipment. The paper highlights that it is crucial to include firm-internal ability to learn and improve the technology, in the search for how an industry can increase competitiveness. The paper suggests focusing on the organisational behaviour and organisational culture⁴ related to learning in the perception of what influences the development processes of technology and capabilities inside the firm. The purpose of the study is to understand *what enables firm-internal learning related to the technology by including the behaviour of the organisation*. The point of departure is that this understanding can be used in the search for areas which can enhance the performance in the auto-components and related manufactures.

The investigation incorporates the physical resources, the human and organisational resources, and the learning routines of the organisation, embracing formal and informal social relations and work practices at the shop floor in understanding what enables learning. Thus the paper connects to the growing interest in organisational behaviour and learning in the understanding of firm development related to technology (Bessant 2000, Dosi, Nelson & Winter 2000, Nelson & Winter 1982, Penrose 1959, Leonard-Barton 1996, , Andreu & Ciborra 1996, Dodgson 1993, , Argyris & Schon 1996).

THE APPROACH

The importance given to firm behaviour to understand technological learning implies an inclusion of norms and values, and has been the reason for the selection of a qualitative ethnographic-sociological approach and case studies as the appropriate method of investigation. Such an approach is expected to be able to capture the meanings of the social relations, of the operators' work practices, and thoughts related to learning and to use this to understand how technological learning is achieved.

Three SME manufactures have been selected; two within different areas of the auto-components sector and one firm within engineering services and metal constructions. The industrial sector has been chosen due to the researcher's previous knowledge within the metal industry in Southern Africa and Denmark. The size of the firm is selected to be between 40 and 80 employees. Within this firm size it was possible to accomplish interviews with all employees. The choice of firm size and sector also reflects that the SMEs are politically recognised as important for the general development of South Africa. Furthermore, the manufacturing sector is the second most important in South Africa (Barnes, 2001: 245).

The three case study firms can be classified as 'specialised suppliers' in Pavitt's typology (Bell & Pavitt 1997:108)⁵. This choice was made to have some common conditions for the firms, although they operate in different sectors. It was expected to result in a wider distribution in the skill composition within each firm and therefore more variations in the learning processes. Specialised suppliers are characterised by a technological learning and work practices related to ongoing development of components and equipment and cannot apply scale intensive production methods with a relatively large amount of unskilled workers. They need various kinds of skills in order to cope with the high technical level of the machines (Bell & Pavitt, 1997:103-108). Specialised suppliers are also more independent in their decisions and initiatives compared to supplier dominated firms. The three firms have common conditions for available labour and culture in the surrounding society. They vary in type of production within the area of metal manufacturing and they furthermore vary in management practice, which influences the organisational behaviour. The three cases are therefore expected to represent slight variations in the technical production processes and a larger variation in the organisational behaviour related to learning within the same type and similar size of firm.

The present paper

The present paper builds partly on research connected to a PhD project carried out by the author. The focus of the study has been on learning related to both a) the technology, and b) the behaviour of the organisation, and the interrelation between a) and b), can be a key to identifying and understanding what is important for how South African auto-components manufacturers can improve their use of technology. The paper refers to the theoretical approach, the method and the immediate findings from the fieldwork. The paper will first connect the topic with the political initiatives and related research in South Africa. The theoretical perspective, the analytical framework and the investigation method follow the introduction. The analytic framework is applied to initial findings from the three case firms.

SOUTH AFRICAN GOVERNMENTAL INITIATIVES

The South African economy has opened rapidly to the international environment in the mid 90s as a result of the policy of the first democratic elected government. Simultaneously the government took different initiatives to support the adjustment process. The two most important ones for the present subject are the ‘Growth Employment and Redistribution policy’ (GEAR), and the ‘Motor Industry Development Programme’ (MIDP). The philosophy of both programs was in short mainly to support the development of internationally competitive enterprises to avoid closures, and through this initiative to support the creation of employment. The policy was primarily oriented towards macro-supply side measures, and the MIDP has both supported restructuring and resulted in difficulties for the industry (Barnes 2001:218-219).

More recently there have been signs of increased political interest in more micro oriented policy measures related to firm development. The DTI (Department of Trade and Industry) policy paper from 2001 on industrial strategy to create growth emphasises the necessity of including firm-internal conditions to increase competitiveness, and the policy paper highlights the importance of promoting technological learning in SMEs. The policy paper stresses in general that an increased emphasis is needed on the development of firm-internal resources, and that the level of human resources is a constraint for this development⁶. Other institutions also emphasise the importance of strengthening the technological capabilities of the SMEs like the Department of Arts, Culture, Science and Technology (DACST), the Manufacturing Advisory Centres (Mac’s),

and the Ministry of labour with the National Skills Development Strategy.

SOUTH AFRICAN RESEARCH

Important research on manufacturing in general and the auto-components industry specifically has been carried out by researchers based at the University of Cape Town⁷ and University of Natal⁸. Regarding the state of the industry, Barnes maintains that although South African auto-components industry has improved performance significantly since it was forced engage with the international environment, and that “*domestic manufactures still generally lag their international competitors by a significant margin*” (Barnes, 2001:249) (Black, 2002). Most South African industrial research has primarily focused on the macro or mezo level, and has been carried out through quantitative methods and directed towards innovation strategies, competitiveness, bench-marking and the like. When concerned with learning the research relates mainly to the external environment.

