DOMAIN KNOWLEDGE AS A BARRIER FOR INNOVATION

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This article describes the problem that domain knowledge on the one side is prerequisite to innovation, but on the other side can hinder breakthrough thinking, because the "vocabulary" of solutions is constrained by experiences of the past. The problem is illustrated with a case from business development. As a framework for attacking the problem a model is suggested, "The four C's of innovation", lining out the spheres of Context, Culture, Capabilities & Consciousness. Strategies for coping with the problem are proposed within each of the four C's. These strategies call for a balancing act; building on the core competencies of the company and at the same time disrupting this domain knowledge in order to open up for new thinking.

1. INTRODUCTION

The title of this paper partly is meant as a provocation; in order to analyze a problem and to search for possible solutions you of course need knowledge from the field you work within. However, there are indications of that domain knowledge tends to narrow down the chances for gaining profound new insights:

• Thomas Kuhn in his famous "The structure of scientific revolutions" (Kuhn, 1962) notes that fundamentally new insights are being achieved either by very young researchers, who have not been shaped as completely by the existing paradigm as older researchers, or by researchers entering the field from other disciplines.

• On a more concrete level, the estimated design and innovation consultancy IDEO have summed up their experiences from practicing the discipline of brainstorming (Kelley, 2001), and one of the things they advice against is only to invite people with expert knowledge to a brainstorm; this is regarded as a killer of idea generation.

These two examples illustrate that "breakthrough" thinking can be limited by a too strong dominance of domain knowledge. This takes me to the following problem statement:

1.   Domain knowledge is pre-requisite to innovation, since it's the source for understanding the mechanisms of the problems you are dealing with and also provides you with a "vocabulary" of optional solutions that previously have worked or failed

2.   On the other side, domain knowledge limits your ability to achieve profoundly new insights and solutions, since your "vocabulary" is bound to experiences of the past and may hinder interception of solutions contradicting these experiences – as for instance new solutions made possible by the introduction of new technologies, new market players etc.

In the following, I shall illustrate this problem by a business development case story, which I have experienced myself.

2. CASE STORY:
ERICSSON HOME COMMUNICATION CONCEPT (HCC)

2.1 The starting point

The case unfolds within Ericsson from 1997 to 2001. A new department for Business Development was formed at Ericsson Denmark, in which I was employed on a part-time basis. In 1997, Ericsson was facing the convergence of three industries made possible by the breakthrough of Internet technologies; namely the computer industry, the telecommunications industry and the media industry. The new Business Development team analyzed the consequences of this convergence in search of new business opportunities.

2.2 The development of the HCC

The team was extremely inspired by a new device, a so-called "web-phone" combining an ordinary telephone and an Internet computer, because it seemed to materialize the convergence of the industries perfectly. Consequently, the team described a package of electronic services to private households that could be delivered via this new type of device – services like local news and weather forecast, traffic news, shopping etc. Furthermore, the technological requirements for realizing this service concept were described, following the value chain from the content being packaged into bits and bytes over distribution via the infrastructure to termination into a residential client-server gateway system. Ericsson here had an advantage of being one of the only companies dealing with almost the entire value chain, excluding the content.

To this point on the idea, which was to be known as the Home Communication Concept (HCC), was new only in the sense that it linked together a lot of business units within Ericsson, which normally would work separately on each their businesses; e.g. the infrastructure unit was separated from the unit making the terminals (devices), the unit for fixed networks was separated from the unit for mobile networks etc.

However, the Business Development team also designed a new business model for the HCC – a model inspired by the franchise model used by McDonalds.

Historically, Ericsson would sell equipment to the telecom operators, who on their turn would design and sell their services to the end users. The new idea was that Ericsson should provide the HCC as a turn-key service concept, which the telecom operators should take to the market "as is", paying a license fee to Ericsson. This would require that all the different business units of Ericsson should collaborate to pool together their components into one complete solution. Furthermore, it would require Ericsson to make partnerships with the media industry to deliver the content for the services, and this content brokering would be a new area for Ericsson.

For the CeBIT fair in March 1999, a simple demo version of the concept was developed and very positively received by the public. However, it was hard to find an internal sponsor who would take the concept further. Not surprisingly, the requirements for cross-organizational collaboration between business units caused problems. However, the biggest challenge in finding an internal sponsor was the idea of the new business model; the franchise model was alien to the telecom industry, and most top managers sat with an empty, open-mouth expression after being presented to this idea – as if they had momentarily been transplanted to another planet.

