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Ways of Organisational Learning
in the Chemical Industry
and their Impact on Vocational
Education and Training

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1. Introduction

Martin Fischer

How to conceptualise and to investigate organisational learning in the “learning company”?

Terms like the "learning company" or "learning organisation" have recently become popular terms used to describe a new quality of learning within companies. However, when one tries to explore this new quality of learning to some depth, one is immediately confronted with a score of books and articles that begin with a somewhat mysterious definition of "organisational learning" or the "learning company". As Probst and Büchel (1998: 19) explain,

Learning by organisations is not the same as the sum of individual learning and behaviour. On the one hand, there are pieces of individual knowledge, which are neither known nor accessible to organisations. On the other hand, organisations are able to retain pieces of knowledge in their cognitive systems that are no longer part of any individual's pool of knowledge. Consequently, organisations can have more as well as less knowledge as the sum of individuals within the organisation. But while it may seem understandable that the knowledge of an organisation can be poorer than the total knowledge of the individuals who constitute the organisation, the contrary is more difficult to comprehend.

This definition, like many others (e.g. Senge, 1997:171; Sonntag, 1996: 67) considers individual learning processes as a precondition for organisational learning. It also emphasises that organisational learning is different from and should be regarded as more than the sum of individual learning processes.

But to Vocational Education and Training (VET) specialist, Karlheinz Geißler from Munich, this is nonsense. He criticises the current discussion on the “learning company” or the “learning organisation” for disconnecting the concept of learning from the learning individual and creating a semantics debate (Geißler & Orthey 1996). So the question becomes one of understanding what companies actually do if they claim to be a learning company. To answer this question and to understand what is different about a learning company, it is necessary to refer to key concepts of the learning organisation as well as to empirical measures and to relate these to each other. Otherwise the difference between organisational learning and individual learning in companies on the one hand, and common measures of corporate restructuring on the other, would remain unclear.

It is the objective of the OrgLearn project to identify ways of organisational learning in the European chemical industry and to investigate their impact on vocational education and training. The literature review which follows will thus attempt to clarify the concept of the "learning company". An attempt will also be made to identify conditions under which it is justifiable to speak of a "learning company" as differentiated from learning individuals and corporate restructuring. Furthermore, empirical tendencies which concur with the concept of a "learning company" will be discussed and trends in the chemical industry in participating countries (Belgium, Germany, Italy and the UK) will be described. Finally criteria for a "learning company" will be derived from the literature review which will be used in the final selection of the partner companies that will participate in the OrgLearn project. These criteria will also define the key areas for the empirical investigations in these companies.

This report is structured into three main sections:

- Theoretical considerations and empirical studies of organisational learning.
- Empirical trends in the chemical industry.
- Criteria for organisational learning in a "learning company".

Theoretical considerations and empirical studies of organisational learning

The first contribution by Rik Huys and Geert van Hootegem is written from a sociological background and represents the meso- and macro-level of analysis. The

main focus is on the question of how standardised working and learning procedures are formed and organised within a learning company. It is argued, against a widespread understanding, that even in a learning company a mixture of standardised as well as of non-standardised learning and working procedures can be found. The relations between them and their mutual interdependencies are relevant for opening up or alternatively, decreasing the scope for learning in a company.

But how can this be understood at the micro level of analysis, that is, at the level of learning in the workplace? This is the starting point of the treatise by Maria-Christina Stafylarakis. Corresponding to some extent to the aforementioned processes of standardisation and non-standardisation, she identifies two main approaches towards learning in the workplace, namely, the behavioristic school of organisationally-directed training practice on the one hand, and the andragogical self-directed learning theory on the other. Within a conceptual matrix, Stafylarakis illustrates how these two approaches can potentially be reconciled, her main assumption being that learners need support in order to move up the continuum towards self directed-learning. She then goes on to review theories of organisational learning in order to ascertain which such theories and practices can contribute towards this move. The author comes to the conclusion that interventionist approaches towards organisational learning which focus on the individual as the primary learning agent, offer a more pragmatic understanding of how to stimulate self-directed learning processes even though such approaches are highly normative in their explanations instead of describing an existing reality.

In a similar vein to Stafylarakis, Michele Mariani's contribution focuses on a wide spectrum of theories and approaches ranging from individual learning in the workplace and situated learning in communities of practice to organisational learning at the company level. He reasons that many of these theories and approaches, in spite of their diversity, stand on common ground in that they are implicitly or explicitly oriented towards the economic success of the company. But such a view widely excludes and subordinates the well-being of the individual and the prosperity of society. Mariani thus argues that the objective of the OrgLearn project (e.g. to identify good practices of organisational learning) makes it necessary to move towards a unified view of the individual, the organisation and society. This means that theories of organisational learning should not exclude individual and societal perspectives.

As Stafylarakis points out, there is a remarkable discrepancy between the number of publications on concepts of organisational learning and the number of empirical investigations which deal with concrete reality in organisations. In Peter Roeben's review of research literature on empirical studies of organisational learning a sample of investigations is introduced with the intention of closing the gap between theory and

practise. Visions of a learning company, communication procedures, elements of a learning culture, measures of personal development, and so on, are reported as indicative of a learning company. However, as Roeben points out, within these descriptions, a number of contradictions arise concerning the analysis as well as the theoretical conclusions of the authors. Roeben further detects a short circuit in such expositions. Instead of explicitly describing the processes of organisational learning within these companies, most authors conclude from the economic success of the organisations that organisational learning must have happened. Thus Roeben reveals that the same shortcomings emphasised by Mariani's critique of theories of organisational learning are also true of empirical investigations on the subject. Obviously then, empirical investigations are needed which include the perspectives of the individual, the company and society and which are differentiated from the economic success of the company. This would suggest that a separate investigation is needed to determine economic success.

Empirical trends in the chemical industry.

The second section of this report consists of country studies from Germany, the UK, Italy and Belgium which intend to figure out trends in the European chemical industry. It is pointed out that in all the countries involved, the chemical industry represents a large proportion of each national production sector in terms of the money invested and the number of people employed (even if one considers that the size of the labour force has been massively reduced in all these countries during the last years). Globalisation is often used as a catchword. In the chemical industry, empirical trends as the reaction or anticipation of global competition can be directly observed. They form a picture of a fast changing world in the chemical sector:

Merging and separating business units on a global level

One of the most impressive trends in business involves the ongoing merging and acquisition of enterprises and the separating and outsourcing of businesses - not only on a European but on a global level. Even in the relatively short duration of co-operation between the OrgLearn project and the potential partner companies this phenomenon has been observed several times. Countries are influenced by this trend in different ways: while there is a tendency towards foreign ownership in the UK, such a tendency is not true for Germany. In any case, these processes of merging and separating companies form an important stimulus towards organisational learning in the following ways:

- Enterprises are seeking an organisational structure that is appropriate for permanent change. However, this does not necessarily imply normative decisions concerning the organisational structure, e.g. the reduction of labour division or introduction of teamwork.
- Enterprises are interested in introducing organisational learning processes which allow for international co-operation and collaboration at different levels of the enterprise - not only the upper management.
- Enterprises are looking for ways of learning across organisational barriers, e.g. collaboration of a production unit with a research and development department which previously had been outsourced or concentrated in another location.

New forms of human resources development

Apart from a trend towards a new aggregation of business units according to changing market conditions, processes of change within these business units are of particular interest. Obviously companies in the chemical sector feel a need to engage in human resources development due to different reasons:

One reason lies in the fact that the chemical industry is dependent on research results from the natural and engineering sciences. These research results have to be put into practice as quickly as possible using the best possible quality products and production processes. The time needed from the invention and design of a possible product to market appearance is nowadays one of the most important factors within global competition (cost reduction is also relevant, but here, the scope for the European chemical industry is limited in comparison to low-wage-countries throughout the world). Factors for reducing the time taken from the product design phase to market appearance include all kinds of staff such as personnel from the research and development department, as well as maintenance technicians and operators on the production level who have to cope with different variations and batches of production processes under rigorous time constraints.

Another reason for human resources development lies in the fact that chemical companies in all European countries tend to improve their reliability and their safety regulations (including health and environmental protection), partly due to new safety regulations and environmental laws and partly due to the advantages of increased reliability. This is important because the European industry is in competition with production units in non-European countries where production costs might be much lower but where the reliability of production processes is lower too. High reliability and safety needs suggest the need for enhanced competencies of the production staff. This cannot be achieved by qualifications that are structured according to narrow job routines.

All in all there is an actual need for human resources development in the European chemical industry. However, it is of particular interest that in this situation some forms of human resources development are obviously of minor importance (for e.g. formal classroom teaching and training courses), whereas work-related opportunities for learning are gaining major importance. Consequently, new forms of human resources development (HRD) are being considered. They deal with the question of how the organisation can be transformed in order to stimulate work-related learning processes of their members. For this goal, measures of non-personal HRD (further development of the organisational structure), interpersonal HRD (opportunities for teamwork) and personal HRD (personal attitudes and competencies towards organisational learning) are being implemented in order to achieve measures of a culture of organisational learning.

Criteria for organisational learning in a learning company

While it does not seem to be a matter of dispute that companies from the European chemical sector tend to stimulate and to establish processes of organisational learning it has to be questioned how they do this. By reviewing the relevant literature, a number of deficiencies and open questions could be found in the theoretical approaches to organisational learning and in the empirical research. In order to differentiate between organisational learning and

- individual learning in companies on one hand and
- common measures of corporate restructuring on the other,

the OrgLearn project has developed a set of criteria for organisational learning. For this purpose theoretical approaches and empirical findings had to be restructured and reformulated. These criteria are presented in the final part of this report. They have led to the final selection of partner companies and they will guide the empirical research of the scientific partners.

4 Conclusion

Theoretical concepts of organisational learning talk about learning beyond the individual learning of the employees. As a common denominator they share a focus on the companies' practice of systemic reflection and change in the company culture (cf Argyris & Schön 1978; Schein 1992/1995; Senge 1996, 1997; H. Geißler 1996). This is the only serious definition that can be adhered to if one is interested in discussing organisational and not only individual learning. Most of the authors mentioned in this report write about company culture in terms of its instrumental dimension – as a means to achieve economic success. Therefore the political and social dimensions of a learning company are likely to be ignored or mentioned only with regards to their economic

effects. Furthermore it becomes evident in many of these approaches that the work processes and the point of view of management can only change if a systemic learning culture is created in the company. But what this signifies for the daily work of the single worker or employee and what it means for vocational learning inside and outside the company is not as clear.

From the existing case studies it can be concluded that vocational learning in learning companies has to deal with the following ambiguity: Learning reaches all spheres of a company. Some demanding and varied tasks are created, which are carried out under circumstances of partial self-organisation. A direct feedback on the consequences of one's own actions can become possible as well as an exchange of experience and knowledge within the company. On the other hand, as studies from Germany have suggested (cf Fischer 1998), the carrying out of such tasks may enhance one's personal professional identity but this may be different from the learning of the company.

The development and use of knowledge within a company has always been a cause for dispute with regards to its usefulness for the individual or the company respectively. The concept of the learning company interprets this dispute anew (cf Ostendorf 1998). That someone learns for *his/her* own sake is still allowed or even desirable – but only under the condition that the company directly profits from such learning . Whether the learning brings in a *return* for the individual as well, is not certain. The case study of a particularly innovative chemical company in Italy (Mariani & Parlangeli 1999) shows that the employment of qualified workers for a limited period of time is implemented as a conscious strategy of organisational learning (aiming at stimulating an exchange of knowledge and experience in the company). But this did not necessarily result in permanent employment for the concerned individuals.

Whether and how this ambiguity is going to be dealt with in the context of different corporate strategies of organisational learning or in the context of diverse education systems and learning structures, or whether the ambiguity is ever resolved is a question for further empirical research. In this context, it is important that the *consequences* on vocational structures and the forms/ contents of vocational education are analysed as well as the *contributions* made by people who have gone through vocational education within the processes of organisational learning (cf Georg 1996: 655). Finally the *return* of organisational learning for individuals and companies needs to be analysed further too.

Education specialists tend to be rather uncritical concerning anybody's practice if only the term "learning" is used for it. Therefore we often have to register a one-sided view of organisational learning. The company implements structures and processes of

organisational learning and then the individual as well as the VET-system have to be adjusted. I would suggest a bidirectional view of organisational learning: Input and output should be carefully analysed with respect to the company, the individual and, last but not least, the VET system that organisational learning is embedded in.

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2. Theoretical considerations and empirical studies of organisational learning

Rik Huys & Geert Van Hootegem

Organisational learning through standardisation and non standardisation

A review of some perspectives on organisational learning

One of the main ways of defining organisational learning involves clarifying what it isn't and distinguishing it from the more familiar concept of individual learning, where the latter can be defined as the continuous development of skills that are necessary for individuals to perform in line with changing job demands. The notion that individual learning, or at least, that the opportunity to learn in the workplace is one of the corner stones of a good quality of work life is deeply rooted in a 'human-centred' approach to work organisation.

But how does this individual learning relate to organisational learning? Some authors barely make the distinction and suggest that the individual learning of workers aggregates in a linear fashion to provide the basis for organisational learning, their argument being that the knowledge worker is central to the organisation's performance in the 'knowledge society'. Pralahad, for instance, feels that much of corporate downsizing represents a lost opportunity in that what the older employees have learned disappears. He posits,

"Think what might have happened if companies had used all the 'redundant' brainpower that they got rid of to imagine new markets for tomorrow, or to build new core competencies that would give them an advantage in those markets."
(cited in Gibson, 1997: 65)

But an organisation that is so heavily dependent on what its individuals have learned is typically characteristic of a lack of learning at the organisational level. Other authors thus make the distinction between individual and organisational learning and suggest that the latter is a kind of 'organisational culture' in which individual learning is encouraged. Here, organisational learning comes down to what others more precisely label 'a learning oriented organisation' (e.g. Verdonck, 1995). The idea that organisational learning is in some way dependent on the capability of its individuals to learn is thus still accepted, but this view considers individual learning as more of a necessary rather than a sufficient condition for organisational learning to take place.

However, other theorists cast doubt on this plausible relationship by arguing that organisational learning is quite possible without individual learning. For instance, the sources for learning are not necessarily internal but can be external as well, such as, the imitation of organisational models of other companies. Alternatively, if the essence of organisational learning is viewed as the rapid adaptation to new circumstances, this end could be achieved by bringing in consultants or a steady stream of new employees with a fresh perspective, thereby helping the organisation to learn faster without the workers themselves learning anything in the organisation. Even 'worse', there may be a trade-off or at least a tension between both forms of learning. Adler (1993) captures this 'trade-off' in the concept of standardisation through which organisational learning is enhanced. But as the history of organisations bears testimony to, this is often achieved at the expense of individual learning opportunities. For example, about a hundred years ago, cars were built by craftsmen whose creativity and ability, indeed, the extent to which they were able to learn was vital to the success of their companies. However, organisational learning was soon enhanced by a process of standardisation, a development that was fiercely resisted by these craftsmen as it reduced individual skill levels and learning opportunities for workers. But the organisations relying on the standardisation of tasks soon outperformed the ones relying on the learning capabilities of their workers, a process that was repeated time and again in the production of goods and services. Similarly, while software programming was in the beginning something of an 'art', it has been increasingly overtaken by the standardisation of design, tools and products.

At this point it is worth elaborating further on the process of standardisation as it can shed some light on the ambiguous relationship between individual and organisational learning. According to Adler (1993) in his aptly titled article, 'The Learning Bureaucracy', organisational learning is based on routines and procedures and is reflected in the standard operation procedures (S.O.P.) of the organisation. Organisational learning is thus the process of identifying and creating best practice work

routines, standardising and diffusing these throughout the organisation and then finally, renewing the process. This implies that organisational learning also involves the development of improvement routines, that is, routines for bringing about change in which it is necessary for workers to reflect on the appropriateness of past assumptions and activities. Mechanisms by which this can be achieved include inter-alia, socialisation, peer or shop talk, training, feedback, imitation, problem-solving activities, information-sharing routines, movement of personnel in the organisation either on a short-term (e.g. job rotation) or long-term basis (e.g. as part of a career development strategy), and so on.

The process of standardisation involves two movements. Firstly, through standardisation, individual experiences and know-how are transmitted to the organisation. Secondly, standardisation is a way of spreading the benefits of such improvements throughout the organisation. As such, this should not preclude individual learning as, indeed, S.O.P.'s are an instrument to train (new) employees and to transmit and diffuse the information already available in the organisation. Certainly, without standardisation, workers cannot learn from past experiences. But individual learning without standardisation does not result in organisational learning as it is extremely difficult to improve what you haven't standardised. Existing standards thus provide the baseline for subsequent improvement.

The emphasis on organisational learning as a process of standardisation can be found in much of the management literature on 'high involvement' organisations, inspired by the Japanese management system. As Adler and Cole (1993: 92) point out:

"The Japanese production model explicitly focuses on strategies for organisational learning. Standardisation of work methods is a precondition for achieving this end. You cannot identify the sources of a problem in a process you have not standardised. Standardisation captures best practice and facilitates the diffusion of improvement ideas throughout the organisation. And standardisation stimulates improvement".

Clearly, the authors have a powerful argument in referring to the performance results of these management systems. As Womack et al (1990) claim with reference to the automobile industry, these systems deliver spectacularly better performance results not merely in terms of labour productivity, but also in quality, flexibility and innovation as illustrated by the shorter development lead times for the production of new models.

Yet, this management system bears little resemblance to the recipes often suggested by other proponents of organisational learning. Indeed, in much of the literature on organisational learning, the 'command and control' organisation is depicted as the

antithesis of organisational learning as it stifles imagination and intelligence. In such an organisation, Senge argues that ‘we have massive failure of the centralised nervous system of hierarchical institutions in the face of growing interdependence and accelerating pace.’ (cited in Gibson, 1997: 126). Similarly, Dixon equates the trend towards organisational learning with that of debureaucratisation and the empowerment that is necessary to support it. But one of the main stumbling blocks to enhancing organisational learning lies in management’s concern about the loss of authority that a focus on learning might engender (Dixon, 1994: 129). Dixon (ibid.: 133) thus argues that management must “demonstrate faith in the power of people to solve their problems locally and a willingness to forego the satisfaction of exercising command and control”.

Plainly, these views are in line with ‘human-centred’ approaches to work organisation in which the full standardisation of work tasks is seen as counter-productive (see e.g. de Sitter, 1994). Allocating at least some ‘decision latitude’, ‘autonomy’ or ‘job control’ to workers is thus perceived as the only structural solution to confront deviations and problems in work - ‘structural’ because it is embedded in the structure of the division of labour within the organisation. Certainly, during the execution of work, there are always new problems but this is not necessarily negative. On the contrary, unexpected events or deviations provide many opportunities for individuals to learn during work and to expand their qualifications. But workers must first be given the possibility to deliver an adequate solution to these problems through internal job control, that is, the possibility to alter their own work in order to adapt to changing circumstances. In other words, they must be allowed to deviate from the standard or else, they will be repeatedly confronted with new and unsolvable problems for which they will require the support of ‘functional specialists’ who, in the process, make themselves indispensable.

Clearly, in this approach, the emphasis is more on providing learning opportunities for individuals as a vital part of the organisation’s effectiveness. But if work is fully standardised, then the workers will be unable to respond to changing circumstances. Especially in an environment of rapid change, this will lead to a ‘failure of the centralised nervous system’ and the organisation’s ability to adapt as a whole.

This is exactly opposite to the view put forward by proponents of the Japanese management system, who argue that organisational learning can be maximised in a system that is based on specialised work tasks and great discipline in the definition and implementation of detailed work procedures. Indeed, as work becomes increasingly fragmented, specialised and standardised, it becomes easier to identify problems, define improvement opportunities and implement improved processes. In this way, it is claimed, the Japanese production model has the superior ability to create practical

knowledge, which forms the basis of its superior performance. (see e.g. Fruin, 1997; Kenney and Florida, 1993)

The idea that deviations, disturbances or problems during the execution of work are not 'the problem' as such, is shared by those advocating Japanese management systems. However, they maintain another view regarding the way such problems need to be solved and by whom, and reject the perspective expounded by the 'human-centred' approach which, it will be recalled, postulates that the workers who actually carry out the job need to be assigned more internal job control. Internal job control, even when held 'secretly', enables workers to alter their work and adapt it to changing circumstances, thereby opening the door to non-standardised work which is inadmissible. In their view, work has to be executed according to the standard procedure with no exceptions allowed.

As a consequence, due to a lack of internal job control, workers are unable to solve their problems during work, which is precisely what the emphasis on standardisation aims to achieve. Rather than remove the obstacles that prevent workers from solving problems, these are enhanced, thereby allowing the management system to prosper by virtue of the 'unsolvable problems' faced by workers. By definition, this approach delivers an 'instant recipe' for high stress risks, hence the qualification 'management by stress', which Parker and Slaughter (1995) use to describe the Japanese management system

But how can such an approach contribute to organisational learning? Given that standards embody the best way the organisation knows of for getting things done, it is purported that the emphasis on strict adherence to these standards will make all the inadequacies of these painfully visible. It is only when people are acutely aware of the problems caused by meticulously executing the standards that solutions and improvements to these standards become clear. Hence, the stress on visual management techniques, by which control over the labour process is enhanced and all problems immediately spring to the surface. According to this perspective, the assignment of internal job control, as propagated by the aforementioned 'human-centred' approach, amounts to combating problems with their own causes. It thus comes down to the allocation of even more 'fat', 'slack' or 'waste' by which problems remain invisible for the organisation. Still, it is quite possible that workers, by means of internal job control, are able to solve the problem. Moreover, they may be able to expand their qualifications in the process and learn. But what does this deliver for the organisation? It is not the task of workers to solve problems by deviating from the standard, but they must draw attention to these problems in order to make them visible. Only then, will the organisation be able to tackle these in a structural manner, 'structural' here having a different meaning than in the 'human-centred' approach. Solutions must, therefore,

translate into an adaptation of the standard operation procedures because it is only when these procedures are improved that the organisation is able to learn. It is thus organisational and bureaucratic learning, not individual learning that is important.

As such, this approach to organisational learning draws heavily upon long-established convictions about organisational improvement. Even though these management systems claim to break with the practice of Taylorism or Fordism, the idea of standardisation as the main source of organisational improvement is central to the tenets put forward by these 'founding fathers'. Indeed, Taylor was not aiming for a rigid standardisation either, as this would block the scientific improvements he was advocating. Within the scientifically determined work procedures, a working method is embedded and can always be improved. Taylor thus did not believe in a 'one best way', or at least not in one that should be 'fixed' forever. To him, a standard was always provisional, that is, the best available at that very moment, but he argued that it should be replaced with a better one as quickly as possible.

“This best method becomes standard, and remains standard, to be taught first to the teachers (or functional foremen) and by them to every workman in the establishment until it is superseded by a quicker and better series of movements”. (Taylor, 1911; 1972: 118)

The standardisation of this provisional work method, however, does not impede initiative. On the contrary, Taylor developed a method by which it is possible to make improvements in a systematic way through the application of scientific principles rather than by 'lucky strikes' and where the standard offers a reference that forms the basis for improvements.

The same view is held by Henry Ford as the following quotation illustrates:

“Today’s standardisation, instead of being a barricade against improvement, is the necessary foundation on which tomorrow’s improvement will be based. If you think of ‘standardisation’ as the best that you know today, but which is to be improved tomorrow – you get somewhere.” (Ford, 1988, 82)

However, in the Japanese management system, it is claimed that the workers are themselves involved in this improvement process in contrast to the functional specialists as in traditional work organisation. Having employees involved in the improvement process is thus what prevents these work practices from becoming 'mere' Taylorism. As Adler & Cole (1993) state: “Every worker is now something of an industrial engineer”. In this way, it is alleged, the Japanese management system has succeeded because it reintegrates the old mental/manual labour divide and allows for more effective factory-based knowledge creation in the form of continuous improvement.

Because of the involvement of workers that actually add value to the product or service in the improvement process, the form of bureaucracy found in the Japanese management system is different from that found in traditional western firms and which is echoed in traditional organisational theory (Fruin et al., 1999). Here, the imposition of formal structures, standards and hierarchy is seen as a way of ensuring that potentially recalcitrant and irresponsible employees do the right thing. When a bureaucracy is designed and implemented with this coercive rationale, its efficiency comes at a great cost in terms of lost worker commitment, operational flexibility and improvement momentum. Conversely, the bureaucratic features of the Japanese management system have a different rationale and different effects. Here, formal procedures and standards are designed with the participation of line personnel rather than being imposed by staff specialists. These procedures and standards serve to identify best practices and opportunities for improvement instead of merely setting performance standards for the purpose of deterring 'shirkers'. When bureaucracy takes this 'enabling' and 'learning' form, therefore, it doesn't undercut commitment, flexibility and innovation. It can also simultaneously assist in the collaborative control of routine tasks and engender collaborative creativity when it comes to nonroutine tasks.

However, once again, the involvement of workers in the improvement process is not a foreign concept to Taylor. He acknowledges that workers should, as in any specialisation, learn how to execute the best practice work method. But this standard allows them to build on the experiences of others instead of 're-inventing' old behaviours. He also encourages managers to listen to the remarks of their workers:

“It is true that with scientific management the workman is not allowed to use whatever implements and methods he sees fit in the daily practice of his work. Every encouragement, however, should be given him to suggest improvements. [...] And whenever a workman proposes an improvement, it should be the policy of management to make a careful analysis of the new method. [...] And whenever the new method is found to be markedly superior to the old, it should be adopted as the standard for the whole establishment. The workman should be given full credit for the improvement, and should be paid a cash premium as a reward of his ingenuity. In this way the true initiative of the workmen is better attained under scientific management than under the old individual plan.”
(Taylor, 1911; 1972: 128)

Taylor adds that many improvements to work standards are attributable to workers. However, as industrial practice has shown, the emphasis has traditionally been placed on the imposition of existing standards rather than on listening to and processing the remarks made by the workers who are actually doing the job. Certainly, there is

pressure to combine a reduction of variation around an existing standard on the one hand, with the need to engage in innovation on the other.

Proponents of the Japanese management system claim that it combines strict adherence to existing standards with the simultaneous pursuit of problem-solving activities. Therefore, minimal internal job control is combined with extensive external job control, which makes it possible to solve problems with the help of others. Under the banner 'in every worker is an engineer', workers are supposed to actively participate in all kinds of group meetings and contribute to the improvement of products and processes. Some well-known practices towards this end, which entail production workers and functional specialists meeting on a regular basis, include quality circles, kaizen-groups, TQM, TPM, and so on. In this way workers are still able to contribute to organisational learning even though they lack internal job control.

This would seem to comply with Nonaka's prescription for a 'network' organisation, in which different competences are brought together more closely, thereby allowing the knowledge which is available within a certain organisational competence to be spread throughout the whole organisation. In order to stimulate the learning capacity of an organisation, intensive collaboration is thus needed between different parts of the organisation (Nonaka, 1994).

