

A hermeneutical reading of Penrose and Nelson and Winter - Tracing origins of a misunderstanding?

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Abstract: This paper aims to understand based on a hermeutical reading of Penrose (1959) and Nelson and Winter (1982) what knowledge is and where it is stored in the respective authors. Furthermore, the author wants to learn whether the subsumtion of Knowledge Integration to Knowledge Management, as it can be often in the literature, has any foundation when coming from these authors. Reason for this overall analysis is the widely held view in the discipline of Knowledge Management that these authors are forefathers for it. Based on an interpretative, qualitative approach the author examines the way in which knowledge is held and created within organisations in the main work of this pair of author. The author comes to the conclusion that the discipline of Knowledge Management has seemingly overemphasised certain elements in the work of Penrose and Nelson and Winter, while neglecting the key aspect that for both author(s) the act of Knowledge Integration is much rather described in these works.

Keywords: Communication and Language, Employees, Knowledge Management, Knowledge Integration, Organisation, Resources and Services, Processes

Introduction

In the debate on Knowledge Management often Knowledge Integration and Knowledge Sharing are treated as means to allow for Knowledge Management, not to say that some authors even treat Knowledge Integration as being subordinated to Knowledge Management. Furthermore, and

quit typical for the overall approach held in the first phase of Knowledge Management, knowledge was seen as being an element that had its place in economics from the beginning (cp. eg. Nonaka & Takeuchi, 1995 or Leonhard-Barton, 1995 just to mention the most prominent authors).

When conducting research on the topic of knowledge and/or Knowledge Integration

the author (Krone, 2000, 2007, and 2008) has consistently argued that Knowledge Integration and Knowledge Management are not alike. In addition it was suggested that if the sources of the first phase of Knowledge Management like Penrose (1959) and Nelson and Winter (1982) would be read carefully, it should become evident that they cannot be forefathers for Knowledge Management, not to speak even about Organisational Knowledge.

For this purpose this paper examines two main research questions:

- 1) What, and where is knowledge stored in the work of Penrose and Nelson and Winter?
- 2) Can Knowledge Integration set be equal to Knowledge Management when considering Penrose and Nelson and Winter as real ancestors?

In the next sub-chapter a brief account of Knowledge Integration is presented. In the consecutive chapter first the conception of knowledge and where it is held according to Penrose is described. In chapter three the main analysis is conducted for Nelson and Winter. The consecutive chapter then summarizes the main insights from the two readings and the findings are related to each other and used to answer the research questions.

Terminological Clarifications

In this chapter Knowledge Management and Knowledge Integration are described as conceptual terms and their origin is as much as possible lid up. First the term of Knowledge Integration is described, and then Knowledge Management is defined.

Knowledge Integration

Starting almost in parallel to the surge in the literature in Knowledge Management the field of Knowledge Integration emerged during the early nineties of the last century. During this time it had a very applied and business orientation in the sense that academia and corporate bodies found out that in the wake of the increasing globalisation in particular north-western nations would have work harder in order to maintain their welfare.

With this starting point in the field of Product development first endeavours were made to ameliorate for this situation. In the late the concept of Integrated Product Development was developed (Andreasen, 1997). These endeavours were then increasingly spread and by the middle of the nineties Integrated Product Development became one of the most important approaches for the field of innovation development (cp. Madhavan & Grover, 1996; Kuhrana & Rosenthal, 1998; Gerwin & Barrowman, 2002; Petruska, 2004).

Meanwhile, it became apparent too that communication in these integrated product development teams suffered similar obstacles as that in standard project teams, which made a search necessary as to why these frictions occurred. A first step to understand these frictions were developed by Clark (1996) and his concept of the *common ground*. Based on this idea Bromme (2000) added the concept of the *epistemic style* to understand the cultural and behavioural problems occurring in these integrated product teams.

In (1999) then Ganz and Hermann defined in a research paper the agenda for what has become for the author the starting of his

understanding of Knowledge Integration. According to them this activity should be understood as forming [...] *a common basis for communication, meta-knowledge must be established which helps in uniting different technical disciplines and ways of thinking and acting* (Ganz & Hermann, 1999, p. 35).

Operationalising this understanding the author (Krone, 2007) argued that Knowledge Integration should be understood as *Knowledge Integration (KI) as an activity [...] is a process in which individuals from different domains communicate information and knowledge in a way that the respective recipient, and the domain/project, can act based on the information/ knowledge obtained. It is an activity of knowledge generation. In the process of Knowledge Integration, the participants become aware of cultural differences that are result of their belonging to a dedicated domain* (Krone, 2007, p. 117).

Knowledge Management

In the field of business administration as a discipline Nonaka and Takeuchi are held as ancestors that really established this *discipline* of Knowledge Management. In their interpretation the authors referred to Knowledge Management as being a process of knowledge explication on an epistemological level and the scope of its application in an ontological level (Nonaka & Takeuchi, 1995, p. 58-59). From this starting point they suggest that knowledge appropriation on the side of an organisational as such cannot happen, because *[a]n organization cannot create knowledge without individuals* (ibid.).

Bearing this in mind, the wider discipline of Knowledge Management since this key statement – but also the field of the

resource based view of the corporation (e.g. Leonhard-Barton, 1995) have consistently taken the organisation as source and object that has knowledge. In particular this view has become predominant in the moment that organisations began to collect and attempted to structure their *knowledge* in order to allow for its quicker dissemination.