As a result of these challenges, the HCC ran into a dead end. The relief came from outside; Electrolux had contacted Ericsson to pursue the invention of the ScreenFridge™, a refrigerator with an Internet computer built-in the door of the fridge, operated via a touch-screen. Electrolux had been in contact with an Innovation Manager of Ericsson, and he saw a link between the device from Electrolux and the HCC service concept. Hence, Ericsson and Electrolux established a new joint-venture company called "E2 Home", announced October 1999. The new company was based in Stockholm and staffed both with employees from the owners and with people from outside. E2 Home should develop the concept and the technologies further and finally market a complete solution to telecom operators, based on the franchise business model. As a first step, a field trial was conducted with 50 families in Copenhagen from autumn 2000 to spring 2001. At that time the so-called IT bubble burst and Ericsson was in deep trouble; during the following years, Ericsson was downsized dramatically. E2 Home was closed down and the idea of combining the ScreenFridge™ and the HCC was not pursued beyond the field trial.

2.2 Summing up the case

In reflection, apart from the obvious obstacles to the HCC due to its cross-organizational nature, the biggest challenge in trying to sell the idea of the HCC internally was the attempt to adopt a new business model within Ericsson; the shift from selling equipment to selling a turn-key service concept using a franchise model. This idea contradicted the top managers' understanding of how Ericsson's industry was working; their historical domain knowledge constrained them from seeing totally new business opportunities in the context of the converged industries. Only the meeting with a company from a more end-user oriented industry, namely Electrolux producing household appliances, opened a door for pursuing the new path; and this was made possible via the establishment of a new and separate company, which could define its business from scratch.

3. THEORETICAL UNDERSTANDING OF THE PROBLEM

3.1 Two sources of innovation

In Thomas S. Kuhn's theory of scientific paradigms, a paradigm represents a given interpretation of how scientific problems are to be defined and examined. Kuhn notes that scientists, in the periods of normal "puzzle solving", are not aware of the presumptions, on which their paradigm is based. Only in the periods of scientific crisis, these fundamental assumptions are subject of discussion. The crises and their flashes of consciousness then are the source of fundamentally new insights, following Kuhn.

In a whitepaper called "Sustainable Innovation and the 'Learning Drive'" Mark W. McElroy describes a similar understanding of innovation (McElroy, 2004). He describes how innovation involves a widespread deployment of validated new knowledge into social practice. This deployment process follows a path from ideas born in the minds of individuals to formation of self-organized communities, in which the ideas are discussed and validated, and further to adoption within the organization as a whole. The process happens very much like the formation of paradigms within science; different ideas are discussed and "tested" within self-organizing communities, and at a higher level these communities (like "schools of thought") compete against one another in the context of the organization. McElroy himself compares his description with Kuhn's theory of scientific paradigms and concludes full compliance.

I think this understanding of innovation as social processes is unavoidable. However, I would suggest elaborating the understanding by applying Henry Mintzberg's theories of corporate strategy. In his book, "The rise and fall of strategic planning" (Mintzberg, 1994), Mintzberg describes strategies as overall patterns of corporate behaviour. He defines three sources of strategy:

•   Intended strategies, which are plans formulated ahead of time (some of which are never realized)

•   Deliberate strategies, which are intended strategies realized in use of formal control systems

•   Emerging strategies, which are formed (not formulated) "en route", as adoption to the real world.

Together, these sources result in the realized strategy. I find that Mintzberg's understanding of strategy formation could as well describe the innovation process; to some extent it is a planned process, and to a large extend it is a self-organizing social process, of which nobody is in charge. See figure 1, adopted from Mintzberg, showing realized innovation as a result of planned innovation and emerging innovation.
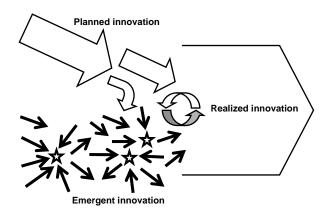
Figure 1 – The realized innovation process as a synthesis of both a planned management process, dominated by established mental models, and an emerging social process, in which many different mental models or "schools of thought" compete with one another.
(Adopted from Mintzberg, 1994)

In science, the "thought competition" results in new paradigms. In organizations, I prefer the term "mental models"; such represent the general understanding of the industry and the market, which guide managers and employees in their decision making. (For a detailed description of the nature of mental models, see Foster & Kaplan, 2001). I would claim that what paradigms do to science, mental models do to corporate management; they form a "map" from which the world is interpreted and directions are pointed out. The map is developed exactly to be able to better understand the world; but once established, it fixes the vision into only what makes sense according to the map, and hence the map not only guides, it also makes mental blinkers.
In the emergent innovation described above (see figure 1), you'll find several mental models competing like "schools of thought", whereas the planned innovation is dominated by the established models or cognitive maps.