In the human-centred approach, these solutions are perceived as largely inadequate, even though external job control is indeed important. The argument here is that if all workers have internal job control by means of which they are able to solve their own problems, stress risks would be minimal, but at the same time alienation would be enhanced. But work is more than the execution of tasks and the solution of problems that occur during this process. It also requires external job control through consultation and communication with others, which gives the organisation a social dimension and a flexibility to adapt to changing circumstances.

Taken from a sociotechnical perspective, the claim by supporters of the Japanese management system that such external job control is compatible with the minimisation of internal job control, is rather incongruous (de Sitter, 1994, 22). After all, where job control is allocated in the organisation, depends above all on the structure of the division of labour. When the work that actually adds value to the product or service is specialised and standardised, therefore, it is unclear how workers can come up with any sensible solution for other than marginal problems. Moreover, if they are unable to have an overview of the process and therefore of the consequences of their solution, it is questionable how such a solution can be relevant. It is also open to question as to how workers can by means of mutual consultation contribute to substantial improvements if

in their work they have nothing to do with one another explicitly. The assumed external job control, therefore, remains limited to one's own fragmented domain and within the existing division of labour. But while management may then well be willing to involve workers in decision making and to stimulate them through the existing division of labour, this involvement is, from the very outset, severely restricted. The execution of work thus remains distinct and 'blind' to its regulation. This leads to the tackling of problems after the fact, resulting in a reactive approach to acute problems instead of a structural approach.

According to this perspective, organisational learning mainly comes down to the 'continuous improvement' of existing processes, which means improving standardised ways of conducting work activities. As such, it is restricted to what Argyris and Schön (1978) describe as 'single loop learning'. Here, workers are oriented to the optimisation of existing operations and activities on the basis of a fixed set of norms. In single-loop learning, deviations are corrected in order to maintain the validity of the existing framework and its concurrent norms, or what Argyris and Schön call the 'espoused theory', that is, the collective picture which is established on how the organisation functions, or at least how it should function. The aim is to enhance a common view among all participants, for example, by formal organisation charts or formal work descriptions.

Double-loop learning, however, involves the critical examination of this 'espoused theory' and its possible adaptation and is a form of organisational research in which the espoused theory itself will be altered. This involves a change in norms and propositions and implies that workers both question the existing set of norms and are also able to alter these on the basis of new insights and information. In order to avoid a 'blind' focus on the optimisation of existing processes without putting these to discussion in the light of internal and external developments, double-loop learning must be enhanced. For it is through double-loop learning that the organisation is able to change its own norms and habits and thereby expand its possibilities for action. Many authors point to this distinction between single and double-loop learning using similar concepts such as 'adaptive' versus 'proactive' learning, 'lower level' versus 'higher level' learning (Fiol & Lyles, 1985), 'tactical' versus 'strategic' learning (Dodgson, 1991) and 'adaptive' versus 'generative' learning (Senge, 1990).

Clearly, the aforementioned Japanese management system is ill equipped for double-loop learning as the workers actually adding value to the product or service are not involved. The regulation of their activities is automatic by means of the existing standards and adaptation of these is only possible when the said standards are officially

altered and ratified 'from above'. Therefore, they cannot be changed autonomously by workers or through mutual consensus within the group.

Encouraging workers to suggest improvements and to remunerate suggestions gives the impression that management wants to support the creativity of workers. But one who makes suggestions also draws attention to certain problems, which is of central importance. Qualifying this as 'external job control', let alone 'empowerment' or 'high involvement' of workers is, however, rather exaggerated. When one has no job control to solve problems, inevitably, one is forced to draw the attention of others to the problem and rely on them to solve it. But the question regarding external job control is whether the worker is able to make a substantial contribution to the solution of the problem. Given the full standardisation of work, the ability for production workers to contribute to organisational improvement is clearly too small.

Moreover, from a sociotechnical perspective, the 'network' organisation as proposed by Nonaka is not a real alternative but rather an addition to the traditional hierarchy. Within this hierarchy, cross-sectional links, whether temporary or permanent, make it possible to exchange knowledge outside of the existing hierarchy. By using horizontal coordination in a network organisation, the decision latitude is decentralised to a certain extent, but the division between the staff and line functions is not tackled. Such organisations are thus desperately seeking to coordinate and integrate the divided responsibilities within their organisation, which is an indication of just how much these responsibilities have been fragmented. Van Amelsvoort and Kuipers (1990: 175) label this a 'traditional staff-line organisation with horizontal linkages'. In an attempt to continue the control of their growing coordination needs, these organisations add a number of co-ordinating structures on top of the existing division of labour. Control is thus being reasserted here by an increase in the control capacity of the organisation, in contrast to the sociotechnical approach, which aims to lower control requirements.

Such a reduction in the control requirements for the organisation can be achieved by restructuring the division of labour in such a way that semi-autonomous work groups are held responsible for a logically coherent and functional product or service. Hereby, mutually dependent activities are clustered together within groups, enabling the allocation of greater decision latitude to these groups. Regulation is also accomplished within the group instead of being imposed from above through standards. To enhance the decision latitude of the group, it is necessary to avoid standardising and to restrict oneself to a 'minimal critical specification' of the work. Minimal standardisation and increased decision latitude in and during the execution of work is thus the key to solving problems where they emerge.

If work is divided in such a way, however, no 'artificial' coordination structures will need to be superimposed on top of the existing division of labour. Instead, by its very nature work will involve communication and mutual coordination. This offers workers many more learning opportunities not only in their job but also through learning from others. As jobs are not fully standardised, they will contain overlapping tasks with other jobs in the group, sometimes referred to as a 'redundancy of functions'. This enhances mutual experiences between group members and improves their common understanding, facilitating the transfer of knowledge between group members in a much better way than the 'artificial' job rotation between fragmented jobs in a traditional work organisation.

However, each of these opposing views delivers a contribution with regard to organisational learning. The emphasis on standardisation reminds us that organisational learning must be more than what individuals learn by virtue of education or experiences. As such, this knowledge is lost when these employees leave the organisation. Processes and insights evaporate if they are not made a part of collective memory. Knowledge must also be defined in more objective terms as being a consensual, supported result of information processing. This orientation emphasises organisational memory or a publicly documented body of knowledge.

On the other hand, a too strong emphasis on standardisation may well undercut the sources of individual learning. What a sociotechnical approach tells us, is that first and foremost, the structure of the division of labour in the organisation must be such that at the very least, workers have the opportunity to learn from their own work as well as from others. It doesn't help to encourage workers to learn if such opportunities are lacking. But, at the same time, management should also take care that workers actually use the opportunities offered to them.

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Processes of learning in the workplace

Introduction

The notion that organisations learn has been around for approximately four decades and has given rise to a plethora of expositions on the subject. For example, Crossan and Guatto (1996) in their bibliographic review showed that as many academic papers were written on the subject in 1993 as in the whole of the eighties (in Easterby-Smith, 1997). Clearly, interest in the subject is prolific and many authors, academics and practitioners alike, are keen to attribute organisational success to processes of organisational learning (OL) and its corollary, knowledge productivity (i.e. how knowledge is developed and used in the organisation). Yet, in spite of its wide acceptance as a major field of study and the fact that several scholars have undertaken the daunting task of reviewing the relevant literature, for example, Dixon (1990), Easterby-Smith (1997), Shrivastava (1983) and Edmondson and Moingeon (1998), to name but a few, the literature remains deeply fragmented with multiple constructs and the creation of a single framework for understanding the concept remains elusive. Certainly, there exists a ‘cacophony of voices’ on the subject (Garvin, 1993).

But this is not necessarily a limitation. As Easterby-Smith (1997) rightly points out, the bulk of the OL literature is grounded in a limited number of distinct disciplinary perspectives, each with their own ontology. Consequently, he argues against attempts at integration that are likely to generate greater confusion and suggests that OL is best understood as a multidisciplinary field with complementary contributions and research agendas rather than as a unified body of knowledge and practise (ibid.). This argument is also borne out by Edmondson and Moingeon (1998) who argue that these various expositions offer a part of the complete picture of organisational adaptation.

But that aside, it makes little sense to consider OL in isolation from individual learning processes in light of the argument put forward by some theorists that organisations as entities cannot really learn, only their members do. Clearly, this view posits that individuals (employees) are the primary learning agents in the organisation, suggesting that the study of individual learning should (and does) inform theories of OL. Consequently, while it is recognised that such theories are often susceptible to an individual action bias which creates the tendency to overlook the role played by structural conditions such as institutional forces, organisational histories, cultures, group structures and power structures (Huysman, 1999), it is deemed that an investigation of individual learning is, nonetheless, appropriate to this study.

Such theories, however, are conceived on certain assumptions about how adults learn. For a fuller understanding, therefore, the latter theme will be examined in an attempt to draw some useful generalisations that lend themselves to an understanding of adult learning in the workplace. This will be achieved partly by juxtaposing two diametrically opposite schools of thought that dominate the field, as exemplified, rather incongruously, by contemporary adult learning theory and current systematised or other-directed training practice. To elucidate, topical interest in adult learning theory is grounded in the humanistic school which considers the 'self' to be paramount and extols qualities such as personal freedom, choice and subjective experience in learning, or in other words, autonomous, personally-directed adult development (Tennant, 1993). Conversely, although attention is gradually being shifted away towards a more 'politically correct' orientation that emphasises concepts such as learning-to-learn and self-directed learning, training practise is still largely rooted in the behaviourist stream which asserts that conditioning forms the basis of learning through the positive/negative reinforcement of desirable/undesirable behaviours by either the manager, the trainer or one's peers (Pont, 1996).

Certainly, a wide disparity exists between the two perspectives with major implications for adult learners and educators that subscribe to either approach. This holds even more acute ramifications for the way learning is perceived in the workplace. In addressing this issue, therefore, the nature of this divergence will be explored and a conceptual matrix will be put forward as a suggested means for viewing workplace learning. This will comprise the first section of this treatise.

But learning in the workplace has to serve a purpose. As academics and business leaders alike contend, the rate at which organisations and the individuals in them learn and create new knowledge may be the only source of sustainable competitive advantage that determines survival in the marketplace (De Geus, 1996; Senge, 1990; Stata, 1996). However, it is erroneous to assume that all individual learning will lead to knowledge

that is relevant to the organisation. Neither can it be assumed that the knowledge base of the organisation will accrue solely from the efforts and actions of individuals in contrast to the populist view mentioned previously. Two major themes derive from this assertion. Firstly, it suggests that OL has to be more than the sum of individual learning. No doubt, there is a strong relationship between individual learning and the learning of the organisation as an entity. However, as Schwandt and Marquardt (1993:23) posit, it is “more a necessary condition, but not a sufficient one”, a point that is also made by Huys and Van Hootegem (2000) in the previous paper included in this report. Secondly, the creation of knowledge and learning must be viewed as concomitant processes that are integral to one another. The second part of this treatise will thus review several theories of OL and assess them against the conceptual matrix put forward in the first section. It will also examine how knowledge is created and managed within the organisation.

Adult learning

Adult learning represents a rich and diverse field of inquiry, the theory and practice of which has been subjected to multiple approaches. Generally speaking, it can be argued that these many approaches are grounded in one of two worldviews (“Weltanschauung”) regarding adult development and behaviour. But although the behaviourist and humanist streams of inquiry are certainly contradictory, each has a value and a role to play in the organisation. This is clearly illustrated by the need to cater for both organisationally-directed and self-directed adult development in the workplace. The purpose of the first section of this paper, therefore, is to illustrate how other-organised/organisationally-directed learning as typified by formalised training practice (based on behaviourism) and contemporary adult learning theory that supports self-directed learning (based on humanism) can theoretically be reconciled so as to achieve better overall learning in the workplace.

As a preamble to the remainder of this discussion, it would be useful, at this point to clarify how certain terms are used in this treatise. For a start, although in academic vernacular, adult learning and development are frequently dealt with as distinct concepts, these concurrent processes overlap extensively and can be thought of as inseparable. They are thus used interchangeably in this discourse. Additionally, the terms organisationally, other-directed or other-organised learning will be considered synonymously to denote the reactive role of learners in learning systems and formalised training situations where external agents provide direction. Similarly, self-directed, or self-organised learning will be treated as equivalent terms in preference over the more ambiguous term autonomous learning, to signify the proactive role of learners in directing their own learning. The problem with the latter is that the term ‘autonomous’

is misleading, implying that learning takes place in isolation when this is not necessarily so. Indeed, self-directed learners tend to make effective use of peers, mentors, trainers and other resources and are also better at learning collaboratively than other-directed learners because they are highly skilled as learners. Having said that, in order to advance this discussion the theme of adult learning can now be explored.

Despite widespread interest, an unequivocal definition of learning remains elusive. Smith (1990) argues that this is because learning has been variously used to refer to a product (i.e. the acquisition and mastery of what is already known about something), a process (i.e. the extension and clarification of meaning of one's experience), or a function (i.e. an organised, intentional process of testing ideas relevant to problems). But while a precise definition may not be on the cards, there is general agreement that learning involves the person becoming altered in some way by gaining new or extending old knowledge, skills or abilities.

At this point, it may be helpful to consider a definition of learning that reveals several useful insights regarding the nature of adult learning. Bass and Vaughan (1966) define learning as "a relatively permanent change in behaviour that occurs as a result of practice or experience" (cited in Reid and Barrington, 1997: 76). But a change in behaviour does not occur for the sake of it. It must consequently be both deliberate and purposeful. Moreover, if it is relatively permanent, then it must be internalised to a significant degree in order to be transferred to future events. This further suggests that the change must be accepted by the individual learner and must eventually be perceived as natural and progressive (even when it occurs as a result of a negative experience or involves some form of unlearning). Generally speaking then, learning can be thought of as a voluntary activity that is personally valued by the individual learner (Harri-Augstein and Webb, 1995; Rogers, 1983). In other words, the learner must be internally motivated and must see a worthwhile outcome to any expenditure of effort (Knowles, 1990; Kroenhert, 1995; Rae, 1994). We can thus further infer that adult learners seek to acquire knowledge, skills and attitudes (KSA) that will enable them to cope with the demands placed on them by their immediate environment, that is, the workplace.

A second point to consider is the idea that change comes about as the result of 'practice' or 'experience'. Although experience can be acquired as a result of practice, presumably this is not the intended interpretation. To illustrate, while 'practice' involves repetition which suggests that the change is both planned and deliberate, 'experience' can be either intentionally arranged or it can occur naturally in the course of events. We can thus infer that learning can be planned or unplanned. Irrespectively, however, learning from experience means that learning is an individual activity. This premise gains support from Kolb's experiential learning cycle, a widely accepted

theory, which divides learning into four integrated stages. Accordingly, learning commences only once concrete experience is processed and critically reflected upon by the individual. Once placed in a meaningful context, it is then translated into concepts which can be tested out in future life and work situations (Rae, 1994). A particular aspect of this cycle is that it is singular to each individual, the implication being that the learning activity itself is intensely personal, be it planned or unplanned. Further still, the cycle is recurring which suggests a transition from learning to doing thus effecting transfer and resulting in further learning and so on with each successive cycle. Learning is thus both purposive and continuous. Moreover, learning transfer is integral to and inseparable from effective learning.

So far, some useful generalisations regarding adult learning have been drawn at the core of which lies the centrality of the individual as the 'driver' of the learning process. To elucidate, if we accept the notion that learning is a natural process that is personally valued and engaged in by individuals on a voluntary basis, it stands to reason that the learning must be relevant to learners' needs. However, since learners themselves are usually in the best position to identify their own needs, the logical conclusion to this argument, therefore, is that a learner-centred approach to learning is required. This is the principle view that underscores personally-directed adult development.

Self-directed learning and humanism

As the writer most closely associated with this mode of adult learning, Knowles (1975, 1990) builds on the basic tenets of humanistic psychology which emphasise concern with the self, to forward his 'andragogical'¹ model of self-directed learning. Adopting Maslow's view that humans are 'fated' to self-actualise, he posits that the capacity to be increasingly self-directing is a rudimentary feature of the natural process of human psychological development. Moreover, he considers that this need continues to develop organically and credits self-directed learners with the ability to interact with the outer environment and to select various resources that are pertinent to different kinds of learning objectives. This notion is reflected in his definition of self-directed learning as "a process in which individuals take the initiative with or without the help of others in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies and evaluating learning outcomes" (Knowles, 1975: 18). This view thus assumes that the ability to learn is a basic human competence and sees adult learners as proactive, intrinsically motivated beings, who actively control the processes through

¹ Derived from Greek, andragogy refers to the art and practise of helping people learn, based on adult learning principles.

which they learn as well as the content of what they learn. Consequently, the argument here is that such learners enter the learning situation more purposefully and are likely to learn better. They also enter learning situations more frequently given that they are proactive and initiate their own learning.

Knowles (1975, 1990) further believes that the natural adult orientation to learning revolves around work-related issues and life's problems and is thus problem or task centred. Towards this end, he recommends the use of experiential techniques such as problem solving activities that will enable learners to engage in discovery learning as opposed to expository learning, which is essentially reliant on a delivery system. The premise is that the former 'engages' the learner in learning that is both pervasive and significant. This idea is also prevalent in the work of Rogers (1983), who talks of the 'fully functioning' person and argues that learning must make a difference in the behaviour, the attitudes and even the personality of the learner. It must, therefore, be meaningful and must involve the whole person and not just the mind (ibid.). But in order for learning to be meaningful, the content and processes that are brought into play in the learning situation must be perceived as having a meaningful connection to past experiences (Smith, 1990). The notion that learning is bound up with experience thus brooks no argument and is borne out by theories such as Kolb's learning cycle. Indeed, there is general agreement among theorists that the experience which adults bring to the learning situation can be a rich resource both for the self and for others. Knowles (1990) even goes so far as to assert that to ignore or devalue the experience of adults is to reject them as persons.

However, it is Nonaka and Takeuchi (1995) who put together a convincing argument in favour of utilising individual experience in their theory of knowledge creation. Distinguishing between explicit and tacit knowledge, they define experience as assimilated tacit knowledge that is highly personal and hard to formalise. Nevertheless, they believe that knowledge can be converted from tacit to tacit in a process referred to as socialisation. This occurs when individuals learn directly from one another and share their knowledge. But this conversion cannot be easily taken advantage of by the organisation. Only once tacit knowledge is articulated and made explicit can it be communicated. The authors argue that this externalisation or conversion from tacit to explicit knowing is the key to the creation of knowledge in organisations since this is where new concepts are generated. Certainly then, it can be safely concluded that the experience of learners is an invaluable aid to the learning process.

Thus far, it is clear that self-directed learning theory, as propounded by andragogues, incorporates some of the general observations on adult learning that were discussed previously. The suggestion is that self-direction offers a powerful, politically correct

approach to adult learning in the workplace. Rooted in McGregor's Theory Y, it regards people as self-motivated, self-controlled individuals who, given the opportunity, will voluntarily integrate their own goals with those of the organisation in pursuit of self-actualisation (Handy, 1993). This is in stark antithesis to the systematised, organisationally or other-directed model that influences current training practice and which is based on McGregor's theory X. The latter posits that humans dislike responsibility and are generally passive, thus preferring to be led (Handy, 1993). In response to these assumptions, it sets out to direct the efforts of people, to motivate them and to control their actions to fit the needs of the organisation.

Other-directed learning and behaviourism

In contrast to the humanistic ethos, behaviourism believes that conditioning or shaping is the basis for learning. Originating from the work of Pavlov and Skinner who initially studied animal behaviour, the basic premise here is that an empirical relationship exists between reinforcement and behaviour (Tennant, 1997). Humans are thus seen as reactive, dependent beings whose behaviour is literally shaped by the environment. But such a view clearly questions the individual's capacity to pursue and personally direct one's own learning. The locus of control in the learning situation thus resides with the trainer or educator who diagnoses learning needs, sets the learning goals, selects the medium of instruction and decides what evidence should be used to evaluate whether learning has been accomplished or not.

Referred to as 'pedagogy'² by Knowles (1975), this approach focuses on the trainer as the expert purveyor of knowledge and relies on content transmission that is submissively absorbed by the learners, if at all. As a result, instead of having the option to explore a number of human and material resources available to them in the wider environment, for instance, family, friends, peers, self-instructing manuals, long distance courses, computer-based training packages and so on, learners are usually limited to the methods chosen by the instructor as well as the knowledge of the instructor which may itself be limited and may even lack immediate relevance. Such a system also relies on the need for societal approval or the fear of failure as a motivator, suggesting a regard for people as an easily manipulated element. Learners are thus not included in determining any aspect of the learning situation and their powers of self-determination and the experiences they bring with them are denied or rejected.

Clearly then, pervasive learning as described by Rogers (1983), cannot occur with didactic, transmittal techniques that focus on the mastery of content. But this is not to

² Derived from Greek, pedagogy refers to the theory and practise of learning that is teacher or trainer-directed.

suggest that people do not learn in such a setting, for indeed they do, although this is not always the case. When it does occur, however, according to Nonaka and Takeuchi (1995), such learning focuses on the conversion of explicit to explicit knowledge in a conversion mode which they refer to as combination. The limitation with this kind of learning is that although it synthesises knowledge and information, it does not really extend the knowledge base. In other words the learning that occurs will be adaptive rather than generative.

Towards an integrated model

In the treatment of the two models, thus far, it appears that the two approaches are conflicting and that the self-directed learning mode, typified by andragogy, is superior to the other-directed learning mode as exemplified by pedagogy. But this account is misleading for a number of reasons. To begin with, if self-direction is better suited to adult learning, then it follows that an andragogical approach ought to work in every situation. However, given the hitherto success of the pedagogical model and the lack of self-directed individuals in many organisations, serious questions arise as to the efficacy of self-directing learning theory. Another limitation lies in the premises that underpin the theory. For instance, the view that adults are essentially self-directing is undermined in the face of the lack of self-direction and individual autonomy discernible in various cultures, particularly in the developing world (Brookfield, 1986). This raises the possibility that the application of the andragogical model may be culture bound or basing its assumptions on ethnocentric evidence. One also has to consider the wisdom of considering self-directed learning as being depoliticised and devoid of power structures. Obviously, this is as untenable as the position that people are wholly influenced by social forces as in the other-directed model. The two extremes must thus be tempered towards a more realistic picture.

Clearly, the self-directed, andragogical model has limitations not all of which have been explored. Yet, despite these weaknesses, its conceptual core has undoubtedly taken hold and must be delved into. Its uniqueness is that, in contrast to pedagogy, it is not viewed by its founder as an immutable ideology. This means that while andragogy is viewed as an alternative set of assumptions that includes pedagogy as a viable approach, pedagogy as a firm ideology excludes, andragogical theory (Knowles, 1990).

In light of the preceding discussion, it may be helpful to view the relationship between self and organisationally-directed learning in a matrix. In Figure 1, assume that the horizontal axis running from left to right represents a continuum of the learner's influence over the learning situation, with no control and control at opposite ends, respectively. Similarly, the vertical axis running from top to bottom can be thought of

as a continuum of the organisation's control over the learning situation, again with no control and control as polar opposites. These relationships give rise to four quadrants.



Figure 1. A conceptual matrix of self-directed and organisationally-directed learning

At one extreme, in the top left quadrant (Area A), neither the learner nor the organisation purposefully pursue learning. Rather, learning occurs incidentally and randomly through chance happenings. It is thus informal and unplanned, stemming from miscellaneous sources, such as, noting an advertisement on television or a billboard, reading a newspaper article, learning from one's mistakes, overhearing a conversation, or casually observing an incident, and so on.

In contrast, in the top right quadrant (Area B), self-organised or self-directed learners purposefully seek out knowledge and skills for themselves. In their quest they make use of non systematised, unconventional sources as simple as learning from intuition, asking various people questions, watching a television programme, reading a book or keeping a diary, in addition to using traditional sources. Learning is thus generative since it is self-initiated. But such learning may be problematical when the learner's needs do not concur with those of the organisation, resulting in a distal fit. In other words, people may outgrow their organisations.

Diametrically opposed to this mode, the other-organised learners, in the bottom left quadrant (Area D), subjugate their own needs to the dictates of the organisation and comply with traditional, formal training methods such as lectures and workshops that are deemed suitable by the training provider. Although learning is intentional on the part of the organisation and may occur, it is adaptive and relatively short-lived and depends on the willingness of the individuals to learn.

Lastly, in the bottom right quadrant (Area C), one of three situations may occur. Certainly, both the learner and the organisation intentionally engage in learning. However, a problem may arise when the two parties come to the learning situation with a different perspective of what is required. Potential conflict can thus hinder any substantial learning. Still, a counter argument can be made that a truly self-directing learner has the capacity to critically examine and question the assumptions being made. Conflict, if constructively handled can, therefore, also be seen as a facilitator of learning. A third view premised on McGregor's theory Y and Knowles's supposition that adults focus their learning around life's problems, suggests that since adults spend so much time in the workplace, they will naturally adapt their learning to organisational needs. Ideally, self-directing learners can operate within an other-directed environment to the mutual advantage of both the individual and the organisation. Alternatively, the organisation can support and nurture the efforts of self-directed learners. Learning can thus be both generative and adaptive and learning strategies are flexible, varied and innovative rather than limited to monolithic, tried and tested methods.

Certainly, it may be argued that all learning that occurs in the organisation will fall somewhere within this matrix. Putting the organisationally and self-directed modes into perspective, it is clear that the right side of the quadrant represents the domain of the self-organised learner. Hence, the vertical axis must be shifted to the left (axis a) in order to enlarge this area and to harness the obvious advantages of this mode of learning especially if the level of learning ability in the organisation is high. However, it is unrealistic and irresponsible to assume that all learners can function in the self-directed mode since most adults have been conditioned by an education system that demands compliance. Indeed, Knowles (1975) argues that most of us only know how to be taught and that we haven't learnt how to learn.

His contention gains further credence from the concept of learning styles. By way of explanation, recall for a moment Kolb's experiential learning cycle. Kolb argues that the amount of emphasis on each of the four stages in the cycle depends on the preferred learning styles of individuals. This assertion is built upon by Honey and Mumford who classify learners into four basic styles, activist, reflector, pragmatist and theorist, each one accordant with each of the stages in Kolb's cycle (Rae, 1994). The activist is thus mainly concerned with the experience of doing, the reflector with thinking about what has occurred, the theorist with identifying patterns and hypothesising and the pragmatist with experimenting to test out previously formed hypotheses. A further discussion of learning styles is not warranted at this time. The salient point, however, is that individuals learn in markedly different ways. Arguably then, they will also vary in the degree of autonomy and structure which they require in their learning (Smith, 1990).

This implies that there will be a bevy of learners at different points on the matrix. Accounting for these differences, therefore, Area C offers the most feasible opportunity for establishing a close fit between individual learning needs and those of the organisation. Enlarging this area by shifting the horizontal axis upwards (axis b) means that the organisation relinquishes more control over the learning situation to the learner.