For Wilson (2002) the appropriation of Knowledge Management happened against a background of not clear distinctions between information and knowledge, and a clear cut definition of what knowledge would be. From his analysis he comes to the conclusion that since the late nineties Knowledge Management was understood as to entail on the one hand the distribution of information of information in any kind of organisations (see the focus on information sharing!) and on the other hand the way in which humans are involved in the process of dealing with either knowledge or information (see emphasis on the topic of management while according to Nonaka and Takeuchi organisation have much more borrowed knowledge that relies on individual employees).

After examining in more detail then also the academic field of knowledge management and its contributions, as what the author labels as being Knowledge Management phase one, Wilson comes to the conclusion that

[...] knowledge management [...] is, in large part, a management fad, promulgated mainly by certain consultancy companies, and the probability is that it will fade away like previous fads. It rests on two foundations: the management of information [...], and the effective management of work practices. However, these latter practices are predicated upon a Utopian idea of organizational culture in which the benefits of information

exchange are shared by all, where individuals are given autonomy in the development of their expertise, and where 'communities' within the organization can determine how that expertise will be used (Wilson, 2002).

It is against this background reading of Knowledge Management that the author is describing in the consecutive chapter the meaning and locus of knowledge in the work of Penrose and Nelson and Winter.

Revisiting the parents – A hermeneutical reading of Penrose and Nelson and Winter

In the consecutive two sections some of the theoretical assumptions as they are held within Penrose and Nelson and Winter are unveiled. With this step it is intended to check whether these authors really have set the groundwork for Knowledge Management. A "hermeneutical reading" of both of both is adopted.

The term hermeneutical reading, in the context of this article, refers to an interpretation of the source, which judges the content against the premise, and objective that the author has given for himself. The value and insights of a given piece of literature are measured against the premise and the objectives set, not against a theory that is inspiring the readers' approach to the volume¹. It is suggested that the work of either author(s) have

¹In a strict sense it is attempted to escape the problem described by Gadamer (1990) that all too often exegetic work of a given piece of literature happen from the point of view with the knowledge that the reader has. Thereby the reader is neglecting the fact that the author cannot have had the same knowledge as the reader, because of the progress of science (Gadamer, 1990).

to be read against their own premises, to understand whether, and how, this parent label can be assigned to either set of author(s).

In particular doubts are raised on the notion of "parenthood", because of the core assumptions that Penrose and Nelson and Winter hold in respect to the character of the term knowledge, the firm and the level of argumentation on which they expect to see knowledge being used. Key aspects which structure the reading of Penrose and Nelson and Winter will be a) the employed understanding of the firm, b) the understanding of knowledge, and its level of presence, c) the way in which knowledge is being presented as being of importance for the firm, and d) the ways in which both author(s) suggest that new knowledge is generated and where it is possessed.

Penrose's core argumentation in respect to information and knowledge

Penrose's firm

Penrose's view of the firm is juxtaposed with the theoretical concept of the firm as it used in (macro-)economics. The understanding of firms within macroeconomics is best described within the limits of the theory of value, which in turn examines how firms behave in the determination of [...] *prices and quantities produced of particular products in the individual firm* (Penrose, 1959, p. 11). According to Penrose, in the economic model of the firm, prices and outputs are used to establish [...] *the equilibrium output for a given product (or given group of products) from the viewpoint of the firm* (ibid.). This means that in the traditional theory of the firm in- and output are defined with the intention to find the optimal price structure under a given set of costs. *Growth of a firm is nothing more than an increase in the output of given products* (ibid.).

She suggests to understand firm as the [...] *flesh and blood organizations that businessmen call firms* (ibid. p. 13). This requires declining the validity of the economical model of the firm. Instead the term in its laymen understanding should be embraced. As result of this extended understanding of the firm, [...] *more attributes than are possessed by the firm in the theory of the firm, and the significance of these attributes is not conveniently represented by cost and revenue curves* (ibid. p. 14). For this purpose the firm is understood as an organisational form, in which economic activities happen in accordance with plans. These plans, so Penrose, define the utilisation of resources as contributions to the provisioning of services and goods to the economy in general. Behaviour of, and within, the firm, is pre-defined by plans (ibid. p. 15). Plans, as reflections of intended utilisation and contribution of resources and services from and to the market, are devised by a [...] *autonomous administrative planning unit* (ibid.). Due to the autonomous character, Penrose argues that this unit is just part of the overall *administrative framework* (ibid. p. 16) of the firm. The administrative framework is in her understanding the summary of the bureaucracy of the corporation, which entails policies, decisions rights, work distribution, and [...] *managerial and supervisory functions* (ibid. p. 17).

While she argues that this framework need not to be exhaustive, she stresses that this overall arrangement is required in order to prevent chaos when certain decisions are made. Based on this rudimentary description of administrative framework, it is possible to argue that this is sufficient close to the author's understanding of organisational structure. Therefore in the continued description of Penrose's administrative framework is

said to be synonymous with organisational structure.

This aspect is insofar important, as the argument provided by Penrose suggests that this structure is part of the resources and services available to the firm (ibid. p. 16). In her understanding the administrative planning unit is equal to *central management* (ibid.), which was referred to, based on Holmstrom and Tirole, as *neutral arbitration instance* (Holmstrom & Tirole, 1989, p. 123-4) whose decisions and rules should be obeyed to, and implemented in the firm. Apart from the organisational structure, the firm is described by the existence of [...] *productive resources the disposal of which between different uses and over time is determined by administrative decision* (Penrose, p. 24).