3.2 Summing up the theory

To sum up this part, innovation is seen as a synthesis of both a planned management process, dominated by the established mental models, and social processes, in which self-organizing communities seize ideas from individual employees, test these ideas and advocate them in an ongoing "thought competition" within the organization. At some management level in the organization, only ideas that correspond to the established mental models are accepted for further action – in other words, a "filtering" takes place. The established mental models are based on the historical domain knowledge, and therefore the vision of the organization is, so to speak, locked by the past.
The question then is, what to do about it – how can we unlock the vision of the organization for fundamentally new ways of thinking? –In the next part, I have listed

up some proposed answers to the problem, admitting that I have not found any "golden key" to unlocking breakthrough thinking.

4. HOW TO COPE WITH THE PROBLEM

4.1 A model of innovation

I would like to begin by describing an innovation model, which could serve as a framework for the discussion.

I call the model the "four C's of innovation" (in recognition of Mel Rhodes' well-known model "the four P's of creativity" – [Rhodes, 1961]). It lines out four spheres of the innovation interactions:

- First, all innovation takes place in a societal **Context**, e.g. the market with its turbulence of customer needs, competitors, technological development, politics, laws and regulations etc. In this sphere, you find many different "schools of thought" both regarding business models and competing technologies, expressed within other companies, within universities, research labs and within the public in general.

- Second, integrated in the societal Context, the organizational life unfolds within self-organizing patterns of behaviour, here called the **Culture**. It is in this sphere you find the many competing "schools of thought" within the corporation. It's the sphere of emergent innovation.

- Third, a more formal structure is expressed in terms of management systems, processes, competences etc., or the overall **Capabilities** of the corporation. It is in this sphere that the official choices between the many ideas and concepts are made and articulated into strategies and plans, based on the established mental models of the organization. In other words, it's the home of planned innovation.

- And finally, there is a possibility for the organization to learn and reflect, to identify the mental models at stake in both the emergent and the planned innovation, and to experiment with alternative ways of seeing the business. I would call such activity **Conscious** learning and leadership of innovation. This sphere represents a "meta-layer" compared to both emergent and planned innovation; it is a separate part of the management or leadership activity.

In the framework of this model, shown in figure 2, I shall now propose actions for coping with the problem of domain knowledge as a barrier for innovation, addressing each of the four C's.
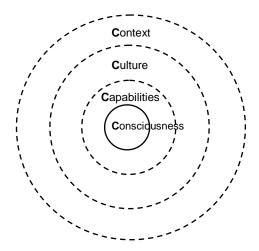
Figure 2 – The "4 C's of innovation", lining out 4 spheres of interactions. The Context is society in general. The organisational Culture consists of self-organizing social processes, in which different "schools of thought" compete. The Capabilities are structures, management systems, competencies etc. Consciousness is a meta-layer of learning and leadership.

4.2 Strategies for coping with the problem

The starting point for such activities is an investment of **Consciousness**: Since domain knowledge forms your mental models or cognitive maps invisibly, any attempt to unlock the constraints of these maps requires Conscious innovation leadership, by which the "invisible" mental models are made visible – "you can't tame, what you can't name".

The **Context** sphere is an infinite resource of knowledge and new ideas. These ideas can be accessed via a dialogue with representatives from universities or from other fields of knowledge such as other industries – remember the HCC case, where the opening for sponsoring the development project emerged through the dialogue with Electrolux, representing quite another industry than Ericsson. A further approach is to "search for the periphery of your industry" (Foster & Kaplan, 2001), i.e. to find these small upstart companies that are developing new kinds of services or products. If what they are working on makes no sense for your company, they might be a good dialogue partner; your industrial domain knowledge includes an understanding of what makes sense, business wise, and what does not. Exactly the projects that don't make sense, seen from the industry's traditional point-of-view, might include future concepts which, in the right hands, are able to disrupt the industry. (Christensen, 2000).