On a cautionary note, this model is meant to be interpretative and is not based on empirical evidence, merely attempting to provide a conceptual framework for reconciling the self-directed and other-directed modes of learning on a theoretical basis. Generally speaking, if learning is regarded as a continuum with self-directed learning as the highest mode, then organisationally-directed training strategies should help learners that have not already attained the capacity to operate at this level to move up the continuum. Alternatively, if learners are essentially self-directing, then their efforts should be nurtured and supported. This first view is thus based on the premise that adult learners are in reality “not self-directing and need to be weaned away from traditional educational consumption”, while the second view refers to the skilled learner (Tennant, 1993). Howbeit, it might be useful to regard self-directed learning as a behaviour to aspire to rather than as a firm ideology. As such, it can incorporate pedagogical assumptions as discussed previously. Put differently, it can thus reasonably be argued that a skilled or self-organised learner has the ability to recognise when a behaviour and learning style is appropriate and automatically bring it to bear on a learning situation.

Tools for integrating self-directed and other-directed development

Accepting self-directed adult development as the ultimate learning mode, mandates the reconciliation of individual needs with organisational goals. Several tools and techniques can be used towards this end. Harri-Augstein and Webb (1995) argue that learners should be offered as much freedom to learn as they can cope with. They offer the ‘Learning Conversation’, that is, a conversation held with oneself about learning, as the inception of enhancing the self-directing efforts of individuals. During this process, a discussion is held in which the learner is probed by the learning coach, a function filled by either the line manager or trainer. A learning coach is defined as someone who “works with learners so that they can develop ways of supporting themselves” (Harri-Augstein and Webb, 1995: 60). The coach thus helps the learner externalise the tacit mental models inside his or her own head and makes this conversation explicit to the learner. As the learner’s skill and awareness develops, the learning coach gradually confers control of the learning conversation over to the learner. A culmination of this discussion is the negotiation of a learning contract that includes a specification of

learning objectives, the actions to be taken, identification of human and material resources or inputs, target dates and criteria for evaluation. The underlying premise beneath learning contracts is that learners will be motivated to follow through on learning projects if they are involved in determining their own needs and identifying their own strategies. This method thus allows learners to maintain their influence over the learning situation and align their learning purposes and developmental needs with the needs of the organisation. An important point to note is that such a system does not exclude current training practice. Instead, it proceeds from the understanding of the learner rather than the trainer who now functions as a resource person. The aim is thus to facilitate the learning while concentrating on the process and purpose over the content. This approach also widens the range of learning resources and may include other innovative tools such as self and peer assessments, individual needs analysis and a personal development journal (Seymour, 1988).

However, a learner-centred approach requires commitment and accountability on the part of the organisation as well as the learner. What this means, is that the organisation should look for ways to provide resources that will enable learners to work at their own pace on materials that have been chosen to meet their needs as per the learning contract. One way of doing this, is through the creation of learning resource centres which represent a more formalised approach to self-managed learning and which may include collections of books, articles, audiocassettes and videotapes, databases, self instructing manuals, computer training packages, and so on (Abbott and Dahmus, 1992). It also means creating a learning environment where the learner will be encouraged to take responsibility for making decisions at each stage of the learning process and where the support of the learner's supervisor and colleagues is secured at the outset. It thus necessitates that a critical mass of people in the organisation are trained in terms of reinforcing learning behaviours. This can only be achieved if a learning culture, as embodied in the concept of a learning organisation, prevails. According to Senge (1993), in such a culture people continually expand their capacity to create the results they truly desire, new and expansive patterns of thinking are nurtured, collective aspiration is set free and people continually learn how to learn together.

But self-directed adult development as the ultimate learning mode raises serious implications for OL and the way that knowledge created by individuals is managed. Moreover, a learner-centred approach requires that the organisation provides resources that enable learners to learn freely and without fear. The propositions discussed thus far suggest that there is a need to take this treatise further in order to explore the impact of the concepts presented thus far on related themes such as collective learning (OL), knowledge creation and management. It is to these themes that we now turn.

Organisational learning

To further our understanding of OL, rather than provide an exhaustive literature review, it is deemed that a simple typology ought to be used to organise the literature. The simplest framework is offered by Easterby-Smith and Araujo (1999) who broadly classify the literature according to whether OL is conceived as a social or as a technical process. Basically, the technical persuasion views OL as the processing of generally explicit information. In contrast, the social lens portrays OL in terms of the constructs people place on their tacit and/or explicit experiences at work (*ibid.*). But even within these classifications, there is widespread disagreement as to what constitutes OL. For example, within the social perspective, views diverge greatly and OL is variously described as being socially constructed, as a political process or as implicated in the culture of the organisation (*ibid.*). Additionally, very few theories can be said to fall neatly into one of the aforementioned categories. A further refinement for organising the literature is thus required. A useful and constructive typology towards this end (see Figure 2) is offered by Edmondson and Moingeon (1998). Differentiating between those theories that regard either the individual or the organisation as the focal agent of learning, they distinguish between descriptive explanations of OL, on the one hand, and theories of intervention aimed at creating organisational change, on the other. These demarcations result in the four combinations shown in the matrix overleaf.

Using this matrix as a template for the main part of this section, an attempt will be made to provide a fuller understanding of processes of OL by exploring the basic precepts that undergird the key theories that fall into one of the above classifications. On the premise that intervention theories generate more useful and pragmatic implications for application, particular emphasis will be placed on the seminal works of Senge (1990) and Argyris and Schon (1978, 1996). However, although these latter works have provided a source of critical leverage for enhancing processes of OL, both expositions are largely prescriptive offering normative explanations of what should be rather than examining what already exists. Still, they lead to important implications that need to be explored further in relation to the conceptual framework provided in the previous section of this treatise, which called for a model that integrates self-directed and other-directed learning. Finally, the OL theories that are presented here will be assessed to the extent that they lead to useful implications for improving organisational effectiveness before rounding up the treatise with a discussion of knowledge creation and knowledge management.

		PRIMARY UNIT OF ANALYSIS	
		<i>Organisation</i>	<i>Individual</i>
<i>Descriptive Research</i>	RESIDUES	Organisations are seen as residues of past learning. (e.g. Levitt and March, 1988)	COMMUNITIES
RESEARCH GOAL	<i>Intervention Research</i>	PARTICIPATION	<i>Intervention Research</i>
		Organisational improvement is gained through intelligent activity of individual members. (e.g. Hayes et al., 1988)	Organisations are seen as collections of individuals who can learn and develop. (e.g. Pedler et al. , 1990)
		ACCOUNTABILITY	Organisational improvement is gained through developing individuals' mental models. (e.g. Senge, 1990, Argyris, 1993)

Figure 2: A Typology of OL Research

Source: Edmondson and Moingeon (1998)

Descriptive theories of OL

OL as residues of past experience (e.g. Daft and Huber, 1987; Weick, 1979, 1995; Levitt and March, 1988; Walsh and Ungson, 1991)

Several theorists consider OL as a function of past experience. Among these, Daft and Huber (1987), in an integrative approach, draw on an information management perspective to present two dominant views of OL, the systems-structural (technical) and the interpretative (social) perspective, respectively (in Dixon, 1990). Grounded in the technically minded school which considers information processing as the primary resource through which the organisation learns about its external and internal environment, the systems-structural standpoint is concerned with the amount, frequency and distribution of information in the form of messages that enable the organisation to expand its range of possible behaviours (ibid.). This idea is prevalent in the work of Huber (1991: 89) who postulates that the organisation as an “entity learns if, through its processing of information, the range of its potential behaviours is changed” (in Denton, 1998; Easterby-Smith, 1997; Easterby-Smith and Araujo, 1999). In a similar vein, Zuboff (1988) also expounds the use of information technology to make information accessible to one and all and thereby liberate employees, on the assumption that

learning will occur where the information flows freely. Such views are thus implicitly concerned with factors that impede or influence the dissemination of information. It can also be argued that such theories tend to see OL as a product of information processes, the premise being that the wider the distribution of information within the organisation, the broader the base of OL across it.

The aforementioned perspective thus identifies the need for organisations to develop internal mechanisms for distributing information. However, the system-structural perspective on its own does not offer an explanation of how meaning is assigned to the disseminated information, merely assuming that organisational adaptation and learning occur as a function of organisational policies and structures that distribute the information. To compensate, Daft and Huber (1987) argue that organisations require two information systems, a rational system to deal with the distribution of information and an interpretive system to allow organisations to reduce the ambiguity of the disseminated information in order to develop shared interpretations of the underlying purpose and meanings of messages (in Dixon, 1990).

Clearly, the interpretive approach is exemplar of the social persuasion and views OL as a product of social interactions in the workplace. It thus inherently mandates the use of language and symbols to create shared perceptions and interpretations of reality among the organisation's members, a view that is put forward by Weick (1979). In his theory of social construction, Weick (1979) further postulates that organisations seek to make sense of chaos through a process of enactment. The latter is a process whereby the organisation seeks to "sort chaos into items, events and parts which are then connected, threaded into sequences, serially ordered, and related" (ibid.: 148). The goal of organisations viewed as sensemaking systems, therefore, is to create and identify recurring events in an effort to make the organisation's environment more predictable and stable (Weick, 1995). The argument here is that members of the organisation directly engage with the external environment and actively seek to make sense of it before organisational responses are chosen. In other words, which organisational responses are chosen depends on the 'enacted' environment as perceived and represented by the organisation itself. But for an event to be sensible, Weick (1995) argues that it must resemble something that has happened before. This suggests a direct connection to past experience.

The lessons of the past are also embodied in the work of Levitt and March (1988) who contend that organisations learn "by encoding inferences from history into routine behaviour" (cited in Prange, 1999). In other words, the argument is that organisations as entities accumulate and encode experiences in routines that dominate organisational life. Indeed, these routines, whether formal (forms, rules, procedures, policies,

technologies or work processes) or informal (culture, beliefs, paradigms) are said to determine the way organisations behave (Watkins and Marsick, 1997). OL is thus seen as a product of organisational memory that is stored in the artefacts of the organisation. But as Levitt and March (1988: 320) point out, “the experiential lessons of history are captured by routines in a way that makes the lessons, but not the history, accessible to organisations and organisational members who have not themselves experienced the history” (in Dixon, 1990). Consequently, the informal elements such as the stories and interpretations that colour an event are lost.

Clearly, the theories that have thus far been explored are descriptive models that offer explanations of how organisations adapt to various stimuli. OL is thus considered as a product of the process of organisational adaptation and is also shown to be dependent on past experience as embodied in organisational artefacts and their social context. However, given that such learning is grounded in past experience, it is most likely to be adaptive or incremental rather than generative. For learning to be truly effective, therefore, there is an argument to be made that organisations must first unlearn. This idea is not uncommon in the literature (Hedberg, 1981; Inkpen and Crossan, 1995). Levitt and March (1988: 323), for instance, point out that “a competency trap can occur when favourable performance with an inferior procedure leads an organisation to accumulate more experience with it, (which can, at the same time) keep experience with a superior procedure inadequate to make it rewarding to use” (in Dixon, 1990). This notion is also contained in the work of Walsh and Ungson (1991) who argue that organisational memory can have negative consequences if it influences the way a situation is viewed to the extent that other, possibly better alternatives are excluded.

Walsh and Ungson (1991: 61) define organisational memory as “stored information from an organisation’s history that can be brought to bear on present decisions. This information is stored as a consequence of implementing decisions to which they refer, by individual recollections and through shared interpretations”. According to the authors, organisational memory resides in individuals (in their memories, knowledge, assumptions, beliefs and cause maps), in culture (myths, stories, language and symbols of the organisation), in transformations (processes of the organisation), in structures (organisational roles and design of the organisation) and the ecology (physical structure) of the organisation. They also identify external sources of stored information such as former members, government reports and competitors’ records. Clearly, a vast amount of information relevant to an organisation can be stored. The difficulty, however, lies in knowing where to access particular information that is no longer in current use and also in finding suitable retrieval mechanisms.

Retrieval of stored information can be both, intentional or automatic. However, both can be problematical for different reasons. One reason has already been discussed and concerns the extent to which stored information leads to inertia through heavy reliance on past experience that excludes the exploration of new alternatives. A second problem pertains to the assumption that the stored information will be retrieved in the same form. For example, whether the information is retrieved from an individual's memory or external reports, it is subject to the perceptual filtering and interpretation of the 'storer' and the 'retriever'. For this reason, Weick (1979) argues that people ought to treat memory as a pest. Finally, a third problem arises when routines are so deeply entrenched that they become unconscious. According to Argyris (1990), automatic retrieval of information that is tacit makes it unavailable for reflection. Consequently, although automatic retrieval may be necessary for the functioning of the organisation, undetected errors may be repeated perpetually and not be discarded when they are no longer applicable.

Nevertheless, on the positive side, Walsh and Ungson (1991) posit that organisational memory can successfully guide the organisation by providing a record of what has historically worked or not worked thereby preventing the organisation from repeating the same mistakes. Additionally, they argue that decision choices that are grounded in the historical context of organisations are imbued with a sense of legitimacy that helps foster commitment (*ibid.*). It can thus be argued that organisational memory is a useful component of OL theories.

OL as communities of individuals who can learn and develop (e.g. Brown and Duguid, 1991, De Geus, 1996; Stata, 1996; Inkpen and Crossan, 1995)

In contrast to the aforementioned models of OL, some additional descriptive theories focus on the individual as the unit of analysis and portray organisations as collections of individuals who can learn and develop (Edmondson and Moingeon, 1998). Models that fall into this category also include theories that outline the conditions that facilitate or describe the benefits of individual learning (*ibid.*).

Brown and Duguid (1991) offer an interesting proposition that communities of practise emerge when individual learners become 'insiders' and absorb the tacit or 'non-canonical' (informal) knowledge of the organisation. In other words, OL occurs when individuals are socialised into the organisation and acquire its values, norms, beliefs and language. Clearly, the implication here is that OL is a product of culture, suggesting that learning is contextual and cannot be easily transferred from one situation to another. Immediately, however, this raises the question as to whether a particular culture is better at promoting learning than another.

The theme of organisational culture is prevalent in the work of several authors. Based on their experiences at Royal Dutch Shell and Analog Devices respectively, De Geus (1996) and Stata (1996) believe that true competitive advantage lies in management innovation, that is, the ability of managers to continually revise their worldviews and to learn faster than their competitors. Learning is thus seen as a process through which individuals gain new insights and knowledge. However, it is only through shared insights, knowledge and mental models that OL can occur. For instance, De Geus (*ibid.*) argues that the implicit knowledge of individuals becomes a building block for the institutional model once that knowledge is made explicit. But, he goes on to say that how fast this model changes will depend on the culture and structure of the organisation (*ibid.*). This point is also made by Stata (1996) who notes that the values and culture of an organisation have a significant impact on the learning process and the ability of the organisation to change.

In yet another study, Inkpen and Crossan (1995) have attempted to develop and apply a conceptual framework of OL. In their empirical investigation of joint ventures involving American and Japanese companies, they found that although individual managers in the joint ventures were generally positive about their learning experiences, integration at the parent level was problematic. This was attributed to a rigid set of managerial beliefs related to an unwillingness to unlearn and discard past practises (*ibid.*), a finding reminiscent of the point made earlier regarding the negative impact of organisational memory. But that aside, of particular importance is that their study identified three mechanisms that facilitate the process of individual to collective integration. These include: (1) personal facilitation whereby a leader or influential member of the organisation guides the integration of individual schemas towards the development of shared interpretations; (2) shared facilitation whereby common ground or a sense of trust and respect allows individuals to manage the process of integration themselves; and (3) artifactual information where organisational systems and structures act as integrating mechanisms.

Clearly, the above theories consider that individual learning lies at the heart of processes of collective learning. In that sense, OL is thus still viewed as a product. The obvious weakness to these propositions, however, is that they assume that individual learning readily transfers to processes of OL, a premise that is grounded more in optimism than in realism. A further limitation is that these propositions tend to ignore the issue of power and political activity in organisations. Thirdly, with the exception of Inkpen and Crossan (1995) who consider the role of organisational systems and structures, the fact that patterns of interaction in organisations endure even when individuals leave (Weick, 1979) is largely ignored in the theories that we have looked at so far. An argument can

thus be made that such paradigms have a tendency to be oversimplistic. To counteract these weaknesses, therefore, several authors attempt to offer prescriptive models for intervening in organisations to bring about change.

Intervention theories of OL

OL as organisational improvement gained through the participation of individuals (e.g. Barrow and Loughlin, 1992; Beck, 1989; Donegan, 1990; Illes, 1994; Swieringa and Wierdsma, 1992)

According to Edmondson and Moingeon (1998), theories of intervention at the organisational level of analysis propose various strategies for creating a learning organisation (LO). These theories assume that organisations learn when their members participate fully in substantive matters through problem solving activities, and so on (ibid.). In the majority of these expositions, however, the overriding concern appears to lie in finding solutions to the problem of becoming a LO (for e.g. Barrow and Loughlin, 1992; Beck, 1989; Donegan, 1990; Illes, 1994). The emphasis is thus on strategic approaches and human resource policies that will promote continuous learning, participation, teamwork and flexibility. As a result, processes of OL are frequently of secondary concern.

One exposition that can be said to fall into this category is put forward by Swieringa and Wierdsma (1992) who see the learning process as the cause of organisational change, not the result of it. Proceeding from the standpoint that organisational reality cannot be taken for granted and must be seen as a result of negotiation, they propose that changes in organisational behaviour can be initiated by starting a collective learning process. Towards this end, they further propose the use of 'goal-conscious' educational interventions in the form of specifically designed programmes, which the authors differentiate from traditional, prescriptive courses and refer to as 'learning organisational courses'. The latter, which primarily aim at helping organisations learn how to learn and to change as they learn (on the basis of self knowledge), are defined as a series of coherent interventions, the goals and content of which are negotiated in a learning contract that is agreed to by the contract partners, that is, the instigator, the participants and the educational staff or project leader. The main weakness with this model, however, is that there is no guarantee that the educational intervention will actually result in learning. Moreover, it implies an imposed learning process where the project leader or educational staff member is still the driver, a notion that undermines the theme of self-knowledge and its implications for self-direction. However, Swieringa and Wierdsma (1992: 77) argue that this is inevitable as "the greatest paradox

with the LO is that one has to be prescriptive on the meta-level in order to keep the organisation as a learning one, especially where the handling of learning principles is concerned". But whether this is true or not, such a view creates the tendency among employees to regard any such intervention as another 'wonder-drug' remedy thought up by top management and as one which is bound to fail.

Certainly then, an argument can be made that theories within this quadrant will have reduced effectiveness if underlying sources of resistance among organisation members are not identified and dealt with. For this reason, several theorists propose intervention theories at the individual level in order to overcome barriers in the mental models held by the members of an organisation.

OL as being dependent on properties of individual cognition (e.g. Argyris and Schon, 1978, 1996; Senge, 1990; Edmondson and Moingeon, 1998)

In contrast to the aforementioned category which focuses on the collective, several researchers have called on individuals to be accountable for changing their organisations. Expositions of this sort include the seminal works of Argyris and Schon (1978, 1996) whose description of OL as the 'detection and correction of error' has formed the basis of subsequent theories and is still one of the most useful and widely accepted propositions, and Senge (1990, 1993) who is often credited with bringing the concept of the LO to the forefront of academia and business practise.

Argyris and Schon (1978, 1996) contend that organisations become more effective when individual members learn through specific interventions that are purposefully designed to cultivate critical self-reflection. Through the agency of individuals, it is argued that learning occurs when anomalies or discrepancies in organisational theories-in-use are detected, corrected and the lessons drawn are subsequently translated into private images and shared maps of the organisation as individuals respond to internal and external environmental changes (*ibid.*). Individual decisions and cognitions are thus seen to shape the organisation, the assumption being that individuals can and do learn to change their cognition in preferred ways (Edmondson and Moingeon, 1998).

Argyris and Schon (1978, 1996) explain that individuals typically employ reasoning processes that create defensive routines and assumptions and which over time, become entrenched at the individual, group and organisational level, thereby inhibiting the exchange of relevant information and creating barriers to learning. Nevertheless, the authors believe that these barriers can be overcome with the help of interventions that help people become aware of and learn how to reduce the discrepancy between their actual theories-in-use, (i.e. the way they behave and are perceived to behave by others)

and their espoused theories-in-use, (i.e. the way they believe they behave). Their basic premise, therefore, is that suitable interventions can help individuals develop new theories-in-use that will enhance their ability to learn in their interactions with others (ibid.), a stream of thought that is rooted in action science.

Building on the work of Bateson (1973) who suggested that learning is hierarchical, Argyris and Schon (1978, 1996) further introduce the terms single-loop, double-loop and treble-loop or Deutero-learning to describe the levels of learning that result from detecting and correcting organisational theories-in-use.

Essentially, single-loop learning involves the detection and correction of error within the existing norms of the organisation (Argyris and Schon, 1978, 1996; Edmondson and Moingeon, 1998; Walton, 1999). Underlying policies and organisational objectives thus remain unchanged as the organisation reacts to changes in its internal or external environment. For this reason, such learning is also referred to as adaptive or corrective learning. Swieringa and Wierdsma (1992) describe it as more of the same but better. In other words, single-loop learning is associated with improvement (ibid.).

But although most authors in the age of the LO generally expound generative, double-loop learning as the bedrock for organisational longevity and growth, Bateson (1973) argues that the organisation's ability to remain stable in a chaotic context is important to the organisation's survival. There is, therefore, a role for single-loop learning in the organisation. This argument gains further support from Broersma (1995) who cites the example of Motorola to illustrate the relevance of this type of learning (in Walton, 1999). By improving its basic work processes, Motorola achieved a quality standard of less than 3.4 defects per million opportunities for error (ibid.). Burgoyne (1995), however, is critical of single-loop learning and posits that it is 'habitual' and difficult to unlearn. Consequently, he reasons that it inhibits future learning and is thus unsuitable for the sort of challenges faced by contemporary organisations. This clearly implies that a higher level of learning (i.e. double-loop) is required to challenge the status quo.

Double-loop or second order learning can briefly be summed up as the detection and correction of error that involves challenging and modifying the organisation's fundamental norms, on the premise that such generative learning will result in greater insights (Argyris and Schon, 1978, 1996; Edmondson and Moingeon, 1998; Walton, 1999). However, this sort of learning is clearly difficult to achieve because it inevitably entails challenging tried and tested ways of thinking and also means doing things that will upset the existing equilibrium.

Still, the potential advantages of this type of learning are invaluable. Broersma (1995) argues that systemic learning of this sort encourages people to think holistically and to

look beyond the work itself to the interplay of systems and activities that constitute the organisation (in Walton, 1999). Moreover, by assessing the wider context and reframing the organisation's core values, old routines and structures can be changed, sometimes even resulting in major breakthroughs. Royal Dutch Shell, for instance, redesigned its planning process as a learning process in the early seventies prior to the OPEC oil embargoes (Journal of European and Industrial Training, 1996: 26). By questioning prevailing norms and configurations, Shell was able to make several changes that enabled the organisation to outperform most of its competitors over the next two decades (ibid.). This example is typical of what Burgoyne (1995: 23) refers to as an 'adaptive' organisation that has "learned the trick of changing its habits to adapt to, and take advantage of contextual changes." Swieringa and Wierdsma (1992) refer to this level of learning as renewal because it relates to the renewal of insights (i.e. knowledge and understanding) within existing principles.

But there is still a higher order of learning which Argyris and Schon (1978, 1996) refer to as treble-loop or Deutero-learning. At this level, previous learning experiences are reflected on in order to generate new insights and future learning activities. Recalling Kolb's learning cycle (see section A), this transition from learning to doing indicates that the cycle is constantly recurring, the implication being that the analysis and application of concrete work experiences to future situations creates an upward learning spiral. Such learning is thus transformative and according to Broersma (1995) consolidates single-loop (operational) and double-loop (systemic) learning into a continuous process of evolutionary change that results in the continuous development of the organisation as a whole (in Walton, 1999). Along the same lines, Hawkins (1994) argues that treble-loop learning not only necessitates the investigation of fundamental perspectives that shape one's understanding of the world at the individual level, but it also involves changing the collective mindsets of the organisation's members, as well as the culture and the emotional context in which these are grounded at the organisational level. Burgoyne (1995) argues that at this level, an organisation is truly sustainable in that it creates as much as it adapts to its environment. This view is also held by Swieringa and Wierdsma (1992) who describe this level of learning as development and see it as enabling the organisation to proceed to a subsequent phase.

Clearly, Argyris and Schon (1978, 1996) view OL as a product of individual learning as well as a process through which organisations can become LOs. This view also finds favour with Senge (1990) who postulates that only two kinds of organisations will exist in the future, those that die a sudden or slow death and LO's. He theorises that the latter represents the panacea for achieving organisational excellence through the mobilisation of people's intelligence and commitment and the capacity to learn at all levels in an

organisation. This notion is encapsulated in his definition of the LO as one “where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together”, thereby enabling the organisation to “continually expand its capacity to create its future” (ibid.: 3, 14).

Senge (1990: 6) also introduces the notion of five component technologies, otherwise known as the five disciplines, which he believes “are gradually converging to innovate the learning organisation”. His argument is that these component technologies (personal mastery, mental models, shared vision, team learning and systems or systemic thinking), are critical to the creation of a LO and must coalesce and develop as an ensemble if they are to be effective. For a holistic understanding, these are discussed below.

Briefly, Senge (ibid.) reasons that personal mastery, achieved through a commitment to lifelong learning, allows people to continually deepen and clarify their personal vision and to understand the connections and reciprocity between themselves and the organisation. He argues further that by surfacing tacit mental models individuals can learn to scrutinise their own deeply held assumptions regarding their existing worldviews. Moreover, by laying that thinking open to the influence of others through a process of advocacy and inquiry, learningful conversations can be held to help build shared visions. This latter discipline involves building shared pictures of the future and serves to bind people together around a common identity and sense of destiny thereby nurturing genuine commitment to the organisation as a matter of choice rather than through compliance. Senge (ibid) also argues that team learning is a vital discipline because teams and not the individual constitute the fundamental learning unit in contemporary organisations. He goes so far as to state that organisations cannot learn unless the teams in them learn, beginning with dialogue and the capacity of team members to suspend their assumptions and enter into a genuine ‘thinking together’. Lastly, Senge (ibid.) draws on system dynamics to put forward his fifth and most important discipline, systemic thinking, which he describes as the ‘glue’ that integrates all the disciplines. This last discipline is premised on a philosophical notion that everything is part of a larger whole or system and that the whole can exceed the sum of its parts. The contention here, therefore, is that members of the organisation can learn to appreciate the interrelated nature of the world and their experience therein. Having done so, it is argued, they will be in a position to understand patterns of causality and the ‘systemics’ in their own organisations. Consequently, they will be able to influence organisational actions better.