Learning and development of technology connected to the firm-internal environment is weakly investigated in South Africa⁹. Nevertheless, the Industrial Strategy Project (ISP)¹⁰ has repeatedly pointed at the firm-internal problems with the skill development, learning and the strict hierarchy in the SMEs, and the need for a focus on the firm-internal factors to improve the quality and the productivity¹¹. The ISP has found that there are problems with the management of incremental technological changes deriving from the shop floor in South Africa (ISP1997). The Industrial Strategy Project states in Report on the survey of innovative activities in South African manufacturing firms, in October 1997: “*South African manufacturers can no longer rely on a largely underskilled workforce which is not consulted or expected to take initiative in enhancing performance. The sources of innovation are not confined to R&D and technical experts. It is widely recognised that the most successful innovative firms are those with relatively flat structures and participatory management styles.*” (ISP, 1997:73).

Ha-Joon Chang (1998) has investigated how technological progress influences human resources in South Africa. Although his concerns are mainly connected to external issues and the macro level, he points at the fact that technology is critically affected by the work organisation and that the area needs to be highlighted together with problem-solving capacity of the workers. The outcome of Hunter’s research (1998) of the implementation of lean production indicates that there are problems with

the way human resource management has been carried out in such a production system in South Africa. In the automotive components industry Barnes (2001) argues that *“to gain full benefits of operating as a lean producer Human Resource Development and worker empowerment are key”* (Barnes, 2001: 27). He specifies that in relation to lean production this industry has improved competitiveness in four areas, namely cost control, quality, and external and internal flexibility. And two areas where *“firms are either stagnating (Human Resource Development) or falling behind previous performance levels (independent innovation capacity)”* (Barnes, 2001: 246). However, his research does not explore these firm-internal areas further.

All in all, research on South African SMEs points at the existence of development problems connected to internal relations in the firms, connected to the human resource management, the social relations and firm-internal behaviour, and that this area needs more attention in the auto-components and in SMEs in general in South Africa. Qualitative approaches to understand firm internal learning, as is the focus of the present study, are scarce in South Africa, like in other late-industrialised countries¹², and empirical investigations in particular are required.

THE THEORETICAL PERSPECTIVE

The approach should be contextualised within recent increased attention among evolutionary, resource-based and management theories in learning and organisational behaviour (Bessant 2000, Dosi, Nelson & Winter 2000, Dodgson 1993, Leonard-Barton 1996, Turvani 2001, Andreu & Ciborra 1996, Lall 1999, 2000) Dosi, Nelson & Winter have inspired with their perspective on firm behaviour and routines, and John Bessant with his focus on learning and routines as embedded in the working culture of the organisation. An older source of inspiration has been Edith Penrose's (1959) perspective on firm development with its emphasis on resources and capabilities in the understanding of firm development. Leonard-Barton has inspired with her management approach to understand the concept of technology and capability development in firms. Dodgson has been important with his focus on technological learning, and his attempt to use both economic perspectives, which he perceives as more oriented towards results, and the more process oriented understandings of the organisation within known as 'Organisational Learning' perspectives. Andreu and Ciborra have inspired with their approach to capability development through organisational learning. Lall's contribution has been to bring a third world perspective on technological development and capabilities in firms. These perspectives have laid the groundwork, first to

identify what has importance for how organisations learn and develop their technological capabilities, and secondly to use this to analyse what enables internal technological learning by a focus on the resources and the behaviour of the organisation in the specific firm.

How organisations learn and develop their technological capabilities is within the present approach perceived as follows:

The technology

The technology of the firm is understood as comprising both a physical part, of equipment and machinery for the production, and a more intangible part of skills and knowledge of the human resources. The intangible part of the technology embraces an individual level and an organisational level, and constitutes the human and organisational resources, and therefore includes individual and organisational skills and knowledge in the concept. The values and norms in the firm are perceived as influencing the way the machinery, the expertise, and the organisation are used¹³. The understanding to a large extent follows Fransman and Lall and is closer to management and sociological theories. In economics the term is mainly used in the more narrow understanding without including the organisation, e.g. the way Metcalfe (1993) and Sundbo (1998) use the term.

The capabilities

According to the resource-based view on the firm, the capabilities and development are connected to the combination and use of the firm's unique resources (Andreu & Ciborra, 1996). The capabilities are thus unique for each firm, and each firm has to find its own way to develop its capabilities (Bessant 2000:1). The capabilities being investigated in the present study are what some theorists call the technological capabilities (Leonard-Barton 1998, Lall 1999, 2000, Bell & Pavitt 1997), due to the focus on the use and combination of the technological resources. However, this has a further relationship with what other approaches call 'organisational capabilities', due to the combination and use of the resources takes place at the organisational level. Dosi, Nelson and Winter define 'organisational capabilities' as social phenomena, consisting of the know-how that enables organisations to perform their production activities (Dosi, Nelson and Winter 2000:1-2). For the purposes of this framework *technological capability can be perceived as the capacity to combine and use the resources connected to the technology in the firm and carried out through the behaviour of the organisation*¹⁴.

Leonard-Barton distinguishes between supplemental, enabling and core capabilities, where supplemental capabilities are “*nice to have, but not essential*” (Leonard-Barton, 1996:18). The enabling technological capabilities are basic for a firm just to stay on the market. The core technological capabilities are those which make the firm solely more competitive in a global sense. The capabilities in focus related to ordinary SMEs in South Africa are in the present approach perceived as the enabling capabilities and not as the core capabilities that allows firms to be international innovative frontrunners. The enabling capabilities are the ones which should be nurtured just to keep the firm operating in an internationally competitive environment. This is close to Lall’s explanation of the level of the technological capabilities in Africa. He uses the term technology capabilities in the wide sense, to capture all the capabilities involved in improving manufacturing technologies, and which deals with expertise and activities already known in an international perspective (Lall 1999:2). It is furthermore in the line with Figueredo’s perception of technological learning and capability development in Brazil as taking place outside international frontier technology.