The resource in its character is described by its capacity to render services to the production process, which might be store able. Furthermore, and being the differentiating factor between resources and services, Penrose argues that:

[...] *resources consists of a bundle of potential services and can [...] be defined independently of their use, while services cannot be so defined, the very word service implying a function, an activity* (ibid. p. 25).

She points out that services that are inherent in a resource are brought to the fore pending on the utilisation of them. This means that the way in which a resource is used, defines the value to the firm (ibid.). This is related to the other characteristics of resources. Resources are, Penrose suggests, either tangible or human (ibid. p. 24).

Tangible resources can be quickly and completely used in the production process.

They can be the basis for further intermittent products (with service characteristics), or they wield same services over a long period of time. They could be, based on this characteristics, bought in the market, produced in the firm, sold to the market, or be produced and only of use to the firm (ibid.). Humans, irrespective of their level of proficiency and level of integration into the firm, are also potential resources. For Penrose potential obsolescence of human resources at a given point in time is irrelevant, as she considers resources in their overall capacity to deliver services (ibid. p. 24-5).

Below the aspects of knowledge and what it means in the work of Penrose, as well as the description of its importance are discussed jointly. For the author this seems useful, since Penrose discusses knowledge capabilities more as an extension to the managerial unit, than as a topic on its own right. Furthermore, and potentially even more important, Penrose is not concerned with the concept of knowledge per se. Rather, she is interested to understand how the application of resources and services rendered from these were dependent on each other. In the development of this notion also a description of the term of information, and its importance for management, is included. Such a step seems appropriate, as Penrose operationalised information and knowledge in two very different ways. Information she relates to uncertainty minimisation, while knowledge is contextualised with resources and services.

Penrose and knowledge

Penrose differentiates two kinds of knowledge. One kind is acquired during

formal education, while a second is result of individual learning processes. Former is in her description *objective knowledge*. Objective knowledge is on the one hand characterised by a level of specificity that is not too narrow, and on the other hand a sufficient large group exists that shares this objective knowledge (ibid. p. 53). While she agrees that people have different degrees of knowledge about this objective knowledge, she refused to accept that differences, which are result of communication processes, are accounted as giving rise to dedicated different sets of knowledge. The knowledge acquired by the individual learning processes, which Penrose labels as experience, is different for two reasons: first it is bound to individual's,

[...] it produces a change – frequently a subtle change – in individuals and [second, it] cannot be separated from them (ibid.).

She argues that experiences are results of actions taken. Due to this action-orientation experiences lead to an enhanced understanding of where and how objective knowledge can be employed.

Penrose suggests speaking of experiences in individuals, if they have acquired new knowledge, and if they are in a position to employ objective knowledge in different ways. These differences are in her account quite small, because all too often the making of experiences, and thus the generation of individual knowledge is dependent on the existence of objective knowledge in the field in which experiences are made.

Based on Penrose's point of view firms' administrative planning units are often subject to uncertainty about actions to be taken. Some coping strategies used to overcome these uncertainties are of rather low profile (e.g. purposeful underestimation of potential

market chances), other relate back to the rendering of services (ibid. p. 56). She defines uncertainty as a subjective feeling, which is result of two fundamental different sources.

One source is of innate nature and is reflected in the temperament. The other source is result of lack of information about a certain field of actions. Penrose argues that subjective uncertainty is a [...] *feeling that one has too little information [that] leads to a lack of confidence in the soundness of the judgments that lie behind any given plan of action* (ibid. p. 59). In this understanding information are collected as means to obtain a better view on the potential sequences of activities to be taken during the implementation of a given plan. Information are in this understanding devices hinting to factors affecting potentially the implementation of a given plan.

In this line of argumentation Penrose asserts that the acquisition of information

[...] requires an input of resources, and to evaluate information requires the services of existing management. Therefore one of the important effects of subjective uncertainty is to induce a firm to devote resources to what might be termed 'managerial research (ibid.).

The amount of information gathered varies on an individual firm basis, but Penrose argues that even after a comprehensive search firm are taking risks: but on a much more informed basis and thereby being less uncertain.

Over time the firm becomes used to this type of information gathering. In turn specified amounts, and types, of information are selected by agreed upon [...] *defined procedures* (ibid. p. 60). These procedures are satisfying the managerial groups' need for information gathering, and are used in the

decision-making. The fulfilment of the procedure in itself ensures the validity of the information (ibid.). As these gathering procedures are standardized across a given industry they give way to the emergence of consultants. To the extent that managerial research is taken over by either other resources, or the managerial unit has obtained enough experience in them, the firm can open up new paths of growth.

Therefore Penrose suggests that the growth of the firm is running in a cycle which consists of 1) the hiring and training of new managerial staff, 2) the development of expansion plans, 3) the collection of information to cope with increased uncertainty in respect to the projected growth path, 4) managerial research and 5) enactment and supervision of growth (ibid. p. 61).

Penrose suggests that *diversification* of the firm into new areas of business is not an inherent obstacle to take such an approach. Rather the management unit will spend more time with this cycle, but it will not halt growth. The growth path of an organisation can only be interrupted if no more managerial capacity is able to perform either activity from those described above (ibid.).