The **Culture** zone is a melting pot for new thinking. The organization's internal "thought competition" addresses technologies, market understanding, business models etc. In general, there is only one official company viewpoint on each of these matters; the alternative "schools of thought" have the latent nature of "skunk

works", and to fully utilize them, they should be encouraged to come to the surface.
At Novo Nordisk, we have for instance set up "innovation days", for which we request employees to propose their many skunk work ideas to be elaborated in group workshops during the day and eventually be subject for further exploration.
Where this approach aims at utilizing the resources already at hand in the Culture sphere, you can also try to force new Culture interactions to take place. One way could be to force people out of the "comfort zone"; domain knowledge represents exactly the comfort zone of the organization, and it is not likely to achieve new breakthrough thinking if you only stay within this safe cubicle. The comfort zone can be disrupted in many ways; as described in the part 3, Thomas Kuhn sees scientific crisis as the source of profound new scientific insights. Similar, you often see the call for a 'burning platform' in literature on change management, and you can of course try to establish such by describing the consequences, if your company does not move beyond the current (industrial) standards.

The **Capabilities** of the organization certainly can be worked upon. Given the nature of the problem of domain knowledge, the general way to cope with it is to extend the "vocabulary" of optional solutions by deliberately searching for alternatives. This is exactly the purpose of the many techniques for enhancing divergent thinking which are described in the literature on Creative Problem Solving. Likewise, you find the term *pattern-breaking tools* (Tanner, 1997), including methods like "lateral thinking" techniques. My own job as an Innovation Manager to a large degree is to train people in applying such techniques. In fact, we have a team of internal facilitators who deploy these techniques in the everyday problem solving.
There are also many tools and models within strategic innovation and business development aiming at identifying new opportunities. ("Blue Ocean Strategy" [Kim, W. & Mauborgne, R., 2005] is one recent example).
Another way to strengthen Capabilities would be to secure the diversity of a team working on a given problem, both regarding professional and personal diversity:
•   Invite professions outside the natural range – it might be anthropologists, philosophers, artists, experts in nanotechnology or artificial intelligence etc. (and yes, you may search outside the company!)
•   Ensure that you have persons good at divergent thinking in the group (the opposite, persons good at convergent thinking, usually always are present, being not as scarce as the divergent thinkers). Use methods like HBDI, MIND Design, or KAI to ensure a fruitful diversity of thinking styles at the team.

If we again turn to the starting point, the **Consciousness** sphere, this represents a "meta-layer" as compared to the other zones. To initiate, plan and drive the activities proposed above in itself would be an act of conscious innovation leadership. By setting the stage for such activities, top management can ensure that there are always alternative ways of thinking available in the organization – as they are in society. And new "schools of thought" can be encouraged as they emerge.
Last not least, management should provide bold and visionary challenges for the organization to deal with. Prof. Richard Leifer et al calls it "articulating the holy grails", like "if we could only…" (Leifer et al, 2000). The invention of Kevlar® fibres followed such management vision of a "superfiber with the heat resistance of

asbestos and the stiffness of glass" (Tanner, 1997). These kind of visionary challenges have a strong motivational impact on innovation teams.

5. CONCLUSION

The realized innovation process can be seen as a synthesis of both a planned management process and an emerging social process, a "thought competition" in which self-organizing communities seize ideas from individual employees, test these and advocate them in an ongoing "thought competition" within the organization. The "thought competition" brings forward new mental models or cognitive maps, from which the world can be interpreted and directions pointed out. The established mental models used in the planned innovation process are based on the historical domain knowledge, and therefore the vision of the organization is, so to speak, locked by the past.

The suggested strategies for coping with this problem all attempt to stretch the latitude of the dominant cognitive maps to open up for breakthrough thinking.

These strategies call for a delicate balancing act; at the one side recognizing and building on the 'core competencies' of the organization – i.e. the domain knowledge – and on the other side trying to disrupt and disregard the same knowledge to a degree that experiences of the past will not hinder the breakthrough of fundamentally new and different ideas. The key is to encourage and utilize the internal "thought competition" so that the organization will not blindly follow the tracks of the past.

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