Capability development and technological learning

Dosi, Nelson and Winter highlight the importance of understanding how organisations develop, maintain and advance their performance and capabilities. They suggest that capabilities are acquired by use of organisational routines connected to the organisational behaviour, and improved through organisational learning processes (Andreu & Ciborra, 1996:122, Dosi, Nelson & Winter, 2000:14-16¹⁵) Related to the development of the general internal ability to learn in the firms, Bessant describes this as ‘learning capabilities’¹⁶. Much firm behaviour can be called routines¹⁷, in the sense of regular and predictable behaviour and including responses to non-routine problems and unexpected events (Dosi, Nelson & Winter 2000: 12)¹⁸.

According to these researchers, organisational routines should be seen as emerging from work practices, and the activities and values at the organisational level in the firm. Technological learning is perceived as the firm’s ability to improve the use of technology and to develop the technological capabilities. The technological learning processes are shaped by both the organisational routine use of the resources and of the organisational culture related to learning in the enterprise. The development of the firm’s use of the technology is perceived as influenced by the behaviour of the organisation, and the development of the organisational behaviour is influenced by the technology.

Hence, this study argues that important factors for how organisations learn and develop their technological capabilities are a) *their resources* and b) the *routines of organisational behaviour* in the firm related to learning. This includes everything in the firm, which is significant for learning related to:

- a) the technological resources: 1) the machinery and equipment, and the facilities for the employees, 2) the skills and the knowledge of the individual and 3) of the organisation of the firm.
- b) the routines of the organisational behaviour, the work practices of the activities and the values related to how employees acts and interacts related to particular kinds of formal and informal learning like training and problem solving.

The organisational behaviour and the organisational culture

It is well known that enterprises can know ‘how to do things’ in a certain way, which indicates that it is not only individuals who can acquire and hold knowledge. Dosi, Nelson and Winter discuss “*what are the principles that govern how it is acquired, maintained, extended and sometime lost?*” (Dosi, Nelson and Winter, 2000:1). They perceive ‘the behaviour of organisations’ as made feasible through the operation of a complex system of equipment, individual skills and organisational arrangements, and a system, which is a product of a long and complex process of technological and organisational change. Bessant (2000) focuses on learning and routines as a way of understanding organisational behaviour and change. The development of organisational capabilities can within his perspective be perceived as taking place by use of learning capabilities build by organisational routines for enabling learning and consisting of patterns of behaviour which enables the learning (Bessant, 2000:3). The learning capability itself has “*been learned and embedded in the organisational culture*”, consisting of the values and beliefs, which drive the ‘way we do things around here’ (Bessant, 2000:3).

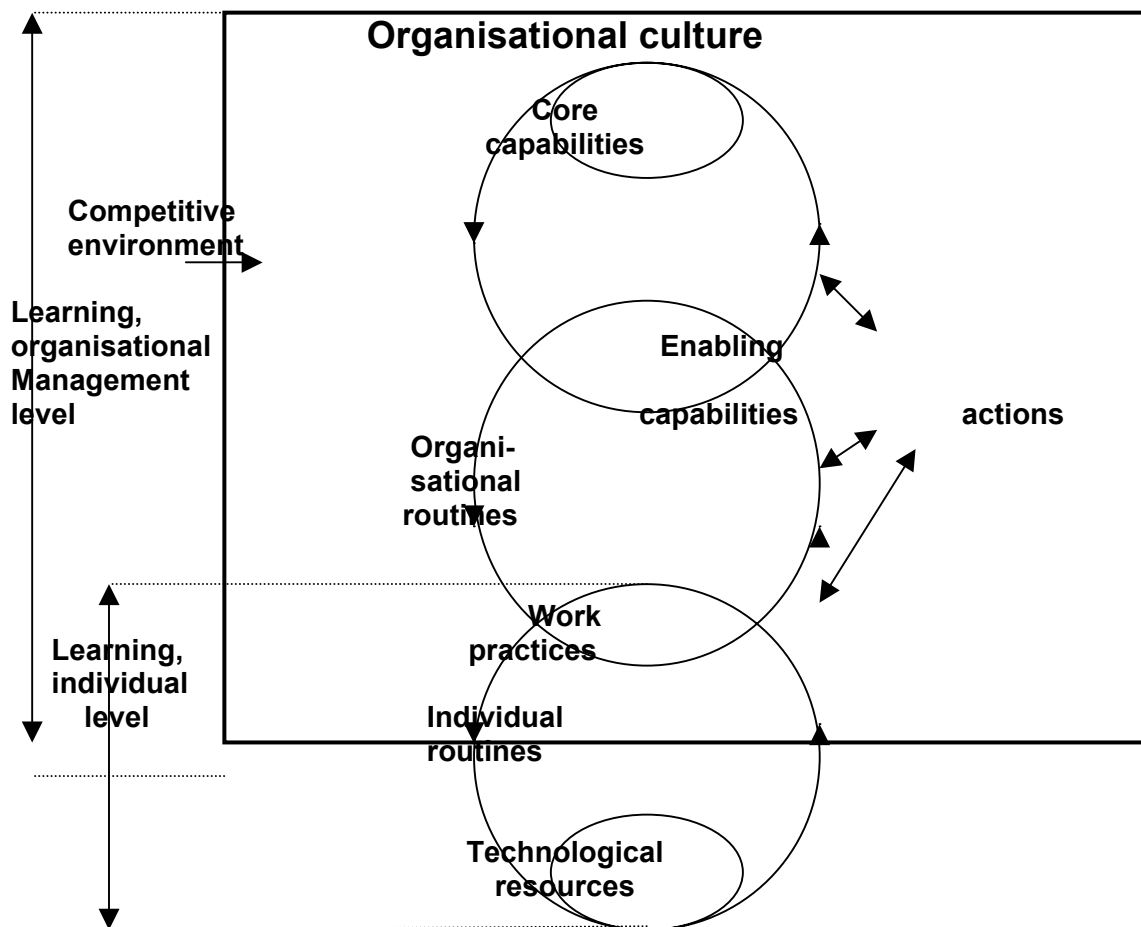
Inspired by Bessant’s view the present study argues that the patterns of the behaviour, the learning routines, are found in the daily work practices and the social relations influenced by the values and norms of the organisation and including formalised relations and informal relations. The social relations and the values influence the way learning takes place, ‘the way we learn around here’¹⁹. The learning routines operate both as an organisational memory of firm specific ways to carry out work practices and solve problems and simultaneous the routines function as an obstacle