Although rooted in system dynamics as opposed to the influence of action science, it is clear from the preceding discussion that there are several similarities in the work of Senge (1990) and Argyris and Schon (1978, 1996), a fact that is coherently expanded upon by Edmondson and Moingeon (1998). For instance, both expositions view OL as a product that results from interventions aimed at surfacing and altering individual cognitive models (i.e. mental models and theories-in-use, respectively). This argument stems from the conviction held by the researchers that individual ‘actors’ in the organisation act in ways that lead to unintended, counterproductive results through ignorance of causal relationships in the system (Senge, 1990), or through Model I theories-in-use (Argyris and Schon, 1978, 1996) that lead to defensive behaviour. Similarly, both sets of researchers maintain that these same individual actors are unaware that they contribute to such unintended consequences because their actions derive from tacit sources. Consequently, they propose that effective (generative or double-loop) learning can only result through expert interventions that make these tacit sources explicit and understood so that corrective action can be taken. Lastly, both expositions posit that OL is a means towards an end, that is, a LO (ibid.).

But as desirable as a LO might be and as plausible as these theories sound, they are subject to both conceptual and practical limitations. To illustrate, a major weakness pertaining to both theories as put forward by Argyris and Schon (1978, 1996) and Senge (1990), is the presumption that there is a right answer known to the intervening consultant or facilitator as if by some divine right. In reference to the work of the former, Nonaka and Takeuchi (1995: 46) are quick to point out the fallacy in assuming that “someone inside or outside the organisation ‘objectively’ knows the right time and method for putting double-loop learning into practice.” The same criticism applies equally to Senge.

Senge’s account in particular is riddled with seeming inconsistencies that demand further investigation. To begin with, his emphasis on the “continually expanding capacity of a LO to recreate its own future through learning” does not lend itself to practical application or measurement. An additional criticism is that Senge’s explanation focuses too much on the future at the expense of the present. For instance, the implication of continuous transformation contained in his definition is counterintuitive to the way organisations and the individuals within them learn and behave (Walton, 1999). Additionally, it is questionable whether the implied state of urgency and flux that characterises Senge’s exposition permits enough time for reflection and whether it considers the need for stability to enable learning to be embedded into the organisation’s memory so that important lessons are not overlooked or forgotten.

But that aside, one main problem with both approaches, is that they tend to underestimate the individual and organisational dynamics that are likely to accompany the sort of profound, transformational shifts in behaviour and thinking implied by a LO. For although their suggested intervention strategies might result in better individual performance by increasing individual competence, this does not necessarily translate into effective organisational change.

By way of illustration, consider Senge's exposition which posits that a LO is a metanoic organisation that requires a shift of mind. Clearly, this notion is problematic because it implies the ability to induce a collective shift of mind in the same direction. Moreover, this assumption is inconsistent with the fact that the five disciplines are personal disciplines and that throughout Senge's approach, the emphasis is on the individual working within a team. Certainly, an argument can be made that team learning offers a viable medium for this collective shift of mind through the surfacing of tacit mental models, but even within the team, perceptions and interpretations are likely to diverge widely. It also remains unclear as to how making tacit mental models explicit can translate into processes of OL. Moreover, the inference that one cannot mastermind a LO unless one harnesses such individual forces as personal mastery, mental models and so on, begets questions about how this can be done and what sort of mechanisms need to be in place to enable this extraction (Walton, 1999). More importantly, even though Senge attempts to put forward a 'deterministic' view of individuals within the organisation, this is inconsistent with a model of intervention that suggests a regard for people as an easily manipulated element.

A further area of concern pertains to the potential contradictions in Senge's thinking around the five disciplines. To begin with, Walton (1999) contends that the term 'component technologies' to describe the five disciplines is deceptive as the disciplines, with the exception of systemic thinking, are more comparable to value orientations and do not reflect structural or design imperatives. Additionally, he suggests that there may be conflict between the notions of personal mastery and shared vision (ibid.), as it cannot be assumed that people will hold unitary views (shared visions). After all, organisations are pluralist systems and success may well rest on that fact and the ability to challenge the status quo as opposed to monism, which connotes conformity. Further still, Walton (ibid.) raises the possibility that shared vision can lead to new mental models that become just as fixed as previously held convictions. Certainly, in this respect, it is counter-intuitive to believe that individuals are capable of constantly surfacing tacit mental models and questioning deeply held assumptions. It also raises concerns regarding the methodology that may be used to assist individuals to surface

tacit mental models and begets questions over the cultural levers that need to be tackled in order to achieve this state of being.

A number of difficulties also arise with regard to the concept of systemic thinking. In his review of the five disciplines, Flood (1998) argues that the key insight of systemic thinking is that everything is verily interrelated to everything else. As a result, he posits, systemic appreciation is an ever expanding exercise that must, nevertheless, be bounded in order to furnish a viewpoint that is both relevant and manageable. However, this also raises ethical considerations as to who should judge whether any one viewpoint is relevant (*ibid.*). Carrying this argument further, the need to reduce systemic thinking to a more manageable scale implies that systems ought to be considered as somewhat fixed at a point in time in order to be understood, even though in reality, they are not. This points to a major weakness in systems theory which is the tendency to present organisations as static entities rather than as products of the continuing social interactions of their members and of those members with the external environment (Harrison, 1993).

Additionally, the question as to who should judge whether the setting of boundaries is appropriate, highlights a crucial gap in Senge's thinking for it appears that beyond mentioning the negative impact of politics in organisations, he ignores the issue altogether. Moreover, according to Flood (1998), he treats the related theme of knowledge power, a term denoting that what is considered to be valid knowledge is determined by powerful people, far too lightly. Indeed, Flood (*ibid.*) reproaches Senge for unsystemic thinking in his attempt to deal with the issue of management hierarchy, the most obvious of the knowledge power relationships. His contention is that by prescribing a participatory model loosely defined in terms of openness and merit, Senge inhibits a holistic appreciation of possible organisational structures by imposing a preordained judgement concerning the relevance of any one model to a situation (*ibid.*).

Similar criticisms can also be levelled at Argyris and Schon. For example, there is a degree of political incorrectness that underscores the basic precept that an 'expert' facilitator or even an individual's colleague(s) can judge the correctness of that individual's theory-in-use. For example, what may be perceived as Model I behaviour by some, might be perceived as Model II behaviour by others. Finally, one of the major weaknesses of this model is that it neglects to consider the organisation as a system as well as a construction.

To counter some of the weaknesses that have hitherto been discussed, Edmondson and Moingeon (1998), citing more recent writings by Senge (1990) and Argyris (1996) which advocate the need to integrate systems thinking and behavioural disciplines and

to work with behavioural and technical issues simultaneously, call for an integrated model that combines system dynamics and action science. Indeed, Edmondson and Moingeon (*ibid.*) view both contributions as complementary parts of a theory of intervention that focuses on examining and developing mental models, their proposition being that engaging both cognitive models at the same time can prove to be far more effective than either approach alone. They argue that while Senge's approach engages participants in substantive strategic issues, Argyris and Schon's approach helps them to develop critical reasoning and communication skills for learning. For instance, the authors explain that organisational commitment to developing interpersonal theories-in-use will be stronger when the intervention includes a substantive issue. By the same token, they posit that if participants are to take action based on new diagnoses of system interrelationships, action science can provide training in the interpersonal competence and ability to learn in difficult interactions that are needed to communicate these insights and plans to others. They thus argue that the two approaches mutually reinforce a sense of ownership and self-reflection given that both advocate the need for individuals to be accountable for results by striving to be 'on-the-job researchers' with the ability to critically examine and learn from data (*ibid.*).

But while this appears to be a useful proposition, as the authors acknowledge, empirical research needs to be undertaken to assess its validity. A further problem is that like most intervention theories, it is subject to the fallacious assumption that all individuals will respond to the same intervention positively. Moreover, none of the accountability theories that have thus far been presented cater for individual differences and preferences in learning styles and orientations.

For this reason, it is suggested that any theory of intervention targeted at the individual level must be grounded in an understanding of descriptive theories that explain how individuals learn. Recalling the first section of this treatise, it was postulated that adults have a natural propensity to be increasingly self-directing in their learning and that organisations have a responsibility to help their members do so, while also catering for the needs of employees who prefer a different mode of learning or who are unable to function as self-directed learners. This argument was borne out by a critical analysis of pedagogical, organisationally-directed training practise on the one hand, and andragogical, self-directed adult learning theory on the other. Following an examination of the underlying premises of each approach it was argued that the latter model offers greater advantages because it has a wider scope and takes into consideration basic and generally accepted principles of learning. Moreover, it was argued that self-directed learning is more pervasive in that it allows knowledge to be both externalised and internalised thereby extending the knowledge base of the

individual and building in the capability to transfer the learning. However, given that not all learners are able to function in this mode, it was also suggested that a reconciliation of the two approaches is necessary in order to move learners in the direction of self-development, the latter being the ultimate mode of learning. In this respect, a conceptual matrix was derived to help illustrate how the two approaches can be reconciled in order to align individual and organisational goals.

Accepting these premises, an argument can thus be made that intervention models such as those posed by Senge and Argyris and Schon are important to the extent that they contribute to the learning ability of individuals, the assumption being that people who are self aware make better learners and that better learners, in turn, perform better in their jobs, thereby contributing to greater organisational effectiveness.

Examining the usefulness of OL theories

At this point, having explored various approaches to understanding OL in some depth, it may be instructive to take stock of this discussion before moving on to the themes of knowledge creation and knowledge management.

Throughout the course of this discussion, it has been plainly apparent that there is little consensus as to what OL is, with both descriptive and prescriptive expositions varying according to whether they regard OL as a function of individual learning processes 'extrapolated' or as something that the organisation does as an entity. But although distinctive, these demarcations should not be thought of as contradictory or exclusive. Rather, they should be thought of and accepted as complementary contributions that serve to describe or explain a part of an, as yet, undefined whole. For although there is no unanimously accepted definition, there are several areas of consensus that permeate the literature and which have surfaced in the course of this discussion. For example, irrespective of the lens used to view OL, themes of organisational adaptation and change are central to most theories, the implication being that learning is intertwined with the need to align the organisation with its external environment. Additionally, the role of the individual and contextual factors such as strategy, structure and culture appear to be prevalent themes among various OL theorists.

Of particular interest, is the assumption inherent in every case that OL will lead to better organisational performance in the future, indicating that there is a direct relationship between learning, employee performance and competitive advantage. Indeed, there does appear to be a general convergence that the rate at which individuals and organisations learn is the only source of sustainable competitive advantage. But the notion that more learning is always a good thing is a major misconception. For example, one has to consider the possibility that individuals and organisations might be

learning the right things incorrectly or even learning the wrong things altogether. As Hawkins (1994) points out, the value of learning is dependent on where it is taking you. Thus a quality over quantity argument prevails here. Additionally, while learning may lead to better employee performance that translates to increased organisational efficiency, this only means that things that are already being done will be done better. As management guru Drucker (1977: 44) explains, organisational efficiency denotes the ability “to do things right”. However, even the most efficient organisations cannot survive unless they are efficient in “doing the right things” (ibid.). This means that the key to success lies with organisational effectiveness, which must precede efficiency. Indeed, organisational effectiveness is what determines whether the performance of a particular activity will contribute to the strategic goals of the organisation. Generally defined in terms of high quality and a customer-driven focus, it can thus be argued that it is organisational effectiveness that enables the organisation to survive and stay ahead of its competitors.

Accepting this argument, in order to round up this section on OL, it makes sense to assess theories of OL in terms of the extent to which they lead to implications on how to improve organisational effectiveness. In light of the preceding discourse, it can thus be argued that intervention theories offer a more pragmatic approach to understanding OL and improving organisational effectiveness because they generally include a purpose (to become a LO), a process (in the form of the intervention) as well as content (the subject matter of the intervention). In other words, they attempt to answer the questions why, how and what. In contrast, descriptive theories are usually limited to answering the question of how thus generating few useful implications. Still, it has repeatedly been acknowledged that all theories comprise a piece of the OL puzzle. As Hawkins (1994: 78) argues, “it is necessary to have a pluralistic dialogue between the various perspectives and windows on understanding organisational life, so that each can illuminate not just a different aspect of organisations, but the limits of the other perspectives.” An argument can thus be made that intervention theories which aren’t grounded in a concrete understanding of how learning occurs are likely to be limited in their effectiveness, suggesting the need for an integrative approach.

The relationship between learning and knowledge

But even with an integrative approach, one critical limitation of OL theories is that they do not pay adequate attention to the theme of knowledge. As Nonaka and Takeuchi (1995) point out, many theories scarcely mention knowledge itself yet, paradoxically, they expound its pursuit through learning. Additionally, although it is quite obvious that knowledge and learning are inextricably intertwined, this relationship is not dealt

with adequately in discourses of OL. One of the main criticisms that Nonaka and Takeuchi (1995) level at OL theories is that they fail to conceive a theory of knowledge creation. Moreover, where they do address the issue of knowledge, they are concerned with the acquisition, accumulation and utilisation of existing knowledge, not the generation of new knowledge.

To remedy the situation, the authors put forward a theory of knowledge creation in their classic, groundbreaking book, “The Knowledge Creating Company”. Arguing that Japanese companies are successful because of their skills and expertise at ‘organisational knowledge creation’ where the latter is defined as “the capability of a company as a whole to create new knowledge, disseminate it throughout the organisation, and embody it in products, services and systems” (ibid: viii), the authors contend that knowledge is the source of competitive advantage.

Basically, Nonaka and Takeuchi (1995) identify two kinds of knowledge; explicit knowledge which is formal and systematic and can thus be easily articulated and communicated, and tacit knowledge which is highly personal and subjective and which, conversely, cannot be easily communicated. The authors posit that the interplay between these two kinds of knowledge and between the individual and the organisation brings about four major processes of knowledge conversion (ibid.). Although these are briefly explained in the first section of this paper, for the sake of convenience they are briefly summarised below (adapted from Nonaka and Takeuchi, 1995; Nonaka, 1996).

The first of these conversion modes is referred to as socialisation and entails the conversion of tacit to tacit knowledge that is sometimes shared directly between individuals as in the case of an apprenticeship. Learning thus occurs through observation, practise and imitation. But because the knowledge is tacit, neither individual involved in the apprenticeship gains any systematic insight into their craft and the knowledge cannot really be taken advantage of by the organisation. The second conversion mode refers to the regeneration of explicit information through the combination or synthesis of discrete pieces of explicit knowledge from many sources to create a new whole. The problem though, is that this type of conversion does not really extend the company’s existing knowledge base. In contrast, externalisation (or articulation) which involves making tacit knowledge explicit, surfaces that knowledge and makes it available to the organisation to be shared and exchanged. Once that is achieved and the knowledge is shared throughout the organisation, a process of internalisation occurs whereby the newly explicit knowledge is used by individual employees to broaden and reframe their own mental models, making the knowledge tacit once again.

According to Nonaka and Takeuchi (1995), these four patterns of creating knowledge exist in dynamic interaction to create a kind of spiral. However, the authors contend that although some of these have been discussed from various perspectives in organisational theory, for example, socialisation is linked to organisational culture, combination is grounded in information processing and internalisation corresponds to organisational learning, externalisation has been somewhat neglected even though together with internalisation, it is one of the critical steps that forms the spiral of knowledge. But this assertion suggests that the authors have a limited view of OL. Certainly, it has been shown throughout this discourse that OL incorporates more than just internalisation.

Moreover, by mapping Nonaka and Takeuchi's theory of knowledge creation onto Kolb's generally accepted learning theory, it is clear that the four patterns of knowledge creation roughly coincide with Kolb's learning stages. To illustrate, consider Kolb's experiential learning cycle which divides learning into four integrated stages, namely, concrete experience, reflection, conceptualisation and experimentation. According to this theory, learning commences with concrete experience that is processed and reflected upon by the individual. Thereafter, it is placed in a meaningful context and translated into concepts which can be tested out in future life and work situations (Rae: 1994). Similarly, Nonaka and Takeuchi (1995:63) posit that concrete experience is the key to acquiring tacit knowledge. Indeed, using their terminology, experience can be defined as assimilated tacit knowledge. In the process of reflection however, this tacit knowledge enters the explicit realm. Subsequently, it is combined with existing information and placed into meaningful contexts that result in new conceptualisations. The tacit realm is then re-entered and the new conceptualisations become sufficiently internalised to be applied to future situations. This dynamic interplay is shown in the diagram overleaf³.

³ This model as shown here was first presented by Dr. Pete Mann, lecturer at IDPM, University of Manchester during the course of a lecture attended by the author of this treatise.

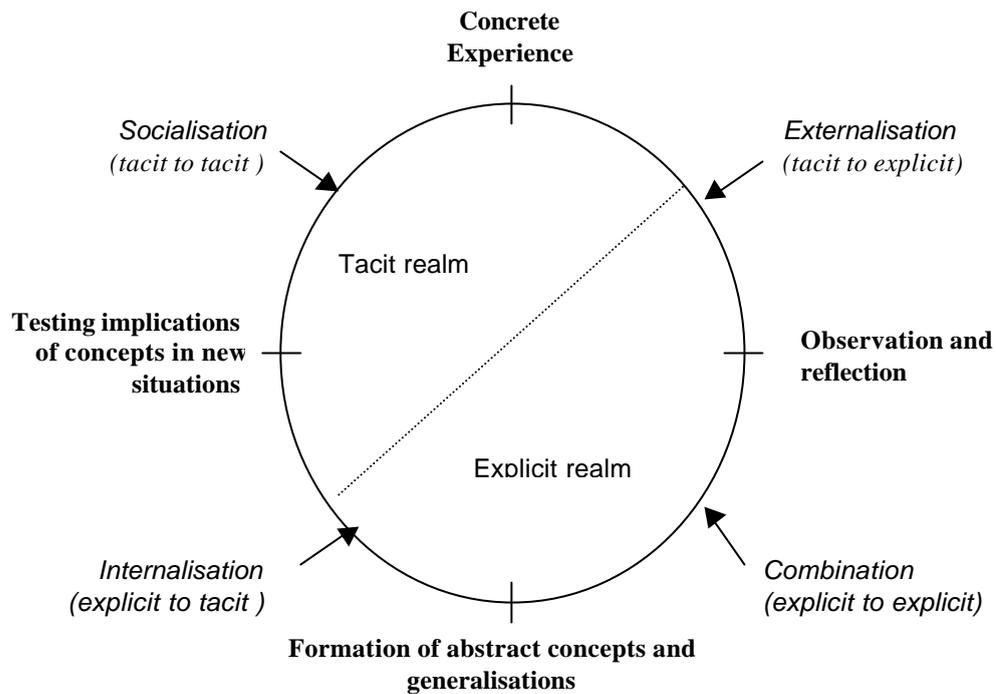


Figure 3: A Hybrid Model of Experiential Learning and Knowledge Creation.

Adapted in part from Reid and Barrington (1997)

Viewed in this way, Nonaka and Takeuchi's model of knowledge creation does not appear to be a radically new exposition. It does, however, offer a more sophisticated, refined analysis that focuses categorically on the issue of knowledge. A further important point is that it contains a continuous movement between the individual and organisational level of analysis.

By superimposing this ongoing dialogue onto Kolb's cycle, the latter as represented in the hybrid model above, incorporates the same dynamic interaction as a key feature. This, in part, addresses the failure of most OL theories to explain how individual learning translates to processes of OL. But the main observation to be drawn from the preceding discourse is that knowledge and learning are intimately intertwined. Certainly, it can be safely argued that knowledge is the logical outcome of processes of learning. However, given that each conversion mode can create new knowledge independently (Nonaka and Takeuchi, 1995; Nonaka, 1996), accepting the hybrid model and the positioning of the knowledge conversion modes on the diagram suggests that knowledge also feeds the learning process.

Clearly, knowledge is vital to organisational survival. As Marquardt (1996) argues, knowledge is the main resource that is used in performing work in organisations given that its procedures, traditions, culture, technology, operations, systems and so on, are all based in some measure on the knowledge and expertise that the organisation has access

to. The challenge for organisations is thus to marshal and channel knowledge in order to gain competitive advantage through effective knowledge sharing. This fact has led to an exponential growth in interest in the topic of knowledge management with 'intellectual capital' being considered the core asset of organisations in the new millennium. To round up this review on OL systems, therefore, the related topic of knowledge management will be explored.

Knowledge management

According to Hansen et al (1999), knowledge management (KM) is usually achieved using one of two very different strategies, a codification strategy or a personalisation strategy. While the former is centered around the use of computers to codify and store information in databases so that it can be accessed easily and used by anyone in the organisation, the latter is chiefly concerned with the sharing of knowledge through direct personal contact, the knowledge being closely tied to the person who developed it. The main purpose of computers in the latter model is thus to help people communicate knowledge rather than to store it (ibid.).

But as soon as we introduce the matter of choice, a number of additional factors come into play. For instance, the type of strategy that is employed must take into consideration the kind of information that is to be stored and the purpose for which it will be used in the future. Hansen et al (1999) suggest that when dealing with routine issues or similar problems where the efficient reuse of codified knowledge is essential, a codification strategy is appropriate. However, where customised solutions and unique knowledge is required, a personalisation strategy is more appropriate (ibid.). Additional factors which they identify as determining the strategy that will be used, include whether the company has a mature or innovative product and whether employees rely on tacit or explicit knowledge to solve problems. Similarly, Dixon (2000) argues that the key to making knowledge-sharing work is in matching the type of knowledge with the right transfer method. She goes on to identify three factors that determine the method through which the knowledge can be most effectively transferred. These are whether the task is routine or not, whether the knowledge that is to be transferred is tacit or explicit and whether there is any similarity between the originator and the receiver of the information (ibid.). Quite obviously, a codification strategy is appropriate to routine tasks that are similar and which involve explicit knowledge. Conversely, non-routine tasks that involve dissimilar, largely tacit knowledge require a personalisation strategy.

Certainly though, people in organisations are faced with both routine and non-routine tasks on a daily basis. An argument can thus be made that both KM systems are necessary to the organisation's success. However, as Hansen et al (1999) warn, trying to

pursue both strategies at the same time can seriously undermine the effectiveness of the organisation. Based on their finding that companies that truly excelled in their KM strategy tended to use one strategy predominantly while using the second strategy in a supportive role, they recommended an 80 to 20 percent split. But irrespective over which strategy is chosen, a number of concerns arise with the introduction of KM. For example, its presence does not guarantee that people will participate willingly in the knowledge-sharing process. After all, the old adage that knowledge is power still holds true in many organisations, particularly in an era of lean organisations, downsizings and redundancies which typically threaten long term employment. To counter this mentality, Hansen et al (1999) suggest that people need real incentives to share in the process of knowledge sharing. One way is to ensure that the quality of employees' contributions to the database or the ability to have frequent high quality interpersonal learning conversations or dialogues is incorporated into their annual performance review (ibid.). Yet, even so and assuming that people do voluntarily engage in the knowledge sharing process, a number of ethical issues also arise.

A particularly burning issue pertains to the ownership of knowledge. McInerney and Le Fevre (2000) point out that while all explicit material that is created on the job rightly belongs to the organisation and should be stored in its repositories, the question of who owns the knowledge that resides within employees is less clear cut. In this respect, they question whether the organisation has the right to 'mine' the tacit, highly subjective knowledge that is the hallmark of a professional and to make it a commodity available for sale. Moreover, if that is the case, they question why CEO's and people high up in the hierarchy are not being asked to share their knowledge (ibid.). Viewed in this way, KM is thus seen as another manipulative tool for management in the upper echelons to command and control. A related issue is that of trust (Davenport and Prusak, 1998; McInerney and Le Fevre, 2000). Certainly, if people are to share their knowledge they must trust that it will be used for legitimate purposes (ibid.). As McInerney and Le Fevre (2000:15) posit, "effective knowledge management calls on those who are experienced to provide the knowledge that they have gained to those who develop the firm's knowledge repositories. It is up to information specialists, then, to treat the knowledge and the people responsible for it in fair and just ways that engender trust and confidence in the systems that are established." Finally, among the ethical issues that are raised, the authors also include the unauthorised sharing of knowledge by employees and the question of privacy and autonomy.

Perhaps one of the most pressing concerns KM, however, is that the corresponding introduction of IT applications, such as intranets, has made knowledge easily accessible to anyone in the organisation thereby cutting across managerial specialisms. This

augurs acute ramifications for the future role of managers in the organisation and has also created ambiguity over the relationship between the use of technology and the pursuit of organisational goals (Newell et al, 2000). That intranets have crucial advantages brooks no argument. Indeed, its ability to allow communication across different operating systems and equipment in order to foster general communication and collaboration among the organisations' employees is widely desirable. However, Newell et al (2000) found that intranet development tended to encourage fission rather than integration because of, what they termed, 'powerful centrifugal forces operating on the strategic development of the firm'. They also found that in certain, highly decentralised contexts, the use of intranets tended to reinforce geographical and functional barriers to the exchange of knowledge (ibid). The suggestion here, therefore, is that there are limitations to the application of intranets as a form of KM. An additional implication is that organisational culture will have a crucial role to play in the transfer of knowledge.

But although this brief foray into some of the key issues surrounding the theme of KM is by no means exhaustive, it is clear from the preceding discussion that the literature on OL and KM run along similar lines, frequently overlapping. For instance, the systems-structural perspective and organisational memory are key elements to the knowledge strategy of codification. Similarly, the discourse on the interpretative perspective is largely reflected in the personalisation knowledge strategy. Moreover, both knowledge strategies are strongly influenced and in turn influence the organisation's culture as with processes of OL. However, the key similarity is that both OL and KM are fundamentally about people. Indeed, if organisations are to succeed in leveraging learning and the corresponding knowledge, learning or knowledge transfer must be achieved. According to Dougherty (1999), the latter is really about connection, which ultimately depends on the choices made by individuals. The lesson to be drawn from this discussion, therefore, is that it is people who are the source of sustainable competitive advantage.

Summary

In summary, this discussion has been divided into two main sections intended to enhance an understanding of learning in the workplace. The first section on adult learning, highlighted the mismatches between pedagogical, organisationally-directed training practise that is grounded in the behaviouristic school and andragogical, self-directed adult learning theory which derives its philosophy from the humanistic approach. Based on an analysis of the underlying premises of each approach it has been argued that the latter model offers greater advantages because it takes into consideration

basic and generally accepted principles of learning. Moreover, it has been argued that self-directed learning is more pervasive in that it allows knowledge to be both externalised and internalised thereby extending the knowledge base of the individual and building in the capability to transfer the learning. However, given that not all learners are able to function in this mode, it has been argued that a reconciliation of the two approaches is necessary in order to move learners in the direction of self development, as the ultimate mode of learning. In this respect, a conceptual matrix was derived to help illustrate how the two approaches can be reconciled. It was also implied that purpose and process must be emphasised over content and it was further suggested that experiential techniques culminating in discovery learning should be used. Finally, some suggestions to help learners move up the continuum towards self-direction were also suggested.

In the second section, the discussion was broadened to look at various theories of OL. Borrowing a typology from Edmondson and Moingeon (1998) which organised the literature according to descriptive and intervention theories at the individual and organisational level, the argument was put forward that intervention theories lead to more useful and pragmatic implications for application in the workplace. Particular emphasis was placed on the works of Senge (1990) and Argyris and Schon (1978, 1996) in the belief that both works have provided a source of critical leverage for facilitating and understanding processes of OL. However, it was also pointed out that these models are largely prescriptive offering normative explanations of what should be rather than examining what already exists. Still, it was felt that these models are the key to unlocking the self-awareness that will allow individuals to move up that continuum towards self-directed learning as argued in the first section of this treatise. Finally, the discussion was rounded up with a brief discourse on the relationship between learning and knowledge and the implications for knowledge management.