Where knowledge is stored

Penrose argues that experiences made by the individual, and also on the side of the managerial group, give rise to changes in the administrative organisation in order to allow for further growth of the firm. This means to her that individuals take actions to disband [...] *managerial diseconomies* (ibid. p. 55). In this perspective experiences are used allowing for new courses of actions. These can lead

to subdivision of work or decentralisation of decision-making. Penrose insists that the making of experiences of managerial diseconomies precedes the implementation of corrective measures (ibid.). As experiences are result of actions taken previously, she argues that the making, or attainment (?), of knowledge can happen already when the firm is performing its regular operations (ibid. p. 56). In this understanding [...] *the productive opportunity of a firm will change even in the absence of any change in the external circumstances or in the fundamental technological knowledge* (ibid.).

Thus, the execution of a given plan, as devised by the administrative planning unit, and its guiding managerial team, give rise to the development of further options for expansion due to won experiences by implementing a given plan. It seems not implausible to argue that Penrose suggests that the execution of a planned activity give rise to new knowledge elements. She then elaborates further on the idea of firms as planning bodies and supposes that these planning exercises are dependent on the [...] *co-operation of many individuals who have confidence in each other, and this, in general requires knowledge of each other* (ibid.). In consequence firms can not exceed a natural pace of growth when attempting avoiding inefficiencies in the firm and in the utilisation of resources and services. The experience of cooperation among current management with new staff cannot be compensated by organisational structure, even if optimal designed. Penrose describes the cooperation of new hired staff with the existent managerial group [...] *as a process creating new productive services available to the firm* (ibid. p. 48).

Due to the focus of Penrose onto growth, as being a collective planning exercise in an administrative organisation, and the dependency of managerial decision making and planning on confidence and knowledge, she argues that managerial activities are a generic service that is required in each firm. Therefore, it does not wonder that Penrose describes the managerial service as having potential to grow.

The growth that she ascribes to managerial services is tied to intermediate steps included in the managerial organisation (ibid. p. 51). In her account, much of the growth of the managerial service is entailed in delegation of authority and accompanying decentralisations measures in the corporation. These steps are taken to ensure further expansion. This means to Penrose that the growth of the managerial service is dependent on the continued development of the administrative organisation, and managerial staff that is trained in interaction with senior staff (ibid.).

In line with general decision-making models Penrose argues that the authorities of lower levels are always bound to context, and as consequence the overall decision-making authority, on a nominal level, is always centralised at the top of the firm. But even then managerial staff is facing decision-making situations in which nothing could replace the experience of making decisions as a team, which are also coherent across the organisation, and thus allow for efficient and confident execution of growth plans (ibid. p. 51-52). In due process of the integration of new staff into the organisation, and by placing them in respective decision-making positions, they learn to adapt to the firm, thereby a mutual experience-making situation is generated. Penrose suggests that the learning

process described above allows the individual, as well as the management group, to become more valuable to the firm. [...] *The services they can render are enhanced by their knowledge of their fellow workers, of the methods of the firm, and of the best way of working* (ibid. p. 52). She argues that during the phase of integration into the corporation the executives are also integrating themselves into the organisation. This allows over time that same activities are performed with less effort, and thus options for new services are rendered (ibid.). Experiences gained during the process of immersion also includes [...] *knowledge of the possibilities for action and the ways in which action can be taken by the group itself, that is by the firm* (ibid.).

Nelson and Winter's and concepts in respect to information and knowledge

The firm for Nelson and Winter

The model of the firm that is informing Nelson and Winter is [...] *motivated by profit and engaged in search for ways to improve their profits, but their actions will be assumed to be profit maximization over well-defined and exogenously given choice sets* (Nelson & Winter, 1984, p. 4). The profit maximization is taking place by weeding out firms that are not working profitable in a given market, and the profits themselves are result of the utilization of [...] *certain capabilities and decision rules* (ibid.) which any firm posses, and that have accumulated over time. For Nelson and Winter these capabilities and decision rules, are the means with which firms are attempting to keep abreast in a given market, and markets define which of these capabilities and decision rules are economic viable (ibid.).

Nelson and Winter, just as much as Penrose, decline the unrestricted validity of economics model of the firm. Furthermore, they suggest that production techniques and decision rules can be regarded as being sufficient similar to consider these as being routines. They perceive routine as an expression of [...] *all regular and predictable behavioral patterns of firms* (ibid., p. 14). In their words routines are best conceived as being the same as [...] *a persistent feature of the organism and determine its possible behavior [...]; they are heritable [...], and they are selectable in the sense that organisms with certain routines may do better than others [...]* (ibid.).

Firms deviate from each other because of stochastic deviations in their routines (ibid., p. 15). As a consequence the thread to explain these deviations becomes of interest to the field of Knowledge Management. According to Nelson and Winter the stochastic deviations are result of organisational quarrels and attempts to forge compromises, or of attempts to cope with certain courses of events within organisations under the condition of crisis (ibid.).

Knowledge and Nelson and Winter

For Nelson and Winter the premise of their analysis of knowledge is not to understand knowledge in its own right, but the assumptions held within orthodox economics about determinants of *firm's production set* (ibid., p. 60). Nelson and Winter cite the answers given by orthodox economics were that these production sets are determined by the firms knowledge to be able to change the state of certain [...] *commodities into products* (ibid.). According to Nelson and Winter the

concept of knowledge is less defined in the field of economics. They argue that if knowledge is seemingly the cornerstone of the firm, this issue is under-researched, and quit open for discussion. The understanding of knowledge that Nelson and Winter identify in economics is one in which knowledge is referred to as [...] *a way of doing something or technological knowledge* (ibid.). Ultimately, so Nelson and Winter, knowledge seems to be something that is contained in *blueprints*, or knowledge that is held by [...] *engineers and scientists* (ibid.). They argue that knowledge is associated with a notion of being shareable, because of the characteristic to be *articulable and [being] articulated* (ibid.).