for changes of the way the learning takes place. The learning routines can in this context be understood as related to Savolainen's (2000) perception of positive and negative learning cycles.

Dosi, Nelson & Winter explain that the capabilities to a large extent are built by unintentional processes, far from the specific action and outcome, rather than conscious intentions. The capabilities are perceived as rather built by unintentional self-organising, bottom-up processes, than of realisation of intentions (Dosi, Nelson & Winter, 2000:2). Therefore, to realise intentions, the management needs to understand how the learning²⁰ is shaped by the organisational culture and containing both formal and informal work practices and social relations.

The following figure illustrates how the present paper perceives the relations between the capability development, the resources, and the organisational routines for technological learning:

The technological learning processes



Developed from Andreo and Ciborra (1996:128)

Following Dosi, Nelson and Winter (2000) the present approach suggests that the technological learning can be investigated through a study of the above mentioned system of equipment, individual skills and organisational arrangements related to learning, which is here perceived as a firm's technological resources. Following Bessant's argument (2000), the intention is to investigate the routines of the organisational behaviour related to learning by a focus on the work practices in the organisation and organisational culture of the organisation's norms and values.

The development of the firm's technological capability through learning from the daily work practices is analysed in terms of the resources in the firm, and their interaction with the routines of the organisational behaviour, including formal and informal learning. The present investigation analyses the importance of the informal learning and the importance of the formal learning both connected to building technological capabilities.

INVESTIGATION METHOD

The investigation has been carried out as a case study in three metal manufactures in Greater Durban. It consists of participatory observation of the daily work practices and the interaction and relations at the shop floor related to learning, and by semi-structured opened interviews with the employees at different hierarchical levels, and short interviews with all employees. Through these interviews, the investigation focused on the technological resources and explores the work practices, the norms and values for what is perceived as important to improve the technological learning in the firm from the point of view at different levels within the hierarchy. The observations cover the point of view of the researcher²¹. A research assistant has assisted with the interviews, especially with those carried out in Zulu, and partly with the observations.

The investigation referred to in the present paper was carried out in 1999. The enterprises were visited in 2001 with a one-day observation and an interview with the management, mainly to evaluate the outcome from 1999²². The problems, which are highlighted in the present paper, do not reflect precisely the problems in these specific firms have today.

The investigation of the firms is divided in:

The technological resources with importance for learning:

1.1. Physical resources

Intangible resources a) Human resources, and b) Organisational Resources

2. The behaviour of the organisation related to learning

2.1. The formal routines (the work practices and the values) training

2.2. The informal routines (the work practices & values) training and problem solving

The values embrace the opinions of the workers, the middle management and the management and are included in the description connected to the above intangible resources, and the behaviour of the organisation.

The findings are used to discuss what has importance for the upgrading of the resources and the development of the use of the resources in the firm and how the two areas 1) and 2) influence each other.

The technological resources and the behaviour of the organisation at the shop floor is described by use of a phenomenological analysis of the observations, supplied with central statements from the interviews.

However, the present paper does not represent the results from a full phenomenological analysis, due to the fact that only the initial stages have been carried out thus far. The interviews are used to include variations in perceptions of the firm-internal learning, and hereby deepen the understanding.

The organisational culture for firm-internal learning is analysed related to formal and informal routines for a) training and b) problem solving.

These learning routines are related to the technological resources to discuss how the learning routines influence and are influenced by the resources.

SUMMARY OF THE IMMEDIATE FINDINGS IN THE THREE FIRMS

Characteristics, the three firms

The automotive component sector, firm I and II

Firm I is around 18 years old and has 66 employees of which more than one third are employed in the middle management. It is White owned and managed by patriarchal management practice carried out top down and with emphasis on control, however delivered with some caring aspects as well. The firm operates in the area of high precision machine processing with 20 CNC machines. The firm has no formalised R&D, but continuously ongoing experiments related to improvements of production

methods. The firm is ISO 9002 certified and is preparing to move into export as well.