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Michele Mariani

Organisational learning: towards a unified view of individuals, work and society

Introduction

This contribution begins by drawing attention to the fact that the concept of a Learning Organisation¹, as distinguished from other management paradigms, both acknowledges the necessity for and advocates the participation of all the components of a company's layers. After a general discussion on the concept of Learning Organisation, the second section is devoted to outlining some of the theories that are pertinent to this topic. Thereafter, in the central section some models, tools, and trends that are relevant to the main argument are briefly exposed. This is followed by three additional sections, which discuss some measures, problems, and national cases of organisational learning in the chemical sector respectively. Finally, in the conclusion, the author contends that it is necessary to orient the activities of the OrgLearn project towards a unified view on work, individual, and society at large.

Learning Organisation: Continuous improvement and change through participation

Moldaschl and Weber (1998) provide an effective and useful summary of the changes that followed Taylor's (1947) Scientific Management. "The Humanisation of Work movement entered the scene alongside, if not in place of, the (continuing) cosmetic

¹ Although some authors distinguish between Learning Organisations and Organisational Learning (e.g. Tsang, 1997), the present contribution will use the two terms as different labels for the same concept.

Human Relations movement with concepts that sought to create improvements in working conditions in the direction of self-determined work [...]. The hopes had by a large proportion of managers of being able to solve rationalisation problems in the future with the help of the 'information technology revolution' made the eighties a 'lost decade' from the viewpoint of organisational innovation. It was also during this time that 'Computer Aided Neo Taylorism' in the form of CIM (Computer Integrated Manufacturing) became a leading work design principle [...]. Nevertheless, it soon became evident [...] that systems were too inflexible, failure-prone, and expensive [...]. In this atmosphere of disillusionment, the study conducted by the MIT on the automotive industry [...] (Womack et al, 1990) made its appearance. Such a study was part of a larger research program on the competitiveness in the trade and turned out to be one of the most influential of the last decade. Its core argument: Western (auto) companies were suffering from Taylorism while in Japan 'lean production' was uniting the advantages of mass production (automation, efficiency) with those of the preceding crafts-oriented production era (flexibility, skills) [...] the theory is put forward that efficiency can easily be increased by partially renouncing the exercise of control, but the conflicting efficiency and control interests of management [...] are not addressed" and "Industrial Relations² and participation don't play a role at all." (Moldaschl and Weber, 1998).

Subsequently, organisational learning emerged as a way of attaining improvements by encouraging the involvement of all employees in response to the "growing need in organisations to move beyond solving existing problems to improving continuously in the face of changing conditions" (Snyder and Cummings, 1998). Indeed, as Snyder and Cummings (ibid.) argue, "organisations' ability to change or redesign themselves continuously may be necessary for survival". The authors further explain that "the capacity for change and improvement has increasingly become associated with organisational learning" (ibid.).

Compared with past approaches, then, the key distinguishing feature of the Learning Organisation is that it acknowledges the fact that "even the people involved in seemingly routine work practices have to be inventive because the world they're working in changes so quickly" (Brown and Duguid, 2000).

Such an acknowledgement makes the Learning Organisation a potential bridge between the singularity of individuals and the continuity of organisations (Nonaka and Takeuchi, 1995). "From the shop floor to management, in a lifelong learning process [...] the effective organisation is one that fosters individual, group, and organisational learning

² For a thoroughly review of workplace industrial relations see Kitay and Marchington 1996.

as a key characteristic in order to become a learning system" (Burns, 1995). The value of knowledge created at the shop floor (or at the front office) becomes evident. And what is valued is not only technical competence or other 'soft' competencies (e.g. social, emotional competencies), but "the totality of all the useful knowledge coming from experience and social interactions" (Ciborra, 1995). The process of transfer from the individual to the organisational level thus always implies participation mechanisms that cut across role-based, power structures.

Defining Organisational learning

The concept of organisational learning tends to divide researchers. On the one hand, critics complain that it suffers from an abundance of definitions and seems too fuzzy (Mabey and Saman, 1995; Garavan, 1997)³. On the other, proponents of the concept, for instance Gherardi (1995), argue that the adoption of a learning approach allows a new, more realistic perspective of companies as cognitive bodies, instead of operational ones. "Organisational learning enables exploration of the organisation as if it were a subject which learns, which processes information, which reflects on experiences, which is endowed with a stock of knowledge, skills and expertise" (ibid.). The view of organisations as learning bodies thus gives managers a 'vision', that they can usefully deploy to convey a message of 'change for continuous improvement'.

Merlino and Del Santo (1996) point out that there is a tension in the field between individual and organisational learning. Similarly, Snyder and Cummings (1998) elaborate on the issue and put forward useful criteria for the definition of organisational learning. The authors base their argument on the widely accepted premise that individuals naturally learn from their working experiences. Their main contention is that a company can be said to be a Learning Organisation if such individual learning transfers to the organisation, which in turn, changes as a function of the learning of its components. In their words: "Learning is organisational to the extent that: i) it is done to achieve organisation purposes; ii) it is shared or distributed among members of the organisation; iii) learning outcomes are embedded in the organisation's system, structures, and culture. To the extent that these criteria are met, organisation-level learning is distinct from individual level learning" (ibid.).

³ The author of this contribution shares this critique, however, the same can be said to be true of many other disciplines, comprising the field of Organisational Science. Such a situation lies at the heart of what Starkey (1998) refers to as "a growing sense of unease with existing paradigms of management and organisation" (ibid.), and, probably, of the very fast rise and fall of many management fads.

The importance of practice for learning

Acknowledging the importance of practice for learning has given rise to an increasing number of on-the-job training initiatives which have in turn, created more room for the conceptualisation and development of arguments regarding the concept of organisational learning. Different scholars have contributed to this conceptualisation putting forward a multitude of theories, some of which are briefly explored below.

First attempts: Revans and Kolby

Introducing learning as a major concern in work activity challenges the notion that the mind is a pure information processor. Information can always be perceived, but only in some cases is it processed and in even fewer cases is it stored as new knowledge. Before the more recent theory of situated learning was developed (see next paragraph), Revans (1980) and Kolb (1984), among others, proposed two theories, action learning and experiential learning theory respectively, which stressed the importance of practice and experience for learning to take place.

In explanation, the theoretical framework of action learning (Revans, 1980) advocates the use of structured projects in organisations rather than traditional classroom instruction. Its key elements include a commitment to learning, social interaction, action plans, and assessing the results of actions.

Kolb's (1984) experiential learning theory contends that the learning cycle consists of four primary stages, namely, concrete experience, reflective observation, abstract conceptualisation and active experimentation. Kolb (1984) argues further that individual preferences for each of these stages give rise to corresponding learning styles.

Subjectivity, sense making and situated learning in communities of practices

More recently, in contrast to the rationalist view and to transfer models that isolate knowledge from practice, Weick (1995) describes organisations as contexts for individual sense making, thereby reintroducing subjectivity in the work setting. The search for meaning is assumed to be an irreducible need and is thus considered a powerful motivational force for people's behaviour.

Echoing Weick's idea and drawing on the argument put forth by ethnographers Lave and Wenger (1991), Brown and Duguid (1991), in arguing for a unified view of work, learning and innovation, posit that learning is a social construction, putting knowledge

back into the context in which it has meaning⁴. Such a view assumes that the organisation "needs to reconceive of itself as a community-of-communities", the argument being that in such organisations, which "are in contact with the environment and involved in interpretative sense making, congruence finding and adapting", learning and change can happen (ibid.). In this way, the social context of learning and the notion that teams are essential units for the self-management of organisations and the reduction of hierarchical levels (see Morgan, 1986) are combined in a unique framework. A new organisational form thus emerges which promises to complement existing structures and radically galvanise knowledge sharing, learning, and change. Referred to as a "community of practice", it is argued that this organisational form can drive strategy, generate new lines of business, solve problems, promote the spread of best practices, develop people's professional skills, and help companies to recruit and retain talent. However, given that managers cannot mandate communities of practice the onus is on successful managers to bring together the right people, to provide an infrastructure in which such communities can flourish and to find non traditional ways of gauging the value of these (Wegner and Snyder, 2000).

In a recent article, Wenger and Snyder (2000) provide a useful 'snapshot comparison' of communities of practice, formal work groups, teams, and informal networks shown below.

	What's the purpose?	Who belongs?	What holds it together?	How long does it last?
Community of practice	To develop members' capabilities; to build and exchange knowledge	Members who select themselves	Passion, commitment, and identification with the group's expertise	As long as there is interest in maintaining the group
Formal work group	To deliver a product or service	Everyone who reports to the group's manager	Job requirements and common goals	Until the next reorganisation
Project team	To accomplish a specified task	Employees assigned by senior management	The project's milestones and goals	Until the project has been completed
Informal network	To collect and pass on business information	Friends and business acquaintances	Mutual needs	As long as people have a reason to connect

Table 1: Snapshot comparison of communities of practice, formal work groups, teams, and informal networks (Wenger and Snyder, 2000).

⁴ See also Vygotskij (Vygotskij, 1962) and Zuccheromaglio (Zuccheromaglio, 1996).

Work process knowledge as a mediator of Organisational Learning

The whole European network (AA. VV., 1999) has focused its activities on the concept of Work Process Knowledge as a central construct for success in the highly competitive marketplace of today. "The concept of Work Process Knowledge was developed to define the knowledge needed in the training of hotel employees, machinists and laboratory assistants. Developing Work Process Knowledge helped them to adjust to more flexible production processes" (Boreham, 1998). Essentially, Work Process Knowledge:

- in opposition with the well-known principle of having 'the right person in the right position', implies an expanded understanding of work roles;
- identifies the mix of the different skills necessary to be active participants within modern organisations, contrasting with the notion of abstract knowledge given by formal education;
- implies an awareness of the interdependency of the activities in different departments including characteristics of the system as a whole;
- is perceived as continuously being produced in the workplace (Kruse, 1986; AA. VV. 1999).

Shared knowledge of the work process thus increases the likelihood of individual learning that can be usefully changed into organisational learning, or in other words, into organisational processes of change.

Implementing strategies for Organisational Learning

The critical issue in bridging the gap between the theory and practice of organisational learning is effectively summarised by Powell (1998) who contends that "the key challenge [...] is to develop organisational routines for learning that are robust, flexible and durable" (ibid.).

The pragmatic way: the step-by-step approach to a Learning Organisation

Towards this end, Wick and Leon (1993) put forward their S.M.A.R.T. methodology for implementing a Learning Organisation. Articulated in five phases, it includes i) Selecting learning goals; ii) Mapping and planning their implementation; iii) Applying them; iv) evaluating the Results and finally, v) Targeting new goals.

Reporting on an additional approach, Prokesch (1997), describes how the leaders of British Petroleum took steps to create an environment that is conducive to learning. These included: i) creating an extremely flat organisation; ii) institutionalising breakthrough thinking; iii) tying people's jobs to creating value; and iv) designing

learning networks through information and communication technologies to facilitate the sharing of knowledge.

In yet another step-by-step approach, Snyder and Cummings (1998), draw on previous authors, to propose a four-stage process for the implementation of a Learning Organisation. They see organisational learning as consisting of four interrelated processes that were originally suggested by Dewey (1933) and later expanded upon by Argyris and Shon (1996) and Senge (1990). These are discovery, invention, production, and generalisation (Snyder and Cummings, 1998).

Finally, Garratt (2000) lists six different pre-conditions for creating a Learning Organisation. These include:

- accepting that organisations are complex adaptive human systems, not mindless machines;
- understanding that organisations are driven more by process than structure;
- understanding the difference between first and second order change processes;
- accepting the need to integrate the operational and policy/foresight learning cycles into a forum of strategic organisational debate;
- accepting and using the inevitability of 'events'; and finally,
- accepting the professionalism of direction-givers.

Garratt (ibid.) further argues that learning is possible through the creation of three 'learning cycles', namely,

- operational learning;
- policy learning, and
- strategic learning.

The technological vs. social orientation

Assuming that knowledge is a frictionless commodity possessed by individuals makes communication technologies and social organisation curious antagonists. Brown and Duguid (1998) argue in favour of "compatible organisational and technological architectures that respond to and enhance the social production of knowledge". They also point out that "sometimes it is useful to think in terms of 'both/and' rather than simply 'either/or'." The authors go on to state: "This seems particularly true when considering the effect of heterogeneous categories on one another, such as the effects of technologies on institutions. Instead of thinking of individuals vs. institutions, or markets vs. firms [...] it may be more instructive to think of how the two are interlaced" (ibid.). A very similar tension is also prevalent between practice and process orientations. "The [...] tension between processes, the way matters are formally

organised⁵, and practice, the way things actually gets done [...] do not represent rival views of the organisation. Rather, they reflect the creative tension at the centre of innovative organisations. In this, organisations resemble the well-known picture that, looked at once, appears to show a vase, but looked at once again, turns into two people, face to face. The vase resembles well-defined and precisely structured process - easy to understand though hard to change. The faces reflect practice - always unfolding in unpredictable ways" (ibid.).

Process	Practice
The way tasks are organised	The way tasks are done
Routine	Spontaneous
Orchestrated	Improvised
Assumes a predictable environment	Responds to a changing, unpredictable environment
Relies on explicit knowledge	Driven by tacit knowledge
Linear	Weblike

Table 2: A comparison between processes and practices (Brown and Duguid, 2000).

Brown and Duguid (1998) conclude that organisation of work should be a matter of balancing various tensions. "Top down processes designed to institutionalise new ideas can have a chilling effect on creativity. But they don't have to. Managers can learn to walk the fine line between rigidity - which smothers creativity - and chaos - where creativity runs amok and nothing ever goes to market" (ibid.).

Learning through storytelling and narratives

According to Moldaschl and Weber (1998), "it isn't so much the empirical validity of a study or result keeping with the objectivist position of scientific theory, but rather the practical effectiveness and compatibility with the respective social construction of reality".

Drawing on the original work of authors such as Savater (1985), Bruner (1990), and Rogers (1995) among many others, an emphasis on organising through processes of narration has thus been imported into the field of organisational studies by a number of

⁵ Given the scope of the project and the vastness of the topic it will not be possible to review the different proposals that have been put forward to describe companies' organisational structures. However, two contributions cannot be neglected: that of Morgan (1997) and that of Mintzberg and Van der Heyden (1999). The first contribution extensively discusses the theme of organisational metaphors, particularly focusing on the two main ones of mechanical and organic organisations (see also Burns, 1963). In the second contribution Mintzberg and Van der Heyden (1999.) reduce the possible number of organisational shapes to four different basic types of organisational representations: "Chains, hubs, webs, and sets can be found throughout most organisations [...]. Each organisational form suggests a different philosophy of management" (ibid.).

scholars (Orr, 1998; Boje, 1995; Boyce, 1996; Gabriel, 1995; Czarniawska, 1997). Indeed, narratives are seen as essential means for knowledge transfer and learning processes in that they are grounded in the social system in which they originate and are being used (Brown and Duguid, 1991). As such, Brown and Duguid (1991) argue, they cannot simply be transplanted and distributed without being beset by precisely the same problems that marked the old abstracted, 'canonical' accounts.

In another article, Brown and Duguid (2000) cite the example of how the stories told by two technicians about their experiences with an erratic machine, eventually formed a single, coherent account that allowed them to understand and fix the machine, the solution quickly becoming part of the 'community lore'. The authors further posit that "the constant storytelling about problems and solutions, about disasters and triumphs [...] serves a number of overlapping purposes. Stories are good at presenting things sequentially (this happened, then that). Stories also present things causally (this happened because of that). Thus stories are a powerful way to understand what happened (the sequence of events) and why (the causes and effects of those events) [...]." (ibid.).

On a related note, Klein and Roth (1997) put forward the idea of the Learning History as a tool for organisational learning. They explain that this consists of a written narrative that is almost entirely presented in two columns, of a recent critical event experienced by the organisation, which subsequently forms the basis for group discussions (ibid.). The authors contend that such a tool, "based on the ancient practice of community storytelling, can build trust, raise important issues, transfer knowledge from one part of a company to another, and help build a body of generalizable knowledge" (ibid.).

Rhodes (1997) also proffers a research method that draws on the tradition of storytelling in order to demonstrate an approach to the study of organisational change and learning that is based on three different representations, namely, autobiographical accounts, interpretations of the author and narrative fiction. The author argues that this method has proven to be effective in terms of accounting for the way that different people reconstruct and interpret their different experiences thereby keeping "in the spirit of the moves in many fields to reconceptualise research as narrative" (ibid.).

Learning through benchmarking and best practices

One of the most effective avenues toward organisational learning and improvement is the process of internal benchmarking, which according to Moldaschl and Weber (1998), reflects "the pragmatic approach in an American tradition that entails studying the

market leader, determining the success factors of the company in question, and turning them into practical instructions on how to achieve rational and expedient management".

Benchmarking, reduced to its bare essentials, consists of identifying, using and sharing the knowledge and best practices within one's own organisation. In their article, O'Dell and Grayson (1998) explore how organisations conduct successful internal benchmarking. Apart from the number of techniques and organisational practices they have observed, the authors reason that internal transfer is, firstly, a people to people process and must thus be preceded by relationships, the latter being a precondition for meaningful sharing and transfer (*ibid.*). Secondly, they consider learning and transfer to be an interactive, continuous and dynamic process and finally, they conclude that specific skills and capabilities are needed as a foundation (*ibid.*). These capabilities include:

- a process improvement orientation;
- a common methodology for improvement and change;
- the ability to work effectively in teams; the ability to capture learning; and
- the technology to support cataloguing and collaboration (*ibid.*).

O'Dell and Grayson (1998) eloquently summarise their argument by stating that "ultimately, successful transfer of best practices comes back to a personal and organisational willingness and desire to learn. A vibrant sense of curiosity and a deep respect and desire for learning from others are the real keys".

In attempting to define the limits of an uncritical adoption of the 'best practice' approach, Campbell (1999) warns managers not to view benchmarking as another 'holy grail'. "Taking ideas from other companies can be valuable, but it can also mislead and distract. It can prevent managers from focusing on what is unique to their situation" (Campbell 1999). Similarly, Moldaschl and Weber (1998) emphasise the need to always critically assess the extent to which such success is "not due to irreproducible socio-cultural factors [...] or greater deployment of technology and capital, and lower wages, but to rational and generally applicable management methods" (*ibid.*)⁶.

⁶ In the opinion of the authors of this contribution, 'best practice' resembles a more successful story than a procedures manual for building up a successful organisation. Probably the best way to look at best practices is as if the latter is a 'library of cases' that deserve to be known (see also Lawrence and Lorsch, 1967, for the constraints and mediating factors placed by a specific context on the uncritical adoption of practices and models).

Learning through Knowledge Management

According to Grant (1996), "the principles of organisational design suggested by the knowledge-based approach conflict with those of other organisational models, particularly the bureaucratic and information-processing approaches".

Certainly, however, the theme of Knowledge Management is relevant to the discourse on the Learning Organisation given that the former has both been inspired by it and also represents its 'natural' continuation.

Brown and Duguid (2000) state that "the new thing was Knowledge Management - businesses that could capture the knowledge embedded in their organisations would own the future [...]. Business Process Reengineering focused on processes. Reengineering is about the structured coordination of people and information. It's top-down. It assumes that it's easy to codify value creation. And it assumes that organisations compete in a predictable environment [...]. Knowledge Management focuses on effectiveness more than efficiency. It's bottom-up. It assumes that managers can best foster knowledge by responding to the inventive, improvisational ways people actually get things done. It assumes that value-creating activities are not easy to pin down. And it assumes that organisations compete in an unpredictable environment".

Based primarily upon the results of a study of 431 US and European organisations, Ruggles (1998) describes "what firms are actually doing to manage knowledge, what else they think they could be or should be doing and what they feel are the greatest barriers they face in their efforts". Proposing eight major categories of knowledge focused processes, he asks executives to evaluate the performance of their organisation against each process. The results of this study are shown below:

- generating new knowledge (46%);
- accessing valuable knowledge from outside sources (34%);
- using accessible knowledge in decision making (30%);
- embedding knowledge in processes, products, and/or services (29%);
- representing knowledge in documents, databases, and software (27%);
- facilitating knowledge growth through culture and incentives (19%);
- transferring existing knowledge into other parts of the organisation (13%);
- measuring the value of knowledge assets and/or impact of knowledge management (4%).

In another study of thirty-one Knowledge Management projects in twenty-four companies, Davenport et al (1998), identified four similar objectives. To i) create repositories by storing knowledge and making it easily available to users; ii) provide access to knowledge and facilitate its transfer; iii) establish an environment that

encourages the creation, transfer and use of knowledge; iv) manage knowledge as an asset on the balance sheet. The authors further identify eight factors that seem to characterise a successful Knowledge Management project.

- The project involves money, whether saved or earned.
- The project uses a broad infrastructure of both technology and organisation.
- The project has a balanced structure that, while flexible and evolutionary, still makes knowledge easily accessible.
- Within the organisation, people are positive about creating, using, and sharing knowledge.
- The purpose of the project is clear.
- The project motivates people, for example by rewarding those who share knowledge.
- The many ways of sharing knowledge, such as the Internet, Lotus Notes, global communication systems and face-to-face communication⁷ are activated.
- The project has senior management's support and commitment.

On the critical side, Fahey and Prusak (1998), provide a list of the 'eleven deadliest sins of Knowledge Management'. These are:

- not developing a working definition of knowledge;
- emphasising knowledge stock to the detriment of knowledge flow;
- viewing knowledge as existing predominantly outside the heads of individuals;
- not understanding that a fundamental intermediate purpose of managing knowledge is to create shared context;
- paying little heed to the role and importance of tacit knowledge;
- disentangling knowledge from its uses;
- downplaying thinking and reasoning;
- focusing on the past and the present and not the future;
- falling to recognise the importance of experimentation;
- substituting technological contact for human interface ;

(ibid.).

Measures

As a consequence of the 'fuzziness' of the concept, the issue of measuring organisational learning does not have a unique solution. Measures directly derive from the adopted definition and for the projects' goals. Authors agree that a multiple methodology

⁷ In a recent contribution, Hallowell (1999) recalls the importance and necessity of face-to-face communication, giving it the tricky label of 'human moment': "Face to face contact is essential to true communication [...]. The human moment has two prerequisites: people's physical presence and their emotional and intellectual attention" (ibid.).

(survey, interviews, observation) would be the most appropriate. Some experiences that are more likely to be useful to the aims of the OrgLearn project are summarised below.

Cognitive, behavioural and performance measures

Among others⁸, Garvin (1993) suggests that organisational learning should be "traced through three overlapping stages. The first step is cognitive. Members of the organisation are exposed to new ideas, expand their knowledge and begin to think differently. The second step is behavioural. Employees begin to internalise new insights and alter their behaviour. And the third step is performance improvement, with changes in behaviour leading to measurable improvements in results"⁹. The cognitive dimension in this project will thus be measured through surveys, questionnaires and interviews to ensure that concepts have been well understood. The use of surveys gains support from Garvin (1993) who cites the example of a Worldwide Marketing Managers' Meeting held by Ford in 1989. Here, participants were presented with a series of hypothetical situations in which customer complaints conflicted with the short term profit goals of dealerships and the company. They were then asked to indicate how they would respond, the premise being that such surveys "are the first step toward identifying changed attitudes and new ways of thinking" (ibid.). For the behavioural dimension, supplementary direct observation is needed. Observations can be conducted internally, or can entail "inviting outside consultants to visit, attend meetings, observe employees in action, and then report what they have learned" (ibid.). Finally, performance measures in the form of 'half - life' curves are suggested as essential tools for ensuring that the cognitive and behavioural changes have actually produced results¹⁰. According to Garvin (1993), "a half-life curve measures the time it takes to achieve a 50% improvement in a specified performance measure. When represented graphically, the performance measure (defect rates, on-time delivery, time to market) is plotted on the vertical axis, using a logarithmic scale, and the time scale is plotted horizontally. Steeper slopes then represent faster learning" (ibid.).

⁸ See, for example, the book edited by the team of researchers at the MIT Organisational Learning Centre (Senge et al. 1994) where a number of methods and tools linked to the five disciplines of Organisational Learning are described extensively.

⁹ The relation between learning and performance is assumed to be positive: "Learning, usually, though not always, increases an organisation's capacity to perform better. An organisation which is quick to correct its errors and reacts fast to environmental changes should, on average, outperform one which seldom learns from past mistakes" (Tsang, 1997). Along the same lines, Brown and Duguid (1991) acknowledge that: "It has been our unstated assumption that a unified understanding of working, learning and innovating is potentially highly beneficial, allowing, it seems likely, a synergistic collaboration rather than a conflicting separation among workers".

¹⁰ The learning effects due to the repeated execution of work routines through time have been demonstrated by the detection of learning curves that grow as the total volume of products grows (Shrivastava, 1983).

Auditing a Learning Organisation

Bertini et al (1995) report on a method for auditing a Learning Organisation that is comprised of six processes and five developmental phases, ranging from a strategy of sensemaking, continuous improvement and innovation through to self developed strategies (Bertini et al. 1995; Alby and Bertini, 1999).

According to Argyris and Schon(1978) and Argyris et al (1985), the main goals of available methodologies are to: i) trigger individual and group reflections on the underlying reasons for both the current system of values and the norms that guide organisational behaviour; ii) bring to the fore the different dynamics that lead to erroneous behaviours; iii) distinguish how people really think and behave from how they theorise or formally declare themselves to think and behave. The primary goal of the audit methodology, however, is to transform the 'normal', spontaneous learning happening in every organisation into conscious practices that can be linked to continuous improvement and innovation. The main hypothesis is that the teams that participate in such audits are capable of initiating reflection on their own developmental capacities, the reflection thereafter becoming the starting point for the identification of improvement projects that are autonomously defined and implemented (Bertini et al, 1995). Six processes are considered necessary for an audit on organisational learning:

- learning from experience, where practices developed at the individual or team level are captured at the general organisational level;
- sharing experiences;
- translating knowledge into competence;
- integrating tacit and explicit knowledge;
- acquiring knowledge from the external environment;
- focusing management on knowledge.

The learning company questionnaire

Pedler et al. (1997) provide a questionnaire made up of 55 questions for the assessment of a company as a learning body. The 55 questions are developed according to a set of 11 characteristics:

- a learning approach to strategy;
- participative policy making;
- informing;
- formative account and control;
- internal exchange;
- reward flexibility;
- enabling structures;

- boundary workers as environmental scanners;
- inter-company learning;
- a learning climate;
- self-development opportunities for all.

Accounts for the flows between the collective level (i.e. policy and procedures) and the individual level (i.e. ideas and actions) are thus considered to be effective measures of Organisational Learning.

Failures and problems for Organisational Learning initiatives

In the debate on methods and processes for the implementation of a Learning Organisation, researchers have identified a number of problems faced by organisations that are trying to learn (Snyder and Cummings, 1998).