In stretching the economics account of the knowledge basis of the production basis further, they question the assumption that the production basis is stable, or the costs of engaging in such processes are indefinitely high and thus unreasonable. By suggesting these kinds of answers, orthodox economics is becoming incapable to explain firm variations on the one hand, and have to take the blueprints for granted on the other (ibid., p. 61). From this starting point Nelson and Winter, become interested to learn about three basic questions, 1) where technological knowledge resides in firms, 2) what defines the boundaries of firms ability to manufacture (irrespective of service or good), and 3) how societal and firm knowledge are dependent on each other, if so at all (ibid., p. 62).

Nelson and Winter argued that corporate knowledge can not be contained in blueprints and minds of *knowledge specialist* (ibid.). Reason is that either source

[...] do not contain an exhaustive account of the methods involved in the actual exercise of a

productive capability. As a matter of fact, blueprints often are quite gross descriptions of what to do, and seldom define a detailed job breakdown, much less provide how to do it instructions at the job level (ibid.).

Based on this view Nelson and Winter suggest an account of blueprints as being indicative of jobs to be performed, while the knowledge of the transfer activities is stored somewhere else. Reason for this for split is the logical economic background that

[...] cost considerations clearly limit the extent to which organizations maintain records of their methods and activities, and the records actually maintained are much less complete than they logically might be (ibid.).

The notion that knowledge is contained in the minds of *chief engineers* is equally harsh refuted. The main reason that Nelson and Winter bring forward rest in the human incapacity to know, as an individual, all the tasks that are required to keep a manufacturing site running. In particular this is true with respect to the coordinative and relational aspects of the different elements that have to be combined in order to produce any good (ibid., p. 62-63). As a consequence Nelson and Winter suggest that

[...] the possession of technical 'knowledge' is an attribute of the firm as a whole, as an organized entity, or even to any simple aggregation of the various competencies and capabilities of all of the various individuals, equipment, and installations of the firm (ibid., p. 63).

Here they echo the system theoretical commonplace, that the whole is more than the sum of the single parts together. But there is something different in their description. It

is the fact that they are distinguishing between competencies and capabilities, which have to be activated. In this understanding, and using the analogy to Penrose, they seem to suggest that any firm has resources, but the knowledge to render services from them is setting them apart.

Where knowledge is kept

I. Skills

Nelson and Winter argue that

[..] the behavior of an organization is [..] reducible to the behaviour of the individuals who are members of that organization. Regularities of individual behaviour must therefore be expected to have consequences, if not counterparts, at the organizational level (ibid., p. 72).

In more detail they suggest that routines are equivalent to individual skills. Therefore they propose understanding organisational behaviour by observing individuals behaviour (ibid., p. 73).

In turn a skill is defined as

[..] a capability for a smooth sequence of coordinated behavior that is ordinarily effective relative to its objective, given the context in which it normally occurs (ibid.).

This means for them that human skills can be used in different occasions, and then allow for actions options. The element of choice (the action option) is for them crucial as it is suggested that behaviour is not determined. The utilisation of a skill is differentiated into different tasks that make up a dedicated skill. In short they argue that skills are rather sequences of activities that individuals follow automatically once a decision has

been made to use it (ibid.). The utilisation of a skill, and its enactment in a situation should be understood to be driven by “tacit knowledge” (cp. here Polanyi, 1966, p. 61; Schön, 1982). The element of choice in the enactment of a skill is of importance to the extent that these choices take place unconscious. Nelson and Winter argue that the

[..] the exercise of a skill typically involves no deliberation and it is constituent of the capability the skill represents (Nelson & Winter, p. 82).

Therefore the utilisation of a skill always means more the execution of the underlying behaviour components, than the skill itself. In spite of this alleged automatic character of choice, Nelson and Winter shed light to the phenomenon that often real choices are available.

These dependent on the *[..] frequency with which the unit of behavior occurs (ibid.).* They propose that modes of behaviour are selected actively when they occur less often. Describing in more detail the problem of skills, and the related element of choice in orthodox economics Nelson and Winter argue that *[..] skillful acts of selection from the available options are constituents of the main skills itself: they are choices embedded in a capability (ibid., p. 84).* It is actually very intriguing that this description of skill is quit close to the notions held within self-efficacy theory, and the process of actualisation of skills by using the underlying knowledge structures that are making up a particular skill (Bandura, 1997, p. 34).

Nelson and Winter close the description of individual skills suggesting that the utilisation of a skill always represent a

[..] tradeoff between capability and deliberate choice [..]. The advantages of skills are attained

by suppressing deliberate choice, confining behavior to well-defined channels, and reducing option selection to just another part of the programme (ibid., p. 85).

In respect to the utilisation of skills, and the underlying work structure of these, they ask keeping in mind that these are often characterised by a complexity difference between the knowledge of a skills on the individual's side, and the realisation of these activities. Therefore they argue that it is important to distinguish

[...] the scope of the capabilities possessed by an individual – namely, the distinction between 'knowing how to do X' and knowing how to get X accomplished (ibid., p. 86).