Firm II was established in 1996, has 88 employees, and is White owned and managed with 7 in the middle management, however a few skilled workers have a position, which seems in between middle management and workers. The management style is inspired by modern Japanese management theories, however applied by a top-down approach with an emphasis on control. The production is carried out in light steel processing of metal sheets and tubes with 3 CNC steered machines of which one operates with laser cutting. The firm has a formal R&D department, however without 'Research' and only a limited amount of 'Development', mainly on customers' requirements. The firm is ISO 9002 certified and initiated a limited amount of export in 1999.

General metal enterprise, firm III

Firm III is 5 years old and has 38 employees, with 5 in the middle management. It is Black owned and managed. The management practice seems to be inspired by modern ideas of encouraging continuous development of the operators through informal skill development and emphasis on building responsibility and confidence. The production is connected to heavy steel constructions, tube welding and boiler making. They are not using CNC machines or other more advanced machines. The firm has no R&D activities, although they do some modifications of the product in collaboration with the customers. The firm was in the final preparations for ISO 9002 certification, and have plans for expanding into exports.

THE TECHNOLOGICAL RESOURCES AND ORGANISATIONAL BEHAVIOUR IN THE THREE FIRMS

The three firms vary in their technological resources with importance for learning but mainly in their organisational behaviour related to learning. The following compares the three firms in these areas.

The technological resources with importance for learning

Related to the physical resource development it has been found that firm I and II have some routines linked to regular investments in new and advanced machinery, where firm III seems to focus on development on a lower technological level with purchase of electric hand tools and safety equipment, and have no larger investments in new technical areas.

The human resource development in firms I and II has mainly been directed towards the skills of the middle management. The training of the semiskilled has been connected to routine - and task specific operations of the machines, and in firm II furthermore of training of peers and routine maintenance. As a senior manager expresses: “the training is only task specific”(interview 1, firm I). The human resource development in firm III is mainly directed towards the development of the individual skills of the semiskilled on their initiative. There are no routines for development of the middle management in firm III. As a senior manager explains it is not structured training as such, but “ an approach stressing the values of sharing knowledge and stimulating the workers desire of acquire new skills ... the workers should be trained in problem solving and taking a helicopter view on things” (interview 2, firm III). The workers in firm I and II found their level of challenges in the daily work as too low, because of the limited work portfolio and access to variation in the daily activities. A worker tells: “There is nothing that builds a person in this place ... you learn on your own” (short interview, firm I) And the operators in firm III were satisfied with the level of challenges connected to the production in spite of the less advanced technical level, because of their general access to develop their skills. A operator describes the situation as “the foreman asked each and every bit of us here, what you will like to be ...here. I told him I would like to be a welder”, and another tells “They (the management) treat us nicely, the way they teach us too” (short interviews, firm III) The organisational resource development in firm I and II is directed towards information exchange between the management and the middle management, and does not include the operators. There exists a multitude of ideas among the operators related to improvement of the production and the methods in the firms, which are not used within the present routines. The effect of this is intensified by an organisational culture, which does not support informal information exchange. There seems to be a potential for partial delegation of the working areas of the middle management to the semiskilled in firm I. The investigation found that the formal R&D department in firm II is mainly used to find out how to produce the products that the customers require. Although the management in firm I expressed (interview 1) that they had no R&D, the observations found that there was continuous product and process development taken place on spare machines by the middle manager in charge of the production. There seems to be more genuine emphasises in firm I on continuous improvements than in firm II.

In firm III there is lack of a formal system, which brings the experiences together and takes action to prevent future incidents. Unexpected events

are therefore not likely to affect the organisational routines. The informal organisational culture seems to some extent to substitute the absence of more formalised routines and somehow to substitute the weak formal information exchange. Nevertheless, the firm still appears to be a weak organisational learner. There was no R&D activity going on during the period of observation.

The behaviour of the organisation related to learning

In all the three firms the workers are positive towards receiving more formal technical training. However, in firm I and II the formal training is only supported at the level of the middle management, and in firm III the formal training has been postponed until now. Certification of internal training seems to be a more expressed desire among the black workers than among coloured workers.

In general it has been found that some workers with a limited basic school education can be trained to run advanced machines (CNC) (firm II), and that it is not the formal education as such²³, which determines if the single worker can increase capacity. What has importance seems to be “*a balance between basic school and hands-on*”, however, hands-on is the most important (interview 1, firm I). It is furthermore found that the management expectations towards the worker’s ability to develop are obvious for it to occur, together with the creation of the possibility for that training to take place.

The management practice related to learning is found to be significant for if the organisational culture encourages learning in all the firms. Expectations and the management practice towards how errors are treated seem to be an indicator for how the organisational routines function and to learning from events. If an unexpected event happens it is likely that the knowledge is shared in the supportive environment of firm III and not shared in an atmosphere characterised by anger and fear especially in firm II. As one of the operators formulates his view on firm I: “This Indian (the supervisor) is not doing anything wrong against us, but we are afraid of saying something about the race relations, because we are afraid of losing the jobs”; and another worker: “The way I see that work can be improved is that we must work as a team. Because if the team and players are not in good relations, it will not win. I think if we want to develop this company, we shouldn’t discriminate by saying you are an Indian and you are an African and you are white. The same applies to the employer. He must not take or relate to people as Indians, whites or Africans. He must know that he is building that will win. Work will improve significantly if things are handled in this way. But if there is racial discrimination

between Africans, Indians and whites there won't be any improvement. This is the way I see this issue" (short interview, firm I). The operators in firm II tell: "if you work without being consulted, work does not improved", and "Supervisors need to co-operate with the work men to make him productive, not to make people angry, not to harsh people around, use vulgar language against tem like some of the management do ... swearing at people" (short interviews, firm II).