According to Schein (1996), organisational learning failures may be caused by the lack of communication between three cultures, the culture of operators, the culture of engineers, and the culture of executives. Schein (ibid.) posits that when organisations attempt to redesign or reinvent themselves the cultures collide and failure occurs. He explains that executives and engineers are task focused and assume that people are the problem. Moreover, executives band together and depersonalise their employees and cannot agree with engineers on how to make organisations work better while keeping costs down (ibid.) The solution lies in a three step process which entails i) recognising the concept of culture; ii) acknowledging the fact that engineers or executives alone cannot solve problems but must work together and iii) conducting cross-cultural dialogues (ibid.).

In another study, Szulanski (1996) analyses the internal 'stickiness' of knowledge transfer and tests the resulting model using canonical correlation analysis of a data set consisting of 271 observations of 122 best-practice transfers in eight companies. Contrary to conventional wisdom, which primarily blames motivational factors, the study finds that the major barriers to internal knowledge transfer are knowledge-related factors such as the recipient's lack of absorptive capacity, causal ambiguity, and the arduous relationship between the source and the recipient of knowledge.

Aside from the aforementioned contributions, other authors have also detected barriers and problems with organisational learning. The following is a non exhaustive list:

- 'learning disabilities' (Senge, 1990; Van de Ven & Polley, 1992);
- 'learning errors' (Marsick and Watkins, 1990),
- 'barriers to innovation' (Quinn, 1985);
- 'learning barriers' (Shaw and Perkins, 1992);

- 'learning obstacles' (Mc Gill and Slocum, 1994);
- 'incomplete learning cycles' (March and Olsen, 1975),
- 'knowledge-inhibiting activities' (Leonard-Barton, 1995),
- 'system domain defenses' (Bain, 1998).

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Organisational learning and empirical research

An overview of some empirical investigations and projects in the German-speaking countries

There is a remarkable discrepancy between the number of publications regarding conceptual notions within the framework of organisational learning and the number of empirical investigations that deal with the concrete reality of organisational learning in business enterprises.

Indeed, a large number of case studies in the business management literature hardly qualify in meeting the critical demand for a more exact analysis. In this overview, I present some of the better examples in the literature and examine them in view of their usefulness to the OrgLearn project.

Teich: ways to the learning organisation

One such example is a thesis by Irene Teich (1997) on ways of becoming a learning organisation. In an extensive analysis of a variety of case studies, Teich and her team gathered material from the magazines "Manager Magazin", "VDI-Nachrichten", "Harvard-Manager" and "Wirtschaftswoche". All the case studies were then evaluated in terms of the organisational options selected for becoming a learning company. After evaluating 272 items, it was found that 142 companies were on their way to becoming a learning enterprise but only six of these completely fulfilled all the criteria (p. 199). On the basis of this information, the options for becoming a learning organisation were subsequently extracted.

Vision

In a learning company, one has to work out an agreement regarding the organisation's vision and must reestablish it again and again. Quoting examples from the sample drawn from the various magazine articles, Teich describes how such visions are introduced and translated into action. Unfortunately, she does not try to examine the value of the information gained from the magazines. For instance, the case of Bayer, the chemical enterprise, is used to illustrate how employees first build up the vision and then condense it from the bottom up to the top of the company (p.71). But how can a learning company work out a common and valid vision for the complete enterprise if there is a variety of single visions at the bottom of the company? It would have been interesting to know the response to this question but sadly, Teich's article yields no answer.

Process perspective on social and physical operational sequences

On the subject of a process orientation, the author reports on different forms of learning and uncritically submits some spectacular cases from the periodicals. As an example, she cites the case of the chairman of General Motors, who sent members of the board to do shift-work on the assembly line for one week. However, she fails to reveal what the members of the executive board were expected to study and what they learnt from the experience. Neither are we told if the workers came into the executive suite. Was the whole thing then interpreted as some kind of an adventure vacation? Certainly, it seems interesting that members of the executive board should work on the assembly line, but is this really a measure of a learning company? Clearly, one can only answer this if one knows with what aims the managers were sent to the conveyor belt in the first place.

Under the keyword learning methods, Teich (ibid.) also reproduces a common misunderstanding of single-loop, double-loop and deuterio-learning (p. 83). In contradiction to Argyris and Schon, she considers single-loop learning as the simplest form of learning and equates it with practising in the area of individual learning. This neglects the fact that single-loop learning can be quite demanding. The decisive criterion for the distinction between single-loop and double-loop-learning is not the simplicity or complexity of learning but the assessment scales used for success or failure. Whereas in single-loop learning, one accepts these scales as unchangeable, in double-loop learning, they are reflected upon and may also be changed.

Control perspective: Self organisation and flexibility

On the topic of control, we find a reference to the literature on mechanics who can plan, dispose of work and produce independently because tasks are transparently displayed on

a monitor. But quite obviously, the instructions given on the screen limit the mechanic's independence. Without the context of such instructions the work of a mechanic can thus hardly be considered successful. Teich does not check here, to what extent one may apply such well-sounding strategies to the practice of a learning company.

Her thesis goes on to list eight so-called "sharp" criteria and a series of indicators for the evaluation of an enterprise as a learning company (p.271f). These criteria are presented below for consideration, given that the OrgLearn project has to develop criteria for a learning enterprise, too:

Vision:

- A generally known, long-term vision exists.
- The vision is applied, not only formulated.
- All members of the enterprise are consciously committed to the vision or shall be committed in the future (commitment).

Communication:

- Before introducing a new measure, all persons affected by it are informed and participate in its discussion, that is, "they are included in the decision".

A wide spectrum of measures are considered:

- Management informs, discusses and includes the opinions of employees.
- Management stimulates discussion, collects solutions, discusses the alternatives and decisions are common.

A wide spectrum of methods to translate measures into action are considered:

- Management informs/presses for translation into action
- Management informs, discusses and includes proposals for improvement
- Management activates further improvement, collects solutions, discusses the alternatives and decisions are common.

Change:

- Change is aimed at creating long-term modifications.
- The modification of consciousness occurs.

Error culture:

- The fundamental attitude is to avoid errors from the beginning.
- People learn from mistakes.
- Errors are seen as a challenge.
- New possibilities arising from errors are recognised.
- Risk is accepted.

Responsibilities:

- Responsibility is shifted to the person who has the information and who needs to make a decision.

Personal development of the individuals:

The following are actively promoted:

- Individual strengths,
- Creativity and the implementation of ideas,
- Entrepreneurial behaviour in terms of creative approaches to tasks and challenges,
- Systemic thinking,
- Opportunities for constructive feedback,
- Discipline, order and assistance towards achieving personal development.

However, this list does not contain essential criteria that lie at the core of a learning company. In other words, it lacks criteria for translating deuterio-learning into action. Deuterio-learning requires measures, facilities and structures that promote and develop learning within the enterprise. In the above list, only one point can be identified as a central criterion of a learning company. The other criteria are associated prerequisites of a learning company. For example, it is difficult to conceive of a learning company without realising the points made under the criterion "personal development". Certainly, Teich's list contains features that apply to a learning enterprise, but it remains unclear whether these are suitable for clearly distinguishing learning enterprises from other enterprises.

Teich (1997) also introduces the enterprise Mettler-Toledo from Albstadt as a "prime example" (p.201) of a learning company. Simultaneously, her analysis of this enterprise illustrates the use of her classification scheme using the above criteria.

Her statements on this company are based on four articles taken from the aforementioned magazines, company documentation, two visits to the company and an interview with the managing director. In a relatively detailed description of its organisational development since 1985 and the exposition of its current situation in 1996, many empirical characteristics of a learning company are mentioned. This is illustrated by the following quotation loosely translated from German: "Employees can experiment, test and implement actions. They themselves look for ways and possibilities to convert their aims into actions. This translation into action happens with 'active idleness' on the part of management" (p. 205). However, the text gives no advice regarding the problems that may be related to these experiments. It is also hardly conceivable that management will allow all experiments and every implementation simply because they come from employees considering that experiments may not

actually be meaningful and a given implementation may not fit in with other implementations.

"sharp" criterion	Evaluation of the METTLER TOLEDO GmbH (ALBSTADT) case on the basis of magazine articles
Vision	A well-known, long-term vision is disseminated throughout the organisation and all employees are committed to it.
Communication	Employees participate in decision-making. Before introducing a new measure, executives inform employees and the procedure is clarified.
Modification	Complete restructuring is aimed at long-term modification, the employees' consciousness is modified.
Error culture	No statement possible.
Responsibilities	Self-directed working is supported. Responsibility is shifted to the person executing plans.
Personal development	Confidence, holistic thinking and the support of employees are encouraged. Entrepreneurial behaviour by employees is promoted by controlling only the teams, practising integration across the functions of the company and supporting autonomy. Systemic thinking and change through problem-solving activities is also actively supported.
Relations development	They are in partnership. They also encourage interdisciplinary knowledge and contacts.
Values	Confidence and openness in the workplace are encouraged. Employees are taken seriously. The company knows when to "let off".
KO-Criteria (exclusion criteria)	Management has developed a restructuring plan and carried out measures after previously informing employees. This KO-criterion can be countered, since tight leadership is necessary in such a case and does not do any harm. All in all, the evaluated article presents an excellent example of a company, which in our understanding is already on its way to becoming a learning company.

The application of the KO-criterion is remarkable. It is an exclusion criterion introduced by Teich. This basically implies that management should not carry out measures in a Learning Company without the participation of staff. If correct, however, this criterion puts into question the designation of Mettler-Toledo as a learning company given that management is shown to carry out measures without depending on the vote of the staff, thereby violating the KO-criterion as put forward by Teich. Certainly, no measure of organisational development can narrow the substantial difference between managing an enterprise with the interests of the owner and management in mind versus that of the lower echelons, the workers.

Meyer: The development of Colgate Palmolive into a learning enterprise

Meyer's doctoral thesis (1996) contains two different points of interest. First, there is abundant information about the organisational development process of an enterprise in the chemical industry. Second, he reports on the development of the learning enterprise from a point of view of someone who is virtually an insider in the enterprise. Certainly, this is unusual in that, in contrast to most practical reports, the requirements for a scientific argument in a doctoral thesis obligate the author to maintain a certain distance from his topic.

As an internal advisor from 1991 to 1994, Meyer was responsible for the processes of organisational development and transformation at the production areas of the Colgate Palmolive (CP) factories in Hamburg. CP's project for organisational development was called the 'High Commitment Work System (HCWS)'.

In his study, Meyer focuses on the relation between the individual employees, their ways and forms of learning, and the learning of the organisation as a whole. "... In an enterprise, the individual member of the organisation [is] the starting point for the development of a learning organisation. Cultural change at CP means, in the first phase, the production and modification of individual learning processes. Here the question arises, how to possibly improve individual learning and how to transfer these learning processes to teams, departments, areas and the whole enterprise." (p. 47).

Like Argyris and Schön, Meyer regards the relation between theories-in-use and espoused theories as a crucial frame for investigating the relation between individual and organisational learning. For this reason, he tries to determine the concrete forms of the theory-in-use and the espoused theory within CP: "The HWCS model factory¹ and the desired culture of the enterprise as well as the HWCS principles form the factors of CP-specific terms of reference, i.e. of CP-specific theories of action." (p. 49).

However, the statements on the theory-in-use within CP are clearly lagging behind in their degree of specification in comparison to the espoused theory: "... concerning the theory- in-use.. [we assume], that within informal or formal terms of reference - under knowledge of the official theories of action -, because of integration in the social setting the actual actions are based on individual or common experiences." (p.49) Unfortunately, Meyer's study lacks further empirical investigation of the theories-in-use, although he regards their discrepancy with the espoused theory as an important starting

¹ According to Meyer, CP's HCWS model factory in the US realised in a prototypical way what Europe and especially CP still strove to achieve. The HCWS model factory is the starting point for benchmarking.

point for organisational development: "If the gap between the actions expected by the official theory and the actions carried out by the theory-in-use widens too much, this may produce processes of organisational learning. These learning processes may consist, as e.g. at CP, of recognising the requirements for modifying the organisation and initiating an extensive training process. It can be stated, that a process of organisational learning occurred regarding the transformation of the organisation, since the theory-in-use and espoused theory do not correspond." (p.49)

The fact that Meyer does not explicitly state the theory-in-use may be due to his position as an insider at CP. The hypothesis here is that he took the discrepancy for granted and so neglected to provide an explanation.

The road from individual learning to collective learning

In the conceptual part of his work, Meyer treats the question of how to construct a connection between individual learning and collective learning as one would expect to find in a learning enterprise. "First, the individuals in the organisation and second, the organisational systems consisting of a number of individuals are considered as learners in the organisation. Individual learning processes lead to modifications of personal behaviour without a doubt. Likewise, teamwork may contribute purposefully to the modification of the enterprise's knowledge base. Here, the process of identifying consensus becomes the crucial learning factor. By this process, a collective learning process can take place, which leads to the modification of the theory-in-use and the espoused theory and even puts this knowledge at the organisation's disposal. Thus, considering in-house cultural change, one can regard the individuals in the core team as primary carriers of learning followed closely by the core team as a whole and then the whole 'focus factory'² as the carriers of collective learning processes." (p.57)

For Meyer (ibid.), the team presents the crucial interface between individual and organisational learning. The introduction of teams thus plays a crucial role in the process of organisational development at CP, as is apparent from the steps of organisational change at CP (see box).

"Deutero-learning as 'learning of learning' is converted in the development of skills like introspection, systemic thinking, development of the personality and holistic thinking. Since process learning requires each individual to be able to reflect on his own behaviour and in particular to reflect on his adaptability and learning behaviour, introspection is a central part of this process."(p.57)

² A focus factory is a new form of organising the productive entities in Hamburg.

According to Meyer, the team is once again the key for deuterio-learning to occur. For him, teamwork is the pivot of organisational development at CP and obviously, for the learning enterprise as well. "Here, it becomes clear that factors such as interaction, a goal orientation, action theory and the knowledge base in a group, or in a network of groups in an enterprise, influence learning and differentiate organisational learning from the learning of individual subjects. ... If in this context one shares knowledge with the group members e.g. by individual learning and thus modifies the group's knowledge base, then organisational learning of the group has taken place." (p.64)

Meyer (ibid.) goes on to argue that the development of individual competencies which are important for successful team work thus support organisational learning. These include:

1. The skill of introspection and self-estimation.
2. The ability to think systemically.
3. The ability to connect personal development with the improved performance of the enterprise
4. The ability to think holistically. (Meyer: 162)

He also states that to develop these competencies, a training-concept that would initiate cultural change (CC) was developed at CP.

"The aim of organisational development was the continuous introduction of teams. One has to regard the focus factory (FF) as a kind of profit centre, which contains almost all operational functions for self management in the form of appropriate teams (p.92).

The management of a FF, too, was carried out by a management team, which consisted of experts on process engineering, packaging, production and planning/organisation. These teams were the first to co-operate on a permanent basis and not only for an interim project term (p.94)".

Meyer further explains that at the level of the workers, the teams were called 'Self Managing Work teams (SMWT)'. "In SMWT's, the workers take over managerial functions and therefore are responsible for functions like production-planning, distribution of functions in the team, co-ordination with other teams as well as setting objectives and controlling for performance measurements." (p.123).

One can infer the characteristics of such teams with regard to their functional tasks and their central role as the unit of organisational learning from the description of the SMWT approach in the following selection of definitions and principles:

- "The SMWT consists of employees, which are determined to carry out the different functions in the team (...)

- The SMWTs regularly exchange feedback with each other and there is also a feedback system towards Management (...)
- The SMWTs organise themselves, i.e. they plan autonomously, monitor the quality of their products, measure their performance, judge themselves and are thus also responsible for their costs as the smallest department (...)
- The SMWTs design their work in such a way that they are able to carry out the 'whole job' in its entirety (*Whole Job Principle*). (...)
- The dynamics inside the team permit no negative behaviour that may spoil the performance of the team or the climate in the team. (...)
- The SMWT has the function of problem solving and must therefore correct itself in its work and methods (...)
- The SMWTs provide the possibility for individuals to learn and develop (...)
- In SMWTs, the team members have sufficient individual freedom to satisfy their personal needs (...)
- Teams make decisions on the basis of knowledge, not for hierarchical reasons. Operational decisions are thus based on knowledge.
- All employees contribute to the decision and therefore feel jointly responsible for the decision." (p.125ff)

The above principles illustrate what management typically expects of such groups. Surprisingly, however, Meyer's work hardly considers the concrete realities of operational practice. His empirical investigations are limited to "simultaneous process observations" (p.214ff) and "tendency analyses" (p.353), both of which fail to yield any meaningful information regarding the way that such groups actually go about meeting these expectations. Consequently, one does not learn what difficulties may have occurred during the process of self-organising when the SMWTs may have for example, wanted to organise themselves in a way that was not in harmony with the other areas of the enterprise. Likewise one is none the wiser as to whether individuals actually had the possibility to develop further or if they encountered a lack of opportunities to learn.

Meyer's investigation concludes by listing the benefits of organisational development as follows:

- Increased safety in the workplace
- A decrease in absenteeism
- Improvement of quality protection
- Improvement of efficiency in the system
- Improvement of delivery service
- Reduction of labour costs
- Reduction of operational costs

- Reduction of capital investment in stock (p.375ff)

He further argues that "the better execution and organisation of work suggests that the employees developed the desired abilities to constantly improve their ability to take action, which implies individual and organisational learning." (p.379)

But this is a marked contrast to his remarks at the beginning of his work. In his conceptual considerations, he heavily emphasises organisational learning and interprets many elements of the organisational development process as learning processes that are indicative of organisational learning. In the empirical analysis of CP, however, he almost totally neglects the empirical instances of organisational learning. In other words, the investigations he carried out are not directed towards organisational learning. Rather incongruously, he then writes in his conclusion about the existence of successful organisational learning processes, but these are deduced. Meyer assumes that because the organisational development initiative was an economic success, the organisational learning process must, therefore have been a success, too. According to this logic, the "bottom line" would thus be the best instrument to analyse the success of a learning enterprise. However, the bottom line is already the preferred instrument for measuring the success of enterprises. Therefore, the question arises, whether the success of a learning enterprise can be expressed in purely economic terms.

The next study presented in this outline offers a response to this question.

Stricker: Observation of fundamental change in enterprises (1997)

Gerald Stricker (1997:2) states the intention of his thesis as follows: "with the help of a broad range of indicators and methods of observation, we can develop pictures of enterprises as a basis for managing change. The indicators must be grounded in all levels of organisational reality. This is the starting point of the work presented here, which develops a framework for the observation of change in enterprises. "

In the subtitle of his work he describes organisational learning as the target area of observation in the enterprise, which makes his work directly relevant to the OrgLearn project.

Stricker's work was developed in the context of the "New Winners" project (see Gomez, Mueller and Stewens, 1994) of the St. Gallen University in Switzerland. The "New Winners" project was carried out by an international collaboration of researchers. Stricker belonged to the group that dealt with Daimler Benz, whose chairman made the project possible. In the first phase of the project, a case study was created that covered the development of the enterprise during the period from 1983 to 1993. In the second

phase, an empirical analysis of selected areas, that is, so-called areas of fundamental change, (see table 1) was carried out.

Areas of Change	Description
'Spin-off'	Establishing a company as an example for 'entrepreneurship inside the enterprise'
'Decentralisation'	Splitting up branches of production into partially autonomous, self-responsible 'companies' of a Daimler-Benz subsidiary for the purposes of cutting costs, achieving acceleration, and flexible business processes.
'Management development'	Creating further education programs for subsidiaries to initiate 'entrepreneurship inside the enterprise' and to integrate different partially autonomous 'sub-companies'
'Co-operation'	Participating in joint ventures between different 'sub-companies' of a subsidiary and one of their European competitors in order to gain necessary competitive size and secure a supply of skill potential
'System Providers'	Common enterprise of the subsidiaries co-ordinate activities inside an area of business by developing new offers as the integrated main system providers in the area
'Core competencies'	Participating in joint ventures of two subsidiaries to concentrate strategically relevant micro-electronic skills which are seen as a new core-competence.

Table 1: Places of the change: Investigation areas of the empirical study of Stricker (1997, p.117)

As required by qualitative social research, no hypotheses were developed in the run-up to the empirical investigations, which still need to be verified or falsified. Rather, the theoretical construction was meant as an explanation of the preliminary understanding that delivered the interpretative framework for the empirical data.

For this reason, we shall refer briefly to the essential features of Stricker's preliminary understanding, before explaining his method for the observation of change in enterprises and his tool for measuring the success of organisational learning.

To explain his preliminary understanding of OL, Stricker relies on Pautzke (1989) and Kirsch (1990) and understands organisational learning "as the way the knowledge base of an organisation is used, changed and developed further." (p.97)

Since the major part of an enterprise's knowledge base is not used, the use of the knowledge base may still be labelled learning if buried stocks of knowledge are used (ibid. p. 97).

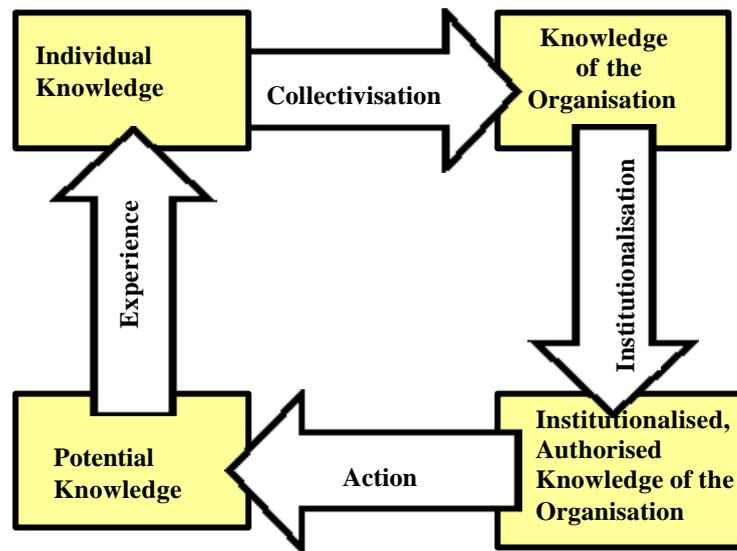


Figure 1: The organisational learning circle and the key problems of organisational learning by Stricker (p.97)

Stricker describes the problem of the collectivisation of individual knowledge, which is supposedly solved by Meyer, as a process of negotiation inside groups. "The modification of the knowledge base in the exchange between individuals and the organisation is characterised by a duality of the learning subjects. Knowledge acquired by individuals through learning processes becomes the divided knowledge of the organisation through collectivisation; collectivisation and strengthening of knowledge is then supported by its application and conversion into manifest structures." (p.98)

For Stricker, the problem of collective knowledge that is independent of individuals hardly exists or emerges as a strange "duality of the learning subjects". Since the agent of learning is the individual, however, the question arises as to who might know the organisation's knowledge.

Stricker differentiates organisational learning processes according to Argyris and Schön's model and assigns to deutero-learning the status of a higher order. This is made particularly clear in his diagram of deutero-learning as an uncoupled loop (see figure 2).

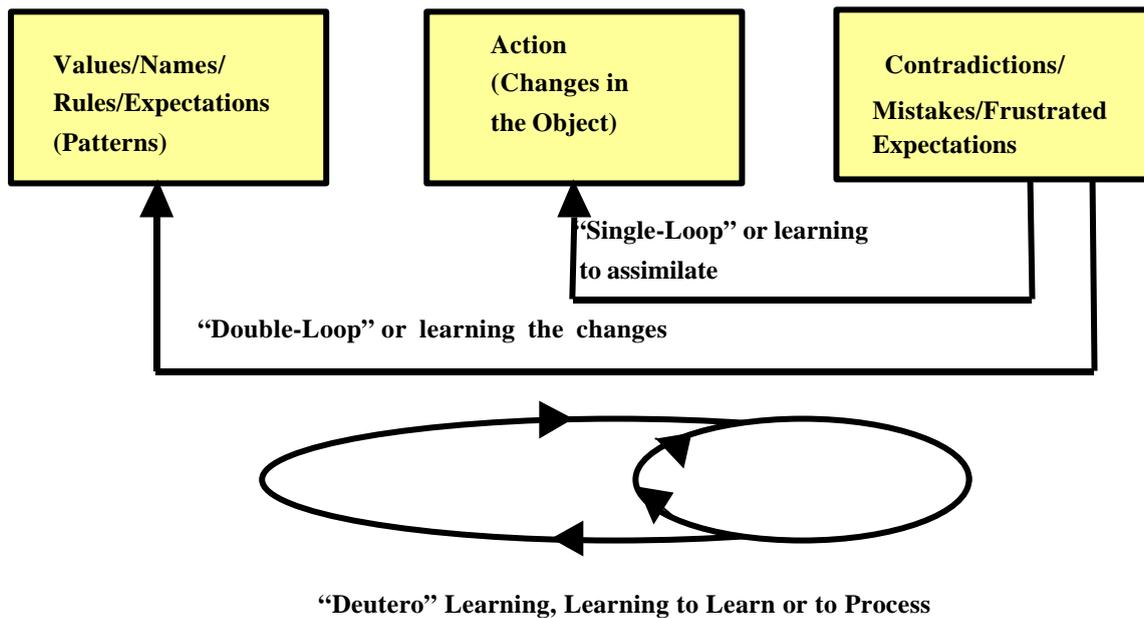


Figure 2: Types of learning in Stricker's modification (p.100)

"The bases for the dissemination and collectivisation of knowledge are communication and social interaction. The distribution of knowledge inside the organisation and the degree of its collectivisation determine the influence of the knowledge stocks on organisational courses of action. ... A focus of the observation of organisational learning entails observation of communications, interaction and their frameworks. ... As change, organisational learning becomes more clearly visible if learning experiences lead to the modification of observable rules, standard procedures, strategies and programs, artefacts, management systems, organisational structures and procedures." (p.101)

Here, in a similar vein to Meyer, we find the view that organisational learning is accessible via empirically visible phenomena of organisational development. Learning therefore becomes visible via change, i.e. via the effects of learning. It may be correct that organisational learning can become apparent in modifications of procedures, rules etc., but one should not confuse these effects of learning with learning itself. It imposes an unnecessary restriction on the empirical analysis to assume learning only where organisational change takes place.

For the observation of organisational learning processes Stricker (ibid.) distinguishes "three significant dimensions in the processing of knowledge with respect to organisations, namely, coding, abstraction and diffusion." (p.199)

Stricker defines the first step from individual to collective learning processes as coding: "new knowledge is taken up, structured, i.e. 'coded' in a certain way (translation of

knowledge into obtainable form, e.g. writing), to make it manageable, understandable and communicable." (p.199)

Since not all knowledge is taken up and coded by individuals in the enterprise, however, it is quite obvious that a note on the selectivity of this process of codification is missing from Stricker's thesis.