Based on this distinction they propose that the planning of an achievement can be considered as being a skill in its own right. It encompasses the knowledge about the regular boundary conditions under which a given skill regularly is be actualised, and by whom (ibid.). Nelson and Winter refer to this element of skill utilisation as *planning vocabulary*. With this assertion they point to the social embeddedness of skills. This means: They suggest that the activation of skills by others is a dependency of an individual's knowledge which skills, or activities, are required to perform an activity on their behalf (ibid., p. 87). Therefore it can be said that the utilisation of skills, either individually, or on a collective level, is a dependency of the knowledge that skills are 1) socially spread, and 2) that skills, in order to be activated from others, had to be referred to by their name (ibid.).

2. Organisational routines

From the authors perspective it is important to recognise for which set of

organisations Nelson and Winter describe organisational capabilities. Reason is, that they indicate that capabilities are bound to the fact that

[...] organizations that are involved in the production or management of economic change as their principal function [...] do not fit neatly into the routine operation mold (ibid., p. 97).

Furthermore, it has to be recognised that Nelson and Winter apply their concept of routines to *organizations that are engaged in the provision of goods and services that are visibly the same over extended periods [...] and [...] routines structure a large part of organizational functioning at any particular time* (ibid.).

Therefore, in an approximation they suggest that the routines of an organisation shape its behaviour, just as much skills shape individual behaviour (ibid., p. 96). This idea leads them to propose understanding routines as storage for organisations operational knowledge. The knowledge stored within routines is actualised by the implementation of routine. *[O]rganizations remember by doing- although there are some important qualifications and elaborations* (ibid., p. 99). Nelson and Winter suggest 1) that organisations rarely describe all their steps of routine actualisation and 2)

[...] cost considerations make 'doing' the dominant mode of information storage even in many cases where formal records could in principle be kept (ibid.).

In this respect it is not wrong if one summarises routines as organisational memory.

Given the social character of organisations, and thus also of execution of routines, Nelson and Winter ask readers' understanding that for the purpose of routine activation

it is sufficient if individuals working in a particular job know how to perform their particular part of the overall job, and continued to do so over time (ibid., p. 100).

This knowing one's job includes the [...] *ability to receive and interpret a stream of incoming messages from other members and from the environment* (ibid.). Based on these information individuals' select appropriate routines from their own job description. Thus, it can be argued that the performance of organisational routines is guided by specific routines in the contributing elements. The messages that Nelson and Winter suggest as trigger for activation of sub-routines refers back to the social constructedness of work (cp. Crabtree, 2001, pp. 11-2). In this sense, to take up an additional aspect of Nelson and Winter which can be questioned, it seems as if they interpretate the notion of *tacit* knowledge along the lines of Tsoukas (1996, 2003) and Cook and Brown (1999).

Co-workers' reactions towards triggers, are on the one hand side job-specific, and on the other

[...] abilities that usually characterize an organization member quite apart from his role in the organization – that is, they are sorts of things a new member typically brings to the organization (ibid., p. 101).

Accordingly it can be said that Nelson and Winter point out the distinction between necessary and ample capabilities. Based on this premise it does not wonder them arguing that employees in the organisation have to be able to interpretate the incoming message as a trigger for an activity (ibid. p. 102). This interpretation has to include for them an understanding of the overall societal language spoken as well as the capability to have [...]

command of the organizational dialect (ibid.; cp. Krone, 2009) Taking a wider perspective, the capability to take action based on incoming messages is the equivalent to the arousal of a cycle of information processing activities, which lead to the execution of a capability (or routine) as a coordinated activity (Nelson & Winter, p. 103). This coordinative character of routines can only be achieved if the contributors to a routine are knowledgeable about their role to play. Therefore Nelson and Winter suggest that if routines work as a coordinative activity, routines rest on the smooth interaction of [...] *skills, organization, and 'technology'* [...] (ibid., p. 104).

From this point they suggest that [...] *the knowledge an organization possesses is reducible to the knowledge of its individuals members* (ibid.). However, the information that humans have stored about processes and how to react towards information in a given set of activities

[...] is meaningful and effective only in some context, and for knowledge exercised in an organizational role that context is an organizational context (ibid., p. 105).

Employees' knowledge and skills, as far as they relate to the work sphere, are bound in their effectiveness to the interpretative capabilities of their peers' as to what their input is in the realisation of a given routine. Knowledge of an organisation, or as Nelson and Winter say, *organizational memory* is result of

[...] shared experiences in the past, experiences that have established the extremely detailed and specific communication system that underlies routine performance (ibid.).

The generation of knowledge

Given the author's understanding of the argumentation provided by Nelson and Winter, different forms of knowledge generation in the organisation exist. They all relate, and this needs to be stressed, to changes in the organisational routines. Therefore one could argue that knowledge generation is happening based on, and within, the exercise of routines.

1. Mutation

Acknowledging Nelson and Winter's argument that routines contain an element of control, which is performed by several actors in the organisation, e.g.

personnel department and by trainers, supervisors, and co-workers, or, for non-human inputs, by engineers or production workers (ibid., p. 109-115, here 115)

one still needs to consider those elements in the execution of routines that lead to the occurrence of deviations in the routine. These deviations can be triggered by the loss of key staff that might have been the sole storage of a particular set of information for the execution of a routine sub-task (ibid., p. 115). In due process to fill this gap in the routine, the different participants in the overall routine will re-assemble the routine based on their knowledge and information about the tasks at the empty place, by doing so the overall routine will "mutate" (ibid., p. 116). Another reason for changes in the routine can be result of purposeful redesign of the routine, based upon an agreed *change routine*. While these change routines can be an organisational *programme*, Nelson and Winter strongly argue that these can originate in individual steps taken by a single part. This,

on a whole, could result in overall ineffectiveness's. In turn, and extrapolated from the argumentation of routine change caused by key employee losses to the organisation, Nelson and Winter argue that often the control mechanism enshrined in the existent routine are so strong that [...] *organizations tend to resist mutations, even ones that present themselves as desirable innovations (ibid.)*.