The behaviour of the organisation in firm I and II seems to be affected by a negative learning cycle²⁴ connected to learning, which reinforces itself, because of resistance from the workers towards initiatives from the management. The level of rework increases and the chance that the situation will improve on its next occurrence is low. As one of the senior managers in firm II describe the situation: "They know it is not right [the production], but they will say 'well, I did my production' ... and a lot of them will rather stand and do nothing and wait for you to come, if a problem appears and they don't know what to do about it" (Interview 1, firm II). And from the workers point of view: "...this thing of a supervisor shouting at you, he knows nothing about how this job start and how it ends. He just shouts and says 'leave this' and 'do that' ..That creates slow down". The workers pay for costs connected to accidents where the workers feel "they (the management) don't really investigate why the error took place" (interview 3, firm II) and "a person went and used the wrong material and he is still paying for it" (interview 3, firm II). Uncertainty in employment situation seems to support the development of the negative approach to support organisational learning. An operator explains: "When someone wants to learn, how can you teach him everything, then you can get fired". Although the workers sometimes help each other, in firm II they are reluctant to share knowledge with colleagues or superiors. What the management explains as training in firm I is by the operators perceived as a warning or discipline. In both firms it has been found that the negative learning cycle reduces the possibility for occasional events and accidents to become opportunities for organisational learning.

By contrast, firm III has an organisational behaviour with a positive learning cycle. The individual skill development is perceived by the management as taking place due to importance given to keep the operators mentally active by continuously broadening their skills and their understanding of the work processes. The observations found that this approach was applied in practice at the shop floor.

Summing up firm I and II from the automotive component sector have some supportive routines for learning at the organisational level, along with a limited technological learning at the individual level. Firm III, the metal enterprise, has an organisational culture which encourages individual skill development, however with weak structures to support routines for technological learning at the organisational level.

THE TECHNOLOGICAL RESOURCES AND THE BEHAVIOUR OF THE ORGANISATION

Both increasing technical demands and internal training are in the three firms found to be important to improve the technological resources at the individual level. The organisational behaviour has been found to be a significant factor as to whether technological learning takes place. Technical training seems to result in technological learning when the organisational culture is dominated by confidence and responsibility as in firm III, and results in a limited outcome in the organisational culture characterised by control and mistrust in firms I and II.

In all the three firms it has been apparent that the physical conditions for the work and the facilities for the workers reinforce the general organisational culture towards learning. In firm II and to some extent in firm I the workers seem to add inadequate labour facilities to their negative perception of the firm, which again creates more anger²⁵. This finding includes the approach towards safety, changing and eating facilities. The workers in firm III seem to accept areas with inadequate working conditions and poor personal facilities, when they feel that they are taken seriously and are been listen to.

It is found that both the formal organisational routines and the informal organisational behaviour including expectations and trust seem to be crucial for the technological learning at the organisational level.

DISCUSSION

The paper discusses firm internal capability development and ability to learn connected to technology. The importance of the organisational behaviour and the informal learning environment has especially been highlighted related to whether or not technological learning occurs. The discussion has been connected to a case study of three enterprises in South Africa, two within the auto-component sector and one general metal enterprise.

The case study shows that the organisational behaviour has high importance for whether or not internal technological learning takes place and the way in which it takes place in the three firms. It is found that the organisational behaviour influences the development of technological resources and the technology influences the organisational behaviour connected to learning. In particular, it has been found that the organisational behaviour has significant influence on the internal formal training and upgrading of skills and is increasing the likelihood for informal organisational learning.

The case study illustrates that the two auto components firms I and II, have an organisational behaviour which mainly seems to restrict the technological learning, while firm III, has to a large extent succeeded in supporting technological learning. The case study shows that although the management in firms I and II, from their perspective, try to upgrade the employees, their efforts only have a limited outcome, and does not attain the intended outcomes. It seems that the training routines are accomplished at the level of the middle management and that there are formal and informal routines for information exchange between the middle management and the senior management. However, at the level of the operators, the organisational behaviour limits the outcome of the formal upgrading of skills, and especially limits the informal skill development. In these cases, knowledge seems to be kept individually and not shared, which limits the possibility for that organisational learning takes place.

It appears like the management in these two firms somehow is aware of the importance of the informal learning routines to develop the production. Nevertheless, it is not recognised that the informal learning is closely connected to the organisational behaviour, and that the organisational behaviour does not support the learning in these two firms. It has not been the task of the present study to evaluate if this situation has emerged due to the history of the firms or due to other reasons. However, to create a supportive informal learning environment requires a change in the present organisational culture and behaviour in these firms. The difficulties with using the resources and bringing events and experience into organisational learning appears in the two firms linked to 1) the lack of importance given to the informal learning, 2) lack of inclusion of the operators in the organisational learning, and 3) to the locked positions, which influence the way the organisations behave regarding both the operators and the management. It is not an easy task to change the organisational behaviour, because it is built into the norms and values of the routines in the behavioural culture.