Analysing the remaining steps of organisational processing of the use and passing on of knowledge, Stricker, also fails to look at which barriers actually obstruct the processing of knowledge in an enterprise. Rather, he looks at problems that may emerge on an abstract level of communication-theory (e.g. problems caused by coding rules, restrictions of diffusion caused by bad coding etc.).

One gets the impression that organisational learning is obtained by an apparatus within the organisation that may or may not work well, but whose operational principles can be considered totally independently of the interests of different groups within the enterprise. Yet Stricker's work does supply a theory which can be consulted for the explanation of learning restrictions beyond technical difficulties.

If one wants to measure change in an enterprise, one needs some terms of reference that indicate whether the change in the enterprise succeeded in bringing about organisational effectiveness. Stricker mentions different models of organisational effectiveness: (p.140ff)

- Target approach: Reaching targets is more important than the means of attaining them. It is focused on the realisation of profits or shareholder value.
- System approach: In addition to considering the relationship of an organisation to its environment and apart from targets, the means, that is, the processes, structures and procedures are also considered.
- Stakeholder approach: The organisational elements, interest, power and conflict are analysed in light of organisational effectiveness.
- Interest approach: This approach tries to overcome the weaknesses of the target and system approaches. It includes interests, targets and means in the analysis.

In the interest model, criteria of effectiveness can be divided into four areas. The first area covers the "personal function" of the enterprise. One looks at the conditions of work, the rate of dismissal, the reasons of dismissal and the fluctuation rate as derived targets. It supposes a positive correlation between work satisfaction and the economic targets of the enterprise.

The second area covers the adjustment functions, for example, flexibility, adaptability, long-term planning, proximity to the client, entrepreneurial freedom and so on. The third area considers the integration function, that is, management styles, motivation, control, consensus on targets, and so on. Finally, the fourth area covers target functions, that is, cost minimising, profit, liquidity and other criteria of economic success.

The advantage of the interest model is that apart from the economic criteria, other categories of organisational effectiveness that are of interest for organisational learning are also considered in the investigation.

In his empirical investigations (which are restricted to the level of top management), Stricker's interest is not directed towards the processes of organisational learning themselves. The results of the observations made at each "area of change" do not concern forms or the content of organisational learning. So, it seems that just as in Meyer's case, processes of organisational learning lies in the background and is not made explicit in the empirical work.

Castiglioni: Organisational learning in processes of product innovation (1994)

In her doctoral thesis, Elisabetta Castiglioni limits her empirical investigation to questioning members of development projects. In her criticism of the literature on organisational learning, she posits that "organisational research treats the discussion around the learning organisation from a standpoint that is largely detached from concrete problems within the company" (p.19). She thus draws the conclusion to strictly limit her field of investigation and to bring in problems of product innovation into the focus of her investigation.

Her concept of measuring organisational learning in practice, interprets organisational learning as "the use, modification and development of the organisational knowledge base" (p.77) that is related to the work of developers. As indicators for the quality of this knowledge base, she uses features that are "related to the availability and decisional relevance of their constituents" (p.77). Against this background, a structured and standardised questionnaire with given response specifications (p.95) was submitted to developers, which unfortunately is not printed in the published version of her work. The groups that were investigated were made up of interdisciplinary project groups that were assembled from different enterprises. The groups were then asked how they used "system descriptions, user manuals, product information, software data structures, project documents, concepts, ..." (p.79) as concrete manifestations of the company's knowledge base for their development work. The value of these documents is estimated

by their degree of re-use, the availability of the knowledge base and the length of the training period for new employees, which correlates with the availability of the knowledge base. The questionnaire also attempted to ascertain the interviewee's estimation of the company's knowledge base. Here, she asked for an estimate of the number of working hours that could be spared through the use of existing knowledge (p.80). However, she does not indicate what would be a meaningful or valid response to such a question.

Of particular interest for the OrgLearn project is the part of her investigation design, in which "learning from the past" becomes the subject of the analysis. In order to examine learning from the past, she asked whether co-operation in earlier projects was an explicit criterion for selecting new employees for new projects. She also questioned whether, apart from qualifications and availability, learning from earlier experiences of project work was emphasised as a criterion.

With regard to learning from past experiences, the design of documents and access to carriers of knowledge is assigned its own area of investigation. However, the relevant items on her questionnaire only ask for quantitative specifications, for example, the duration of tenure in the company and the fluctuation rate. Only these numbers are presented in the results. The limits of such a quantitative analysis show up in her discussion of the fluctuation rate: "Regarding the learning capabilities of the organisation, the change within the company has positive and negative aspects." (p.109) Without a qualitative discussion of the numbers, one cannot know whether a high degree of fluctuation is an indication of a learning enterprise. For instance, because the high value may be due to the dispersion of project experience into other areas of the company. Or it may be an indicator against a learning enterprise, because the continuity of the project experience is destroyed by the fluctuation. To interpret her data, Castiglioni goes back to the literature. So, given her methods of investigation, this question cannot be answered.

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3. Empirical trends in the chemical industry

Peter Röben

Production characteristics and special features of the German chemical industry

Special features of the chemical industry

The chemical industry is a comparatively young industry. It is structured differently from traditional manufacturing industries such as car manufacturing and the machine tool industry which grew out of the craft trades and small industrial production. Additionally, although the pharmacist is the forerunner of the chemist, the method of production in the chemical industry did not emerge from the pharmaceutical laboratory. Still, however, many similarities can be drawn. For instance, just as the test tube swinging pharmacists may produce powder in bag quantities for their customers, chemists similarly concoct and analyse various syntheses. Their procedures and modes of operation usually take place in a laboratory too, but here test tubes are replaced by tanks and agitating boilers, bunsen-burners by heating furnaces and quantities are measured in tons rather than in grams.

But the success of a chemical reaction in the laboratory does not say much about its industrial use. Moreover, whether it can be used on a production scale depends on the regularities of the process engineering system. Chemical reactions run successfully in tubes, containers and agitating boilers only when suitable thermodynamic, chemical and technical facilities are created. For example, a few grams of a substance in a test tube can reach high temperatures very quickly. But in the case of trying to achieve the proper conditions for pumping a ton of substance through a pipe system, mix it, agitate it, pressurise it and finally heat it, chemical production requires not only knowledge of chemistry, but also physics, technology and process engineering.

Sometimes, however, the laws of nature leave some of the product behind at the end of the chemical reaction. Frequently, the obligatory production of secondary and joint products thus arises. The product that is left behind is seen as waste, a thorn in the eye of the chemists, until new procedures and reactions are discovered that enable the conversion of this waste material into a valuable raw material that is useful for other chemical production. Industrial chemists have thus been extremely successful in their 130 year long history. Sites such as BASF in Ludwigshafen form an extremely complex network of many interconnected, chemical manufacturing plants. These plants constitute an enormous network location. Every single of these individual manufacturing plants often perform only one operation, with the help of a few or even less than one hundred workers. In Ludwigshafen the total number of employees is about 30 000.

Clearly, the chemical industry, in particular the successors of IG-Farben Bayer, BASF and the former Hoechst AG, features prominently among the large-scale industries. However, the structure of the manufacturing plants of these large companies consists of many small and middle sized plants. In addition to the usual range of products that are produced from applying a few modifications to a basic procedure, a number of completely different products are also produced. BASF for example produces several thousands of initial, intermediate and final products. Consequently, the chemical manufacturing process must be understood as being more than the modification of an output procedure as in metalworking.

These basic conditions influence the enterprises' organisational learning, too.

Production and organisation

At the very beginning of every chemical production a process is brought to production scale from the laboratory's scale by the assay office. As in the laboratory, only a certain quantity of original substance is brought to reaction at a given time. This first chemical production is called batch production. The final product develops in form of batches and the process engineering system must be periodically fed and emptied (viz. Schumann et al, 1994). The idea of transferring intermittent load production into a continuous production was developed very early when producing sulphuric acid. Here, ideally, an installation configuration develops, which by connecting all process apparatuses creates a system that is characterised by a continuous technical need to couple the production process with material transfer. Thus, the transition from an intermittent to a continuous production procedure combines a saving of time with personnel expenditure. This is achieved by "improving capacity through abolishing preparations, feed, emptying and filling work (among other things by avoidance of losses of energy and material driving

on and off processes at the single aggregate) – and saving of space (by omission of temporary buffers).” (Schumann et al, 1994: 532)

The continuation of production enhanced the need for monitoring, measuring and control, which had already been satisfied early by the unification of many measuring points in a central control room, and which created a favourable prerequisite for the computerisation and automation of production. In contrast to the fordistic-tayloristic production in the manufacturing industry, this rationalisation did not lead to the loss of the chemical workers’ qualifications. This was hardly possible, because the chemical industry – a classical industry for unskilled and semi-trained workers – started with only a few highly-qualified employees in its production in the first place. The other side of that argument is that the newly created work in the central control rooms placed greater demands on workers. The introduction of control rooms and the need to have working knowledge of the chemistry process thus led to an increased demand for workers with appropriate qualifications. Typically, chemical workers have to rely on the know-how they have acquired while working on concrete systems so that they can correctly interpret the displays and intervene in the production process in a suitable way. Unlike manufacturing workers who gain experiences over things that they handle, process and change, workers in the chemical industry must be experienced with the structure of their chemical plant. Their know-how requires a feeling for the processes and an idea about the connections in the container system, whose contents cannot be handled, processed or changed by the workers. "The sensual representation of knowledge consists of experience of both spatial conditions and temporal operational sequences. Spatial conditions, like geography and architecture of the systems, therefore, are not only experienced as pictures, but as movement, which is activated by walking through the plant and from memory. In another way, this applies to temporal operational sequences too. They are the central quantity that must be targeted during process control and regulation. The system drivers know how much time a certain process is required by a system and on this basis can judge whether deviations occur in relation to the normal run." (Boehle and Rose, 1992).

Apart from their know-how, the system drivers also increasingly require expertise and an understanding of connections in the production process, which is available in the control room. Obviously, acquisition of this expertise can hardly take place by learning solely from work or at the workplace, but refers to an extensive training and qualification program (Drexel, 1998).

Despite the supremacy of the account processes in chemical mass production, batch processes are not by any means extinct production procedures in the chemical industry. While not all steps in a procedure can be implemented for small outputs as

economically as in account processes, batch production does permit high flexibility, even with the production of a large number of different products in contrast to relatively small amounts (e.g. in the lacquer production, in the field of cosmetics or fine-chemicals) (Schumann et al, 1994: 536).

Products and Markets

In the course of the last decades, the German chemical industry shows a clear trend towards high-quality special products, produced by modernised production equipment and improved procedures (Schumann et al, 1994: 543). Thus, expenditure for research and development has increased enormously and has more than doubled between 1980 and 1991. Since then, it has continued to rise rapidly (see table 1). Conversely, the proportion of basic materials used to total production in the chemical industry has decreased while the proportion of special products created for commercial and agricultural needs, as well as pharmaceuticals, has risen accordingly.

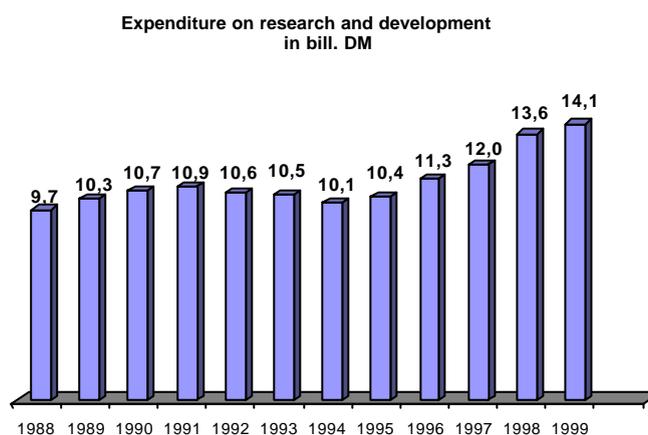


Figure 1: Expenditures for research and development in the German chemical industry (source: VCI 2000).

In recent years, the German chemical industry has reduced its personnel by approximately 12,2%, that is, from 536.000 in 1995 to 471.000 in 2000 (viz. table 1). In the same period, production has risen by around 21,7%. This increased productivity has also been accompanied by an increase in material asset investments over the same period. Indeed, the tangible assets investments in 2000 are estimated to have risen by 130% compared to 1995.

Table 1: Chemical economic indicators since 1995 and a prognosis for the year 2000.

	1995	1996	1997	1998	1999	2000*
Turnover (in bill. DM)	180,1	175,1	188,9	187,4	190,0	209,0
Production (gg. year before %)	+0,1	+4,9	+5,7	+0,5	+4,4	+4,5
Employees (in Tsd.)	536	518	501	485	477	471
Tangible assets investments (bill. DM)	11,3	12,5	12,5	13,5	14,2	14,6
Export (in bill. DM)	101,4	104,5	119,7	122,2	127,6	134,7
Import (in bill. DM)	63,2	63,2	70,2	74,7	78,9	86,3
Expenditure for research and development (in bill. DM) (in bill. DM)	10,4	11,3	12,0	13,6	14,1	-

Source: StBA, VCI, CHEMDATA; * Prognosis, table taken from: *Industry-port-guesses/advises chemistry*. Hrsg.: Federation of the chemical industry, Frankfurt 2000

Europe

Within Europe the German chemical industry has the highest turnover. The following figure shows the percentage of turnover in the chemical industry held by the individual countries in the European Union. In 1999, the German chemical industry accounted for almost 25 per cent of the Union's chemistry turnover. Almost 33% of the European chemistry workstations are in Germany. Moreover, the German chemical industry has invested 14.2 billion DM in assets (1999), thereby increasing their share of the entire tangible asset investments by the various EU countries to approximately 29 per cent (viz. VCI 2000).

Turnover in chemistry 1999 (in per cent)

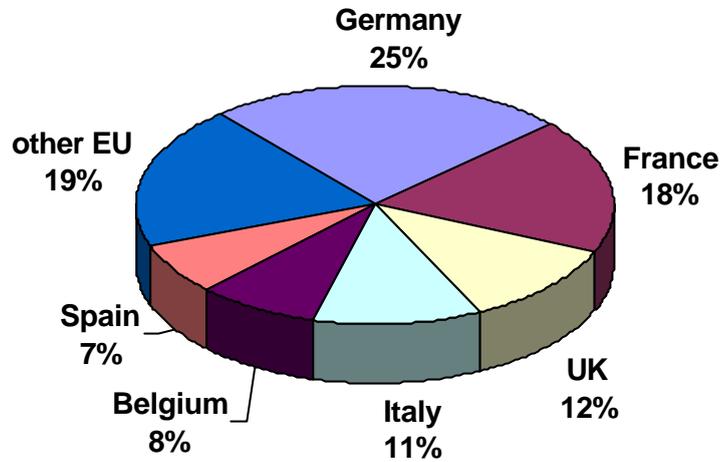


Fig. 2: Turnover of the different European countries

	<i>Total</i>	<i>Share at the EU-Entire</i>	<i>Position within EU</i>
<i>Turn over in chemistry</i>	<i>190,0 Bill. DM</i>	<i>24,2 %</i>	<i>1</i>
<i>Growth of production average (1990-1998)</i>	<i>2,0 % p.a.</i>	<i>EU- average: 2,8 %</i>	<i>6</i>
<i>Growth of production 1999</i>	<i>4,4 %</i>	<i>EU-: average 3,6 %</i>	<i>1</i>
<i>Tangible assets investments (home)</i>	<i>14,2</i>	<i>29,1 %</i>	<i>1</i>
<i>Number of persons employed</i>	<i>477 600</i>	<i>28,3 %</i>	<i>1</i>
<i>Chemistry import</i>	<i>78,9 Bill. DM</i>	<i>17,8 %</i>	<i>1</i>
<i>from that imports from EU</i>	<i>52,4 Bill. DM</i>	<i>-</i>	<i>1</i>
<i>Chemistry exportation</i>	<i>127,6 Bill. DM</i>	<i>23,2 %</i>	<i>1</i>
<i>from that imports from EU</i>	<i>67,2 Bill. DM</i>	<i>-</i>	<i>1</i>

Table 2: The position of the German chemical industry in the European union on the basis of selected indicators, (status 1999)

The German chemical industry is the third biggest producer world-wide. Only the USA and Japan transfer more chemical products. During 1999, German chemical enterprises employed more employees than Japan or any of the neighbouring European countries. In 1999, the export quota of the German chemical enterprises amounted to 67 per cent. In other words, more than two thirds of chemical products produced in Germany, (a value of over 127 billion DM) is sent abroad. This corresponds to a world market percentage of almost 16 per cent. Thus Germany ranks second behind the USA by only a small margin as one of the biggest exporters of chemical products in the world. However, while the American chemical industry depends on internal demand, the German chemical industry depends on foreign demand.

Table 3: Important economical indicators of the large chemical producing countries

1999	USA	JP	D	F	GB	ITA
Turnover (in bill. DM)	796,5	375,1	190,0	143,1	91,4	89,3
Employee (in thousand)	1035	384	478	236	258	187
Exportation (in bill. DM)	129,2	56,0	127,6	78,9	69,4	38,5
Imports (in bill. DM)	114,1	30,9	78,9	63,1	55,9	53,1

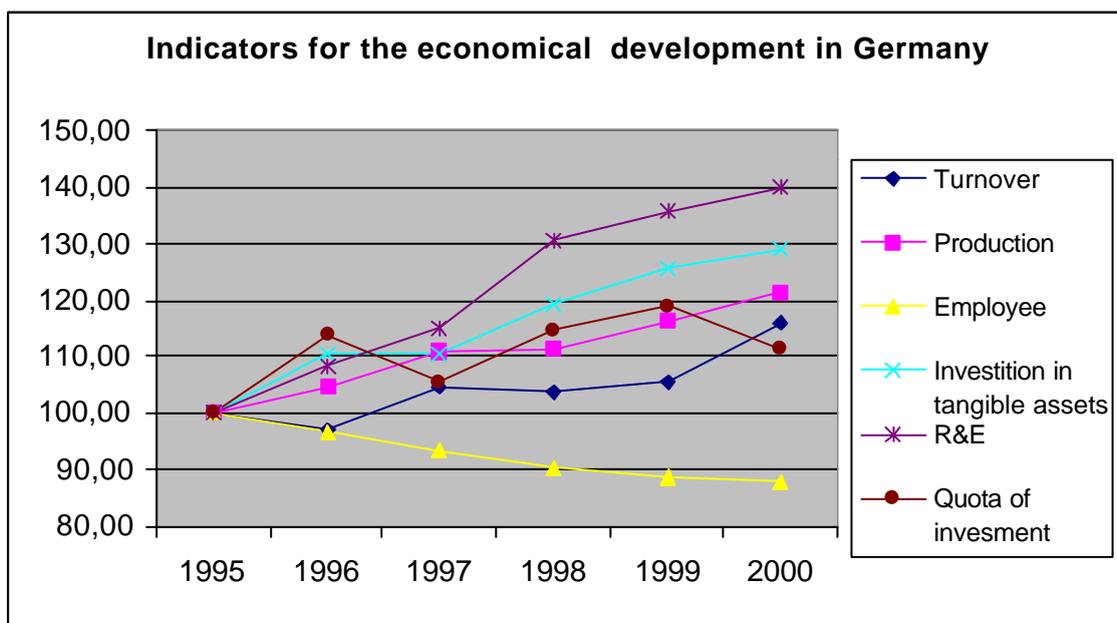


Fig. 3: Different economical indicators for the economical development of the German chemical industry.

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Nick Boreham

Trends in the British chemical industry

Overview of the industry

The chemical industry is one of the UK's largest, being ranked fourth in the manufacturing sector. It exports more than 50% of its product and is the manufacturing sector's largest exporter. There are about 3,500 "business units" in the UK classified within the chemicals and man-made fibres sector, employing around 280,000 people directly. Most of these units are small, with 80% of them employing less than 50 people (CIA, 1994).

The British chemical industry is the fifth largest producer in the world after the USA, Japan, Germany and France. It has a long history. The industry was established during the industrial revolution. In the early 19th century, Britain became the world's leading supplier of chemicals. At this time, the industry was based on dyestuffs and other products for the growing textile industry in Scotland and the North West of England. Towards the end of the 19th century, however, the British chemical industry was overtaken by Germany and the USA.

Historical trends

After 1945, there was a period of rapid growth based on the expansion of petrochemicals production, stimulated by free trade, cheap feedstock and growing consumer demand for an increasing range of chemical products. This came to an abrupt end with the Yom Kippur war in 1974, and the consequent rise in the price of crude oil. The period since then has been turbulent for the British chemical industry, principally due to the three recessions which occurred in the 1970s, 80s and 90s. The chemical industry is particularly vulnerable to recessions because most of its products are sold to

other manufacturing industries, including other chemical firms, and its success thus depends on the success of the manufacturing sector as a whole. In the 1980s recession, bulk chemical capacity was reduced by one-third, and it took the industry the remainder of the decade to return to a state which attracted substantial amounts of new investment.

Present-day challenges

At the beginning of the 1990s, the major western economies again went into recession from which Britain has only recently recovered. The challenges now facing the UK chemical industry are due to a series of major political and economic changes in the 1990s:

- liberalisation of world trade, which has resulted in competition on a global scale;
- the economic development of the Pacific rim, where countries have established their own strategic chemical industries, and are competing aggressively with US and European companies;
- the collapse of the Soviet block, and consequent competition from central and eastern European producers.

The fundamental problem now facing the British industry is that there is a world surplus of capacity and low prices, while British producers have high labour costs. This has stimulated a drive for productivity growth.

The specific challenges facing the five sectors into which the British Chemical Industries Association divides the industry are as follows:

Pharmaceuticals: this is the largest, most research-intensive and most rapidly growing sector of the British chemical industry. The main challenge it faces is the desire of governments, consumers and health insurance companies to reduce health care costs.

Speciality chemicals: the UK industry has particular strength in organics. This sector contains a large number of SMEs, and there has been a general tendency to move into more value-added products to protect profits.

Dyes, paints, pigments: the UK retains a strong market position in this traditional foundation-stone of the industry, especially in paints.

Basic inorganics and fertilisers: these relatively low-value products, used in industry and agriculture, are under threat from low-cost producers overseas.

Petrochemicals and polymers: UK producers have the advantage of North Sea oil production, but are restructuring to increase the proportion of high value-added products in their portfolios.

In response to the challenges faced by the British chemical industry, there have been significant changes in the way it is organised. These can be summed up in the following trends.

The trend to foreign ownership

The main response to the challenges described above has been to increasingly organise activities on a pan-European or global scale, rather than in the UK alone, in order to achieve economies of scale, and to locate specific operations where the cost base is lowest. This has occurred through a recent spate of mergers and acquisitions by foreign-owned companies. Many of the major UK chemical companies have now been bought by foreign competitors, and today (2000) two-thirds of the larger British chemical companies are subsidiaries of foreign-owned companies. Bulk chemical production in UK is now mainly owned by US and continental companies, including Du Pont and BASF, and the largest part of the specialty chemicals sector has been bought by overseas competitors.

The trend to consolidation

Another trend is for companies to consolidate and focus operations on core areas, or areas in which they possess special expertise e.g. Shell has restructured by selling off small-volume specialty chemical businesses, so that it can concentrate on high-volume petrochemicals and integrate its processing and refinery operations.

The loss of R&D facilities

The change in the ownership of UK chemical companies has not yet resulted in the closure of production facilities on a significant scale. However, the rationale for the mergers and acquisitions was usually to reduce fixed costs, and among these R&D has been a prime target. Consequently, in the recent mergers and acquisitions, there has been a widespread transfer of R&D facilities from British firms to the foreign country in which the purchaser is based, reducing UK laboratory work to the provision of local technical services. Between 1993 and 1997, total chemical R&D spending in the UK fell from GBP 707M to 609M, with employment in R&D falling from 16,000 to 11,000 - a fall of more than 30% in the latter (Brophy, 2000).

This trend is a significant threat to the British chemical industry. It has always been science and research based, its growth depending on the introduction of a stream of new products and improvements in existing processes and technologies. In response to the disinvestment in R&D, in 2000 the British government announced measures to

encourage R&D in the chemical industry by tax credits, and in general there is a drive to link university research facilities with the industry. This might tempt some foreign-owned companies to return R&D facilities to the UK.

Human resource trends - downsizing and multiskilling

About 50% of the workforce in the British chemical industry are process workers, with the other 50% classified as administrative, clerical or technical. Employee earnings are significantly higher than in manufacturing generally, reflecting the higher levels of skill and productivity.

One of the major trends in the British chemical industry is to maintain competitiveness by reducing labour costs. This has been achieved by reducing the size of the labour force, increasing functional flexibility and outsourcing. The last 20 years have seen a steady and dramatic fall in the number of employees, and productive capacity has been maintained by the introduction of new technology (especially remote sensing and computer control of operations) and human resource management policies directed towards increasing functional flexibility. In general, there has been a trend towards multi-skilling, aided by legislation which has reduced the power of labour organisations to maintain demarcations, and new vocational qualifications defined in terms of "outcomes in the workplace" instead of the narrow trade categories which characterised previous vocational qualifications. Outsourcing is another way of reducing labour costs, as employees in contractor firms often earn less than the relatively highly-paid employees of chemical companies.

Organisational learning

As already stated, the chemical industry depends on scientific and technological innovations produced by chemists and chemical engineers in research laboratories. However, in order to compete successfully, most British chemical companies also need to improve their reliability (for example, by reducing waste, lost-time accidents and unplanned shutdowns) and their safety, health and environmental protection (SHE) records (by preventing accidents and pollution). Reliability is crucial for maintaining a competitive advantage; SHE protection (apart from social considerations) is crucial for retaining public and political support for operations which are often under attack by environmentalists and public health activists.

It is primarily to improve reliability and SHE protection that the industry has developed an interest in organisational learning. To reduce waste, avoid unplanned shutdowns and minimize spills and smells, the whole organisation needs to learn from its collective

experience in operating the plant. There is a recognised need to develop a safety culture and a collaborative, quality-conscious organisation. High reliability and SHE protection cannot be achieved by forcing employees to follow procedures against their will. To achieve these goals, employees at all levels in the organisation must understand their importance for the survival of the company and thus their own jobs. Employees must be able to unlearn established patterns of behaviour, and live with the effort and uncertainty involved in change. Many companies have therefore sought to harness organisational learning in the service of their commercial survival.

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Michele Mariani

National research in the Italian chemical sector

In 1997, the chemical sector in Italy employed about 190.000 workers, almost 30.000 less than in 1990. Its turnover is equal to 10% of the total turnover of the Italian industry as a whole. From a production point of view, the 40 typologies of products are grouped into three main categories:

- basic chemicals (e.g. plastics and resins, fibres, fertilisers, gas, etc.);
- refined chemicals and pharmaceuticals (e.g. medicines, vaccines, cosmetics, etc.);
- specialised chemicals (additives for textiles, paper, detergents, colours, etc.)

The reduction in personnel and the consequent changes in the organisational structure resulted in a massive increase in investments for training. The concept of Organisational Learning, however, has not been directly addressed in the Italian chemical industry until now. Therefore, the stories told in the next paragraphs are about recent Italian cases, covering a wide variety of different chemical production processes¹, concerned with organisational change and implementing relevant educational programmes².