2. Replication

It has to be kept in mind that Nelson and Winter bring forward a critique on the orthodoxies of economics, and the assumptions held within it as far as the processes in the individual firm are considered. In particular they argue that the notion of identical replication has it cracks empirically (ibid., p. 117-118). The transfer of a routine can be considered as device that helps organisations to perform similar routines in different spatial settings, because they have established the routine in question once (ibid., p.119) according to Nelson and Winter. Based on this premise they suggest that routines are used in the future as a template for new sites, if these routines are set-up for a) either manufacturing purposes, or b) the execution of services that are already in the organisational portfolio (ibid., p. 119-120). Based on the template characteristics of the existent routine, and its underlying control mechanism, in the process of transfer, mutated routines will be set-up. Reason being that the organisation will have to fill gaps in knowledge based on the decline of incumbent employees

[...] exercising complex skills with large tacit components, [...]. Others may have skills of lesser complexity and tacitness, but be very poor at teaching those skills to someone else – doing and teaching are, [...], different (ibid., p. 121).

Another set of reasons that they establish as causes for mutations is the unwillingness to share knowledge about the true character of work. Here again an aspect can be re-observed: It is the problem that Hinds and Pfeffer referred to when describing the problems of knowledge from professionals to new comers in any given field (Hinds & Pfeffer, 2003, pp. 4-26, in particular, pp. 4-10 and 17-21). Also Nelson and Winter consider the social embeddedness of routines as an explanation for the occurrence of mutations.

It should have become apparent by now, that for Nelson and Winter knowledge is contained in the routines of the organisation, and humans who are executing the routines. As the understanding of inputs is dependent on rather general available skills (speaking the same native language, understanding hand-signs etc.), it seems to be possible to distinguish between four knowledge sets.

The first knowledge set consists of the individual capacity to develop, train and execute skills and their contributing sub-skills. The knowledge to understand a native language and to know when which general behaviour is expected in society is a second distinctive set. Understanding the language of the organisation, and being able to activate individually skills that are fitting the input of the routine is the third and last individual knowledge set. Individual knowledge can thus be so specific that it is not useable in other contexts than that of the organisation in which they are employed. The capability to assemble all the individuals' contribution into the routine, and coordinate these so that they lead to a final product in a monitored (controlled) way is the knowledge that

Nelson and Winter ascribe to the organisation. One could argue that the existence of corporate routines is a symbiotic relationship between the individuals' skills and the organisational processes to achieve the production of a given product.

3. Searches

According to Nelson and Winter the generation of innovations is not far away from the execution of routines. In their opinion the generation of innovations is characterised by uncertainties (ibid., p. 128). Nelson and Winter suggest distinguishing two kinds of uncertainties. One of them refers to the outcome that can be achieved as results of the innovation process itself, and the other is describing the changes induced by implementing the innovation in the existing organisational routines (ibid., p. 129).

For Nelson and Winter innovations are active searched for in the process of routines. Innovations may well take their origin from routines employed in an organisation. This means:

Problem solving efforts that are initiated with the existing routines [it has to be remembered that they suggested a hierarchy of routines which control each other] as a target may lead to innovation instead (ibid., p. 130).

This argument suggests that the generation of innovations is part of a higher-level routine existing in an organisation. Its execution is triggered by anomalies in lower-level routines, but the function of the higher-level routine in itself follows routine characteristics (ibid., pp. 129-130, pp. 132-134). Based on this routine like character of the search for innovation, and the fact that the innovation

might contain elements of the current operational routine, they propose that existent routines can become part of innovations. This integration of existing routines into innovations happens as these are known in terms of their necessary input and their potential outcomes. Routines are process elements that are sufficient robust and functioning and can hence be re-employed. Furthermore Nelson and Winter suggest that the innovation in itself is described on its substance in more precise terms than *blueprints* or individual skills (ibid., p. 130).

Searches for innovations are limited in terms of scope (ibid., p. 247-248). In elaborating this argument, Nelson and Winter propose that the search is described by *topologies*. Topologies they define as fields of knowledge within which innovations are sought. This means that with the knowledge on some of the characteristics of a technology, research staff can define and delimit its search for alternatives. By knowing certain characteristics, staff can define areas in which a given new technology can be used within the organisation. Therefore the [...] *technological dimensions, such as size, chemical composition, or thermodynamic cycle employed* (ibid., p. 248) define boundaries within which the search for utilisation within the organisation happens. By pursuing these topographical confined searches, organisations' knowledge sets will change. These changes occur in the area of the technological dimensions of the technology at hand, and/or

[...] *there will be certain previously undiscovered or uninvited technologies that become known and certain previously undeveloped technologies that have been developed sufficiently to permit their implementation* (ibid., p. 249).

Summarising Nelson and Winter on knowledge

From the author's point view Nelson and Winter describe a process of knowledge generation that rests on the understanding of knowledge as the tripartite hierarchy of data-information-knowledge. Having said this, and considering the distinction of skills and routines, it does not become quite clear how this appropriation of Nelson and Winter for the purpose of Knowledge Management can have happened.