According to Leonard-Barton's scale related to the difficulties of changing technological capabilities, the most difficult part to change is aspects related to values and norms. This means that the most troublesome task is to change the perception of how the employees relate to the work and relate to each other, here embraced under the term organisational behaviour. Following Leonard-Barton it is much easier to implement changes in the physical resources and here after the human resources, and followed by the management system (Leonard-Barton, 1998)

The change of organisational behaviour is even more complicated when the behaviour is bound to a negative learning cycle, because new initiative will immediately be met with suspicion from the workers or prejudice from the management, the negative learning cycle reinforces itself. It should be expected that the difficulties to change the organisational behaviour are not similar in firm I and II. In firm I the operators both seem to be aware of the problems and showed a collaborative approach related to change of the culture. However, the management practice of the firm seems to have been carried out in the same way for a long period, and has not been oriented towards change in the organisational behaviour. In firm II the main problem seems to be connected to the workers' widespread negative approach towards the firm, and the management seems here to be more oriented towards change than in firm I.

To create a learning enterprise requires an organisational behaviour with interactive participation of all employees, and where the social processes of collaboration and communication are stressed throughout all levels, due to modern theories of learning based competition (B-A Lundvall, 2000). A learning enterprise needs a behavioural culture, which supports the use of knowledge from all employees at the organisational level to improve production. Learning in an organisation like an enterprise requires opportunity for experimental reflections for everyone, formal training is not sufficient (Lindved Madsen, 1998:7). Particularly if more advanced forms for productive organisational learning is required, it implies a reflective inquiry of the individuals to change values and action frames (Argyris & Schön, 1996:xxiii). In the creation of a learning firm it is crucial to take into account both the formal structures which enhance learning and the 'behavioural world' of the organisation, which includes informal manners, which condition the patterns of interaction (Argyris & Schön, 1996:29).

The case study illustrates a third firm with an organisational behaviour, which supports an informal, general upgrading of the operators' technological understanding. The management supports the development of a broad insight in the work processes and encourages the individual skill development of the operators in practice. The workers take initiatives by themselves and train each other in a supportive manner. The middle management and the operators have the same view towards what is going on and what is possible in the firm, and the behaviour is characterised by confidence towards the ability and the effort of the individual. It seems like that the management in firm III to a large extent has managed to create an organisational culture, which supports an ongoing informal upgrading of the operators, and organisational learning connected to the informal routines. Although they seem to have a positive learning cycle, it appears that the management can easily jeopardise the situation if they do not offer the promised formal training courses, or in other ways create disillusionment among the operators.

It has been apparent from the case study that management practice makes a difference, and that management practice is important for how the organisational behaviour occurs in these South African firms²⁶. The case study shows that it has been possible for the management in firm III to implement a specific vision of how to create responsible operators instead of controlled ones, and employees who develop their skills themselves. This seems to be related to a management who has an understanding of the creation of these processes as linked to general support of the internal training within an atmosphere of mutual trust. It seems furthermore to be connected to a management who has insisted and ensured that the vision is understood and implemented in the original spirit, that both the middle management and the operators perceive the meaning of what is acceptable and what is not.

Some of the findings are maybe ordinary within a western context and understanding of firm development. However, it is found that this is not the case in the investigated firms in South Africa. There seems to be a lack of recognition in the management of the importance of the informal behaviour of the organisation, especially if the firms are managed through a strict hierarchy and emphasise control. There seems furthermore to be a problem with understanding the influence of the resources on the organisational behaviour, and of the influence of the organisational behaviour on the value of the resources. Or in other words: Both the technical level of the equipment, the level of the human resources and the organisational behaviour are important to improve technological learning. The learning can be limited because of the low level of the challenges, or

if the organisational culture of the firm does not support individual or organisation learning. To enable technological learning at the firm level it seems necessary to create both a formal system to permit the desired kind of learning and to secure that the informal behavioural of the organisation supports this development.

CONCLUSION AND PERSPECTIVES

The auto-component sector in general has restructured in South Africa during the second half of the 90s and in some areas achieved success related to expansion into exports and improved productivity. However, the sector has still not met the expectations of reaching the required international standards in all areas of the production and the level of their international competitors (A. Black, 2002). Barnes' (2001) recent research has pointed at that the weak areas in the industry are connected to the human resources and innovation capacity, however without exploring the origin of these firm internal problems. The present paper argues that to reach world class performance is necessary to create firms, which continuously develop their technological capability, e.g. their ability to combine, use and develop their existing skills, knowledge and machinery. The paper has investigated this by a focus on the technology and learning, and refers to a case study of three metal enterprises of which two are in the auto-component sector. The paper addresses the importance of internal and especially informal relations and organisational behaviour to create a learning enterprise and develop the technology.

The two investigated auto-component firms have restructured to improve their productivity. One of the firms has expanded into export, the other one preparing for it. Although the firms have restructured to meet the international standards of the sector, the restructuring has only taken place in certain areas, and does not include the internal organisational behaviour. In the two investigated auto-component enterprises the informal organisational behaviour has been found to be a significant obstacle for the creation of continuous ongoing learning. It is furthermore found that a third firm has been able to create a supportive organisational behaviour, which encourages continuous upgrading and demonstrates responsibility at all levels, in the same type of firm, industrial area, surrounding culture and available labour.

It appears from the two auto-component firms that there are prospects for increasing the outcome of technical investments with a focus on internal relations. These problems might be more widespread than the two case

firms and thus the MIDP and other enterprise supporting programs should emphasise progress regarding internal relations. However, the findings in the present research are generated from qualitative studies within a few enterprises with the purpose of understanding processes. To uncover how widespread and general the findings are in South Africa implies further quantitative oriented investigations.

An issue for policy makers related to the present findings will be to approach the emphasis on the internal and especially the informal obstacle to firm development. It seems to be important to be aware of how the informal learning and organisational behaviour occurs with the purpose 1) of improving existing performance and competitiveness, and 2) including this in the implementation of change strategies for firm performance, which aim to improve technological learning in these kinds of firms in South Africa.