Zeneca

Founded in 1993 after the splitting up of the ICI group, Zeneca's products belong to the category of refined chemicals and pharmaceuticals. The change process mainly dealt

¹ Relevant exceptions are Enichem and Montell cases, where attempts to import the model of a Learning Organisation were and still are under way

² The first six cases concern experiences developed through the participation at a recent (1997-1998) EU Project Leonardo da Vinci programme for the diffusion of innovative experiences in the field of continuous education in the chemical industry.

with the introduction of Project Management as a key organisational mechanism. An education and training programme, lasting 2-3 years, introduced a model for the management of international projects to more than 140 employees (executives, middle managers, and office workers). The model is made up of seven major phases, related to the standard product lifecycle:

- concept forming;
- objective setting;
- team identification;
- definition of roles, responsibilities, and steering process;
- start up;
- delivery;
- completion.

Polimeri Europa

Polimeri Europe is a joint venture between Enichem and Union Carbide, that was made in 1995. Its core business is the production of plastics (polyethylene). The setting up of a new plant that had to replace three old ones made it necessary to initiate an intensive programme of training. Technological innovation, in this case, has been seen as an opportunity to enhance operators' professionalism by teaching them not only technical knowledge but also about things related to corporate functioning, safety, environmental issues, etc. The experience was carried out in strict co-operation with the Unions representatives' and foresaw both class lessons and practical experiences.

Nylstar

Nylstar appeared in 1993 and its main product is the nylon yarn. An educational initiative was put forward to support the implementation of an organisational model based on autonomous teams in order to solve problems of quality and flexibility in the production process. Integrated manufacturing and lean production were explicitly targeted as expected results. Actions were strictly related to organisational change, considered as mandatory for cost cutting and product improvement. The managerial structure was also affected by the change process and shifted from functional to business units. Training contents were defined to improve operators' professional competencies and their knowledge of the work process. New, enriched, professional profiles were derived as a consequence. As in the previous case, the program consisted both of classroom training and on-the-job training.

Enichem

Enichem is one of the biggest chemical companies in Italy. Its main mission is the production of plastics and elastomers in the basic chemicals sector. An intensive education and training program was started in 1990 to face the necessary process of cultural and organisational integration that affected the company as a whole³. Another relevant goal concerned the improvement of the integration between the production sites and their socio-cultural contexts. It was felt that this could be reached through a better capacity of internal communication and the assumption of a set of common, shared values.

The preliminary phase ended in 1996, when it was acknowledged that internal communication and self-initiative had become the common learning strategy of the organisation. A shared capacity for exercising self initiative was found to be the real key to getting workers' involved, stimulating knowledge creation and new behaviours, and achieving a shift from individual to organisational learning.

Air liquid

Air liquid is mainly concerned with gas production, employing about 2 000 workers in Italy and some 24 000 employees globally. The training program was initiated as a consequence of the company's move toward the 'model of a flat organisation. The shift made it necessary both to improve workers' skills in line with the new roles and tasks that emerged and to overcome resistance to the change initiative on the part of the managers. The increased participation of workers on the company's strategic decisions was directly addressed as one of the main expected results.

Lever

Lever is part of the Unilever Group, employing more than 300 000 people around the world. Its main products include specialised and refined chemical products. The main reason for undertaking an intensive educational programme rests in the necessity to move the organisational structure towards multi-skilling, flexibility, and teamwork. People are required to demonstrate:

- a complete vision of the work process;
- a set of competencies that allow them to be active parts of different segments of the production process;
- complete responsibility for their activities;

³ The problem was raised as a consequence of the fusion between Enichem and Montedison.

- a feeling of ownership of the process in which one operates and of the related means and resources.

Montell

The case of the Research Centre of Montell, world leader in the plastic sector, has been extensively studied by different authors (Bordogna, 1989; Catino and Fasulo, 1998, Gandini et al. 1999; Mariani, 2000). The Centre gained prominence in the research community not only because of the innovations it made in the plastic production sector, but also for the continuous research it has carried out on work organisation and training. "The CER Research Centre can be considered a system which transforms 'uncertain knowledge' (i.e. a market request, an intuition, a work program) into 'certain knowledge' (i. e. new processes, new technologies, new catalysts, new products). Therefore, it is inevitably a 'learning organisation' which learns, creates and reproduces knowledge: it is an organisation able to create, learn, and transfer knowledge as well as to modify its own behaviour to best effect the new knowledge and emerging insights [...] CER has developed many significant initiatives for reciprocal fertilization, including the set up of an associate-level specialization course and a Master degree aimed at young graduates." (Catino and Fasulo, 1998).

Conclusion

As for the majority of the studies concerned with organisations, the reviewed papers on Organisational Learning strive to give an answer to the question of: 'What is it that makes an organisation successful?'. As Spender and Grant (Spender and Grant, 1996) put it: "[...] the partial views offered by economics, financial and market analyses, human resource management, production operations, organisation behaviour, and so forth, come together into the essence of the firm: its competitive capability" (ibid.). Framed in this way, learning is mainly instrumental: "learning faster than one's competitors as the only sustainable competitive advantage" De Geus, 1988).

Even if we agree that competitiveness is the central concern for the majority of organisations, it might be the case that it is not the ultimate one. In the context of the OrgLearn Project, perhaps, an even more important question has to be answered. It is the question concerned with the 'goodness' of the organisation, that is to say the extent to which a company ensures the well-being of workers and makes them feel that they are an active and creative part of both the enterprise and society. Paraphrasing Savater

(1994), it can be said that "we don't know when an organisation⁴ is 'good', because we don't exactly know what organisations stand for".

The diversity of the topics addressed by OrgLearn (entailing Organisational Sciences, VET systems, new work forms), its context (European tradition of research), and its scope (provision of sort of prescriptive recommendations for 'good' organisational practices), call for such a unified view, which at the moment is not addressed by the literature on Organisational Learning. Such a perspective would help to give back to the discussion on work, an ethical dimension that is often forgotten in the plethora of claims and recipes for organisational success. The recent changes to work (flexibility, uncertainty, knowledge intensive work, etc.), are in fact, deeply affecting individuals' lives (Sennet, 1998) and, as a consequence, the concept of society as a whole. Once the discussion is filtered from some deterministic rhetoric it should become apparent that nowadays the issue of knowing how to manage and organise a company is less and less different from the one of 'knowing how to live'.

⁴ "Human being", in the original text.

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Rik Huys & Geert Van Hootegem

Research on work organisation, personnel policy and learning in the chemical industry of Belgium

Some characteristics of the chemical industry in Belgium.

The chemical industry in Belgium received a major boost during the fifties when it made the transition from carbo- to petrochemicals. This entailed a shift from the coal mines in Wallonia to the ports of Ghent and Antwerp in Flanders. By means of foreign investments, major chemical sites were constructed around these ports in the following decades. The port of Antwerp is equipped with the largest concentration of chemical plants in the world, next to Houston (USA). Currently, the chemical plants in Belgium which are 100% owned by foreign capital, provide employment for two thirds of all employees.

The chemical industry is one of the main industrial sectors in Belgium. As the specialisation-index shows (see table 1), there are few countries in which the chemical industry delivers such a large contribution to the GNP. In the appendix, the major chemical companies in Belgium are listed.

Table 1: *Specialisation-index for some European countries, Japan and the United States.*¹

Belgium	2,92
Netherlands	1,47
Spain	1,06
France	1,05
United States	0,99
Germany	0,97
Japan	0,94
Great-Britain	0,87
Italy	0,84

Source: Fedichem, based on data from CEFIC and OECD.

The employers in the chemical industry are organised within the federation Fedichem. Due to the federalisation of the country, regional bodies have been set up (SIREV in Flanders and WALCHIM in Wallonia) for specific regional matters. Employees are organised in three different trade-unions (Christian – ACV; Socialist – ABVV and Liberal – ACLVB), all of which have different sections for blue- and white-collar workers. Most employees in the chemical industry are unionised (approx. 80%).

The social partners conclude ‘collective labour agreements’ on a periodical basis. However, due to the high diversity within the chemical industry, the emphasis on negotiations is not at the national, but rather at the company and group level. The national agreements are therefore minimal and provide a general framework for negotiations at lower levels.

In 1991, Fedichem subscribed to the ‘Responsible Care’ principles of the ICCA, which determine the attitude of the chemical industry to the environment in a broad sense. Individual companies that want to become members of the employers’ federation are obliged to subscribe to this program, in order to improve safety and the protection of health and the environment. The employers federation publishes a report on a yearly basis giving an overview of the results with regard to ‘Responsible Care’ programme.

With regard to training, there are no specific courses for process-operators in the chemical industry at secondary level. At a higher level, however, there are specialisation courses within the industrial sciences on chemicals, process-techniques, environmental care and so on. In addition, there are public training centres aimed at the reintegration of the unemployed, but which, equally, are also there for the further training of

¹ *Specialisation-index* = proportion of the turnover of the chemical industry in the GNP of each country, divided by the same proportion for all countries considered.

employed workers, offering courses for process-operators in the chemical industry. Exchanges between industry and the education system are however minimal.

Work organisation in the chemical industry

A survey in the Flemish chemical industry (Huys et al., 1994; Van Hootegem, 2000) sheds more light on the trends regarding work organisation and personnel policy in the chemical industry. In addition, case-studies carried out in specific chemical companies, offer more information on the way these companies support the acquisition and expansion of qualifications of process-operators by means of on-the-job as well as off-the-job training (Verdonck, 1997).

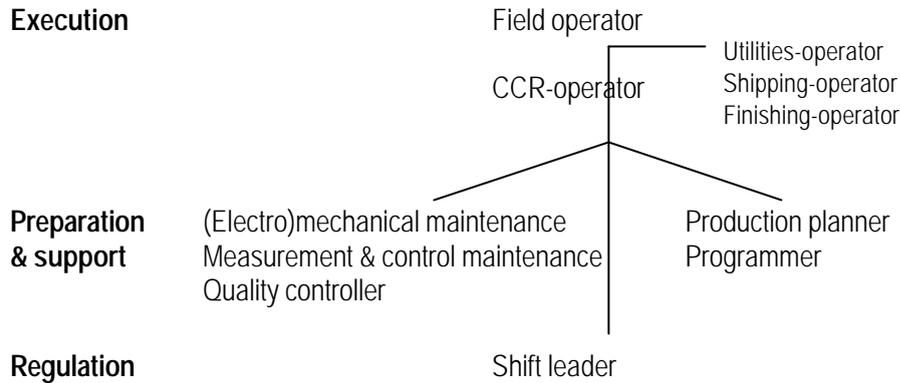
The survey carried out by Huys et al. (1994) covers 36 chemical sites in Flanders, containing 77 chemical plants and 11 373 workers. While these plants differ widely on many criteria, the research identifies the type of process (batch / continuous) as decisive for many of its features, even though many plants are of a mixed type. As indicated in table 2, batch processes (about 25% of the plants), in contrast to continuous processes (about 35% of the plants with the remaining 40% being of a mixed batch / continuous type), are characterised by high product diversity, product mix, customer-specific products, production on order for many different customers and lower levels of automation and centralisation with regard to the control and steering of the process.

Table 2: *Characteristics of chemical plants according to type of process.*

	Product diversity	Product mix	Nature of the product	Basis for production	Number of customers	Level of automation	Centralisation of control and steering
Continuous	Low	Low	Standard product	On buffer	Few	High	High
Batch	High	High	Customer-specific products	On order	Many	Low	Low

Just under half of the workforce in the chemical industry is engaged in production departments. Supporting departments such as maintenance, quality control, administration, personnel policy, safety, and so on, are very extensive (about a third of the workforce) with a remaining sixth of the workforce engaged in preparatory departments such as engineering, purchasing and marketing, among others. Despite the above-mentioned diversity in chemical plants, however, similar core jobs can be identified within these plants (see figure 1).

Figure 1: Core jobs around a chemical production process



Strikingly, the research revealed that the ‘traditional’ boundaries between production and supporting as well as preparatory departments, in which each department has its ‘own’ responsibilities, still remain very much in place. Yet, there is no lack of reasons why an integration of such responsibilities should take place. Table 3 highlights the incentives, but also some obstacles towards such integration.

Table 3: Reasons and alternatives for the integration of quality control and maintenance tasks with production tasks.

Quality control	Maintenance
<i>Reasons for task integration</i>	
Variable process High integration of the process High product diversity Customer-specific products Continuous production Available mobility of production workers to take on additional responsibilities	High integration of the process Difficult and long start-up and shut-down procedure Line-production Available mobility of production workers to take on additional responsibilities
<i>Measures to prevent task integration</i>	
ISO-norms for suppliers Use of on-line analysers Simple processes during shifts Full-time support by functional specialists	Extension of preventive maintenance Availability of routing flexibility (doubling of equipment) Implementation of guard-duty Availability of ‘flying’ maintenance groups Simple processes during shifts Full-time support by functional specialists

With regard to quality control, chemical plants prefer to provide support on a full-time basis across the different shifts, rather than allocating additional responsibilities to operators. With regard to maintenance, a number of alternatives are explored to avoid

such expensive full-time support. Indeed, in contrast to some other sectors, the integration of additional responsibilities with the tasks of operators is not a hot issue in the chemical industry. Similarly, the position of the shift leader remains very important as he delivers full-time support to the operators. Moreover, because of limited decentralisation, his position remains unthreatened.

One of the reasons for this 'traditional' division of labour may be found in the high complexity of the tasks of chemical operators. Efforts are thus aimed at extending the qualifications required for the day to day running of the plant and the co-ordination between the production tasks of different operators rather than expanding their responsibilities. Moreover, this division of labour is compensated for by an allocation policy geared towards the multi-skilling of operators in order to improve their mutual co-ordination and understanding. No surprise then that the personnel policy within chemical companies is elaborated on to support such multi-skilling.

Personnel policy in the chemical industry:

Recruitment policies

Recruitment procedures for new production workers in the chemical industry are generally limited. An oral interview is always included, but in about a quarter of the plants this is the only selection test. In view of the important responsibilities entrusted to chemical production workers, this is rather surprising. Other plants impose additional tests, mostly psychometric tests and / or theoretical written tests.

The recruitment requirements for vacancies are also general. In most cases, a secondary level education is sufficient. It is indeed difficult to describe precise qualifications needed for chemical production work. Attention is given to social skills, communicative skills, and the willingness to perform shift-work, but the technical qualifications needed to perform operator tasks are hard to identify. These qualifications are quite specific for the plant concerned and have to be acquired on-the-job. Moreover, as the orientation is increasingly shifting to multi-skilled operators, such qualification requirements cannot be drawn from a specific job in the plant. The absence of a specific educational training for process operators only enhances this difficulty. Recruitment is therefore more oriented to the examination of the potential and willingness to acquire the qualifications needed as an operator in a chemical production plant, rather than an examination of these.

Promotion policies

In contrast to the above-mentioned general recruitment policy, promotion policies are much more stringent and selective. In half of the plants a formal examination that includes a theoretical and practical test must be passed before promotion. Moreover, evaluation criteria include the degree to which the operator is multi-skilled and an assessment of his daily work. Management wants to assure itself that multi-skilling has been achieved by means of formal proof. Due to the heavy hierarchical structure and the small span of control at each level, there are indeed a number of promotion opportunities for production workers. Moreover, as qualifications are acquired on-the-job, production workers usually start at the bottom of the promotion ladder. In almost all plants, operators can be promoted to the position of the shift leader. Chemical plants are therefore characterised by a strong internal labour market. In this way, long-term and extensive training efforts can be made profitable.

Training policies

As indicated above, the educational level of process operators in the chemical industry is surprisingly low. Three quarters of production workers have only finished their secondary school education level. An influx of a more highly educated workforce may be expected, which could offer opportunities for a move towards less division of labour in chemical plants. In view of the current trends, however, it looks as if the higher qualification potential will be used towards creating more 'multi-skilled' operator jobs and not for a deconcentration or decentralisation within chemical plants.

Training is mainly provided by production workers themselves and may be conducted by colleagues as well as the shift leader. Further formal training for experienced workers is delivered by a specific department within the company. External training centres play only a minor role.

These conclusions are supported by the case-studies of Verdonck (1998) on the training policies of chemical companies. In this study several kinds of training are distinguished according to whether they are formal or informal (see table 4).

With regard to 'formal' learning, the study points out that off-the-job training is quite low for production workers in the chemical industry. One of the inhibiting factors is the usual 4-shift system in the production of chemicals, in which the time to follow such formal courses is lacking. Moreover, formal off-line courses are very expensive, as only a small number of operators are involved and their training needs are quite specific. On-the-job training by colleagues or a supervisor is therefore an important alternative in the chemical industry. In this configuration, the 'natural' teaching qualifications of colleagues or supervisors is used, although these coaches are often not trained

themselves to provide training. Specific courses for these coaches on how to train new production workers could enhance the effectiveness of this model.

It is worthwhile to mention self-study as a training possibility in the chemical industry. With the help of job aids such as manuals, documentation, specialised literature, simulations, and so on, 'quiet' moments during work can be used for self-study. The research reveals that such instruments are indeed available, but until now, these are not used in a systematic way. To illustrate, manuals are not updated regularly and simulations are very expensive and not widely used, etc.

'Informal' training, however, is the most important channel for operators to acquire the qualifications needed. Here learning is not the primary focus of the activity, as the execution of work is central. But during work, operators are learning at the same time. The research points to three measures, which can enhance learning during work: the organisation of work, software for computer assisted learning and an appropriate personnel policy. On these three criteria, the chemical plants investigated offer good learning opportunities for operators (see table 4 for a short summary of the main findings).

Table 4: Strategies to support learning for chemical operators

Source: Verdonck (1995)

INVENTORY			DIFFICULTIES, OPPORTUNITIES AND LIMITATIONS FOR PROCESS OPERATORS
FORMAL	Conscious Training	Training is the first goal	Usual 4-shift systems restrict the planification of specifically designed training courses. This is available in a 5-shift system, if and when the fifth shift is especially aimed at training
	On-the-job	Training at the work place	Useful to circumvent the above-mentioned difficulties. But there is a lack of didactic foundation. Learning principles are not monitored purposefully in order to enhance the effectiveness of such training
	Coaching	Under the supervision of a coach the (new) worker is trained during work	Mainly used for new workers. In some companies explicit heterogeneous composition of teams in order to improve mutual learning
	Self-study, work groups	In quiet moment, workers can study autonomously with the help of job aids,. Work consultation can be developed as a learning tool.	Job aids are usually limited to manuals and procedures. Simulations are exceptional. Specialised literature is still not frequently exchanged between operators. Work consultation is until now rarely used to treat systematically and deductively production problems between operators
	Off-the-job	Training separated from the work place	Difficult to combine with existing shift systems
	Internal	In a own training centre	In many cases plants are too small to be equipped with an own training centre. Leading functions do provide training however on an occasional basis to operators
	External	At supplier, public or private training centres	Due to the shift system such courses are rare. Moreover, mainly aimed at safety or technical matters. Due to the small groups and the firm-specific training needs, such training courses are expensive.
INFORMAL	Learning through work	Incentives to learn while working	An important channel, in view of the difficulties with formal training. This learning is more explicitly enhanced, e.g. through the assignment of additional tasks in a fifth shift.
	A work organisation supporting learning	Work is divided in such a way that operators dispose of many learning opportunities, e.g. broad task profiles, involvement in the development of work methods, programmes, ...	The job profile of most operators offers extensive learning opportunities
	Software supporting learning	Interactive regulation enhances learning instead of 'passive' control.	The software used supports learning of operators to a large extent: programmes are self-descriptive, easy to regulate, consistent in tasks and colours, visually clear and error proof.
	A personnel policy supporting learning	A link between the expansion of qualifications and promotion opportunities and wages motivates operators to lifelong learning	Promotion procedures are based on – proven – increase in qualifications. Link with wages, remains difficult. Companies are looking intensively at a more appropriate personnel policy, as great importance is attached to its potential motivating aspects.

Conclusion: Flexible allocation of workers within a traditional division of labour

The data available on the chemical industry in Belgium shows that the integration of staff departments and the production department is not a hot issue. As a consequence, real job integration is only reluctantly pursued in the chemical industry. Yet, technological changes as well as changing product markets are forcing the chemical industry to engage in organisational transformations. But these are looked for primarily through allocative measures.

An abolishment of the traditional production-organisation would indeed require an enormous training effort in the chemical industry, the economic benefit of which, is by no means certain. Moreover, such restructuring could meet with vehement opposition in diverse sections of the companies. The anticipation of such resistance, as well as a lack of conviction about the need for less division of labour, enhances a kind of escapism. Until now, the orientation towards more multi-skilling allows the industry to meet the new challenges while maintaining a status quo in the structure of the division of labour.

A possible way to achieve such job integration is by making the job of the field operator more 'complete' by adding responsibilities in the field of maintenance or quality control. According to this perspective, the field operator's job becomes a complete job in its own right and is not merely a preparatory step for the job of the control room operator. This last operator could be conceived of more as a 'plant technician', who is recruited externally and with higher recruitment requirements. With this enhanced theoretical knowledge, this plant technician could be more involved in production planning, programming and process-engineering.

Such job integration would, however, be an obstacle in the search for multi-skilled workers. For instance, would this plant technician still be willing to do field work? This is necessary in order to run the centralised process smoothly. It is indeed the knowledge about the process that has slowly been acquired in the field, that management wants to exploit in the control room. Such experiences are maximised by conceiving the field operator's job as a preparatory step in which a broad and precise view of the whole production process is accumulated. The more theoretical qualifications are diverted from the operators. Decision-making authority in important process steps is allocated to the shift leader who offers full-time support. The establishment and adaptation of the 'recipe' used, the maintenance of the equipment as well as instrumentation are allocated to separate departments.

These tendencies lead to the conclusion that operators in the chemical industry will not be 'bothered' for some time to come with such theoretical qualifications. All efforts are geared at deepening and expanding their experiences in the daily running of the process. These are the qualifications, which are vital for the performance of the plant and can only be assured by the process operators themselves. As such, it is important for chemical plants to allow and stimulate operators to learn during work.

Appendix 1: Turnover and employment of largest chemical companies in Belgium

	Turnover	Employees
	(milj. BEF)	(Belgium)
BASF Antwerpen NV	2 324,996	3511
Solvay	1 900,475	2733
Agfa Gevaert NV	1 443,546	5563
Bayer Antwerpen	862,810	2561
UCB	575,883	2267
Monsanto Europe	450,801	1230
Janssen Pharmaceutica	868,955	3380

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1. Criteria for organisational learning

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Criteria for organisational learning in a learning company

Criterion 1. Organisational work routines are being evaluated and improved

Indicators

1.1 The organisation's overall market position, strategic objectives and business plan are under constant review and revision

1.2 Problem-solving groups (either task groups, or self-managing teams) identify and solve problems in standard operating procedures and make recommendations for altering them

1.3 Finding ways of improving performance, and communicating these when necessary to colleagues and management, is an accepted part of everyone's job.

Example:

- improving own skills by attending voluntary courses*
- reflecting on experience*
- peer appraisal*

1.4 Organisational developments that create opportunities for learning are integrated into the work process.

Example:

- the introduction of group work, teams, quality circles, project management, simultaneous engineering*

1.5 There is a willingness to change procedures to meet quality management and continuous improvement requirements.

Criterion 2. Formal and informal learning processes are being evaluated and improved.

Indicators

2.1 There are formal inquiries into organisational learning processes in order to identify learning deficiencies and to draw conclusions from them.

Example:

- *managerially controlled meetings are held regularly*

2.2 People are prepared to challenge assumptions, to question and exchange ideas to gain maximum learning

2.3 The active exchange of ideas and information is frequently and actively sought across boundaries

2.4 Learning processes are stimulated, supported, evaluated and results disseminated

2.5 Managers take on the roles of coaching, mentoring and facilitating learning

Example:

- *managers generate and enhance learning opportunities as well as encourage experimentation and reflection on what was learned so that new knowledge can be used*

2.6 A plurality of modern forms of learning exist.

Example :

- *learning islands, computer aided learning, on-the-job training, learning workshops, etc.*

2.7 Roles and careers are flexibly structured to allow for experimentation, growth and adaptation

Criterion 3. Transformations are occurring in the culture of the organisation

Culture: "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be taught to new members as the correct way to perceive, think and feel in relation to these problems" (Schein).

Indicators

3.1 Staff perceive a difference between the organisation's current standards and what they ought to be

Example:

- *attitudes towards environmental pollution*

- *attitudes towards customer care*

- *attitudes towards level of co-operativeness*

3.2 Staff feel personally committed to closing the gap.

3.3 Staff are empowered to change, and are actively participating in the change process.

3.4 There is a readiness to change the structure of work and learning

Example:

- flattening hierarchies to maximise communication and learning across levels.

3.5 There is a readiness to introduce and improve artifacts in order to increase learning opportunities

Example:

- participative design*
- computer aided training*
- knowledge management systems*

3.6 There is a readiness to change rules and common assumptions

Example:

- company norms*
- rules of social interaction*

3.7 There are feedback loops in place to evaluate any intervention aimed at achieving change in response to external challenges.

3.8 There are systems in place to allow people to make different contributions and draw different rewards

Criterion 4. Knowledge is being created within the organisation, at different levels (not only by the managers/scientists) and it is being shared within the organisation

Indicators

4.1 Knowledge creation projects are officially sponsored throughout the organisation.

Example:

- employees at all levels do R&D*
- there is an official incident reporting scheme*

4.2 Informal knowledge creation is encouraged

Example:

- narrating/story-telling/gossip is permitted in the workplace*
- training courses make use of employees' personal accounts*

4.3 There is a formal system for distributing knowledge throughout the organisation, and everyone has up-to-date information about the performance of the company against its objectives

Example:

- an intranet and organisation home page used by all*
- frequent information sharing events such as discussion forums and phone-ins*

4.4 Systems and structures are in place to code, and store knowledge and to make it available to those who need it and who can use it

Criterion 5. Learning from the environment is encouraged and systematically evaluated. The results are assimilated and accommodated to the company's objectives and local constraints and opportunities

Indicators

5.1 Inter-company learning is an accepted part of the company's overall policy

Example:

- benchmarking best practice
- staff exchange between companies
- willingness to participate in joint ventures
- technology transfer

5.2 Boundary workers act as environmental scanners

Example:

- attending conferences
- examining published research
- meeting regularly with representative groups of customers, suppliers, subcontractors, community members to find out what is important to them.

5.3 External audits by private and public bodies to evaluate the company's performance are seen as valuable learning opportunities

5.4 There are systems and procedures for acquiring and sharing information from outside the company.

Example:

- access to internet and local area networks
- artificial intelligence for production management.

5.5 Internal training is outsourced to external training providers when doing so offers an outsider's perspective on the company's performance.

5.6 Informal and formal networking is encouraged.

Example:

- personal contacts
- links with politicians, political groups, lobbies, environmental groups, employers' associations, trade unions, academic institutions and business services, etc.