Of course it can be argued that the description of routines, as being expression of (organisational?) knowledge, allows for that appropriation. But the questions to be asked then are a) if corporate Knowledge Management is about the appropriation of external knowledge into the organisation, which role do individuals play, and 2) what is it that knowledge is about?

Answering latter question first, it seems useful to understand knowledge in the definition of Nelson and Winter as being the capability to perform certain actions based on given external, or internal, information to achieve a certain aim. The capabilities employed to achieve a given aim, are activated at least partially subconscious. Some of the capabilities are owned by individuals'. These routines are bound in their utilisation to social settings that provide a meaningful frame for the utilisation of these. Knowledge is also the possession of *objective knowledge* about nature or societal phenomena.

Conclusions - Knowledge Management and Knowledge Integration

To answer the question about individuals' role in the appropriation of external

knowledge into the organisation conveys, in the author's point of view, an oxymoron: Knowledge Management. It should have become apparent, based on the above description of the main ideas of Penrose and Nelson and Winter, as far as they related to Knowledge Management, that there is a contradiction in terms. Penrose, as well as Nelson and Winter show that knowledge in the first instance is available, and used, on an individual level. When taking a hermeneutical reading of both set(s) of authors, it becomes apparent that in either case knowledge is not a central object of their analysis. Furthermore, and even more important, both suggest that knowledge is a device for the realisation of other things. To bring Nelson and Winter under the heading of Penrose, it could be argued that both are concerned with the capability how knowledge can be employed to generate further services.

This line of argumentation rests on the insight, that Nelson and Winter, as well as Penrose very strongly approach knowledge based on an individual basis. This means, just as described in the definition of Knowledge Integration, that both conceive knowledge as being in the first instance a property of an individual. Furthermore, and this is the main aspect for the incongruity argument, Knowledge Management, as suggested by for example Nonaka and Takeuchi (Nonaka & Takeuchi, 1995), rests on the assumption that knowledge, once brought to the organisational level, is immediately accessible for taking actions. Meaning differences are considered as problematic only to the extent that they are to be solved by the utilisation of metaphors, myth etc.

In addition, it is thought that technical means are sufficient to allow, in the example of Nonaka and Takeuchi to provide options, for the generation of innovations. Pfeffer and Sutton (2000), in their account of the *knowing – doing* gap, take issue with the very consequence that often corporations have used Knowledge Management in the explicit/tacit understanding

[...] to build stock[s] of knowledge [and information], acquiring or developing intellectual property (note the use of the term property) under the presumption that knowledge, once possessed, will be used appropriately and efficiently (Pfeffer & Sutton, 2000, p. 16).

The hermeneutical reading of Penrose and Nelson and Winter suggests a very different picture. In the first instance it becomes apparent that the social embeddedness of knowledge is recognised, and that seldom two people share exactly the same sets of knowledge.

Looking in more detail into the argumentation that Penrose provides, a compelling argument can be made. She suggests that the service character of management of the organisation is dependent on the availability of shared knowledge about each, and what each other in the unit knows. When taking this aspect onto a more abstract level, the incongruence of the discussion of Knowledge Integration and Knowledge Management is becoming most apparent. Penrose suggests that not all partners in the managerial unit have the same knowledge, and this can be due to differences in understanding of a collectively available set of knowledge. Because of this, the managerial group has to become known to each other.

Knowledge Integration as a research fields suggests, as one of its core premises, that no people from different fields share the same understanding of information, nor even share knowledge sets. This is due to the character of knowledge in its tripartite understanding. When people engage in the process of product development, the knowledge possessed by one is information for somebody else. The argument that can now be provided is:

I. **Knowledge Integration**, as being the process of generation of discipline independent knowledge, changes the knowledge of a particular participant in the project, which is information for others into a shared set of knowledge. In due process of the integration process a new meaning to the knowledge elements is generated on a collective level. Setting this idea equal to the terminology of Penrose, it can be said that the activity of Knowledge Integration, by its collective character, is the rendering of a new service based upon *shared information*, due to the fact that a set of information is potentially only for one participant knowledge.

II. **Knowledge Management**, however, seems not to appreciate the fact that it employs a term of knowledge that is neither describing what knowledge is on a substance level, nor does it seem to be willing to recognise that differences in the available knowledge on an individual level exist.

It seems as if proponents of Knowledge Management work on the assumption from Penrose that there is a set of objective knowledge that is available to all. That this picture is wrong can be seen based on the fact that other means are looked for that allow for

knowledge sharing. Knowledge Sharing, in its own right is as well short in explanatory power up to now, as it has rarely taken into consideration the issue of knowledge differences based on socialisation. There are some exemptions to this general statement, but in broad terms much more has been written about the motivational difficulties attached to knowledge sharing.

Authors taking up this problem of information understanding, understood as conversion of information into knowledge, are usually arguing also, and interestingly, much more based on information. This holds in particular true for the works of Lichtenstein & Hunter (2005) and Markus (2001). In addition it seems as if authors that are arguing in the field of Knowledge Sharing employ the Data-Information-Knowledge hierarchy. Therefore, to conclude, it seems as if knowledge is better understood as having a process character. The discussion on the aggregate modes of knowledge (tacit vs. explicit according to Nonaka and Takeuchi, 1995), in the author's view, prevents to see the real substance that is at stake.

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