It is the aim that the analysis of the case studies can inspire managers in the South African auto-component, other metal manufactures and more widely among SMEs in their identification of what influence the internal learning. It is hoped that the study can add knowledge about the importance of the organisational behaviour related to technological learning at the shop floor, how ordinary employees at different levels think and act in relation to learning.

FOOTNOTES

1. Tidd, Bessant and Pavitt (2001:311-340). Palle Rasmussen, 1999 (the Danish Knowledge Centre for Learning Processes) the importance of understanding the multitude of the learning processes connected to work, and to make this learning visible to improve the outcome.
2. E.g. see Sonia Bendix (2001:304) in Industrial relations in South Africa. Here technological development is perceived as the enterprise's response to change in market conditions. According to the development economist Sanyaya Lall such approaches overlook, that technology is more than technique and treat the process of skill development as oversimplified and connected to insufficient distinction between 'formal skills' and 'experience-based learning' at the individual level and at the organisational level ignores the importance of the capabilities which includes the firm's use of both formal and informal skills and work practices (Lall 2000:2-5 and 27-28).

3. E.g. Lawrence Edwards, paper, TIPS Annual forum 2002.
4. This concept is close to Bessant's understanding of organisational culture as the "*underlying mixture of values and beliefs which drives the 'way we do things around here'*" (2000:3). It is furthermore inspired by Schein and Mary Jo Hatch, and connected to Leonard-Barton's perception of a learning environment, which includes the activities of problem solving, implementing new methodologies, and formal and informal experimentation (1998:8)
5. Pavitt distinguishes between firms, which are 'scale intensive', 'supplier dominated', 'specialised suppliers', or 'science based' (Pavitt 1984, 1999) in relation to the management of technical change.
6. Driving competitiveness: An integrated industrial strategy for sustainable employment and growth'. DTI, May 2001, passages 5.-7. and appendix.
7. Connected to DPRU, Development Policy Research Unit.
8. SoDS, *School of development Studies*, Industrial Restructuring Project.
9. This was confirmed by key researchers at the TIPS Annual forum 2002.
10. University of Cape Town.
11. E.g. Joffe et al 1995, "Improving manufacturing performance in South Africa", and ISP, 1997 "Innovation patterns in South African Manufacturing Firms".
12. Figueriedo, 2002:73.
13. Lall perceives technology as the whole range of capabilities involved in importing, absorbing, adapting and improving upon manufacturing technologies. From a management perspective Leonard-Barton (1998: 18) divides the technological capabilities in the physical system, the skills and knowledge, the management system and the norms and values. However, inspired by Bessant (2000), the present approach finds it more beneficial to include the

organisation instead of the more narrow ‘management system’, and to view values as influencing the other areas within the technology.

14. Dosi, Nelson & Winter (2000) perceive capabilities as reflecting the reliable capacity an organisation use to realise an intended outcome. They emphasise the difference between possessing a capability and how it is exercised, through the behaviour of the organisation.
15. Routines in Dosi, Nelson and Winter’s understanding in 2000 are equal to organisational routines, individual routines are perceived as skills. This should be seen in contrast to Nelson & Winter 82, according to Dosi, Nelson and Winter 2000.
16. The concept is described slightly different among theorist, e.g. Leonard Barton (1996) uses the term ‘enabling capabilities’ for learning, Bessant describes organisational routines for enabling learning as ‘learning capabilities’.
17. The organisational behaviour is more than routines regarding to Dosi, Nelson & Winter (2000: 2-4).
18. March & Simon see problem-solving as short-run adaptiveness and long run adaptiveness as learning. However, the present approach finds that although problem-solving can have very short term perspectives, the way problem solving occurs (or is absent) can give an insight in the firm’s ability to learn from the daily work practices.
19. This refers to Bessant (2000) use of ‘the way we do things around here’, perceived as the working routines embedded in the organisational culture, where Bessant refers to E. Schein’s perception of organisational culture (1984), and Dosi, Nelson & Winter mention the general difficulty about describing routines except within loose terms as ‘the way things are done around here’ (2000:4).
20. Connected to Mary Jo Hatch’s understanding (2001:230)
21. This is close to the suggestion of the director of the Danish Knowledge Centre for Learning Processes to investigate the multitude of the learning processes connected to work by establishing an overview over the informal learning and or by letting the workers reflect over what they have learned. A way to improve

the learning outcome is to know how it takes place now (Palle Rasmussen, 1999).

22. The management in all the firms found that the immediate findings and feed back given in 1999 was central, and they all referred to that in details during the interviews in 2001. This can be perceived as increasing the validity of the research. All the firms had implemented some of the suggestions from the findings, and had plans for implementing others. This indicates that: 1. The management in the three firms perceived the findings as central and important. 2. The three enterprises all had substantial changes, and had included some of the recommendations in the change.
23. However, this does not indicate that a higher level of formal training might not increase the speed of the process, - and the general understanding of the process.
24. Following Savolainen's (2000) use of the term.
25. This could be an enforced problem in a South African context. Several workers refer to that they do not want to feel 'enslaved' after the apartheid has been cancelled. However, they fear for losing their jobs and act obstructively where it will not be noticed.
26. Mary Jo Hatch argues that management might have the highest influence of the organisational practice, because of their visibility and power. However, there is no guarantee for that these intentions are understood and followed by other members of the organisation (Mary Jo Hatch, 2001:260).

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