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MILITARY EDUCATION IN
HE AGE OF THE BOLOGNA PROCESS

Introduction

In the midst of this turbulent, even chaotic, global environment, the educational challenges to be met are increasing at an accelerating pace. At the same time, our military educational systems are changing on a continuous basis. But how systematic are these changes and what kind of role are individual teachers playing in them?

How then it is possible to manage under these severe challenges? For a start we need to ask the "fundamental questions" more than "secondary ones". Some of these fundamental questions are as follows:

- What is and should be the intended outcome of our military education?
- Who are and should be the objects (active versus passive student) of our schooling?
- How can we guide our decentralized school system in practice?

Presently in Europe the so called Bologna process is occurring. The loved child has many names but the name of the educational process can be linked to the joint declaration of the European Ministers of Education, convened in Bologna, Italy, in 1999. Maybe the process gives us some answers for how to handle questions mentioned above. [1]

Even at the Age of the Bologna process, it is vital to remember our global area of operations. When focusing on systems national, even continental, borders are too narrow for us. It is emphasized that our educational systems need to continuously adapt to changing needs and advances in scientific knowledge[2]. Therefore, we really need actively researching teachers to lead the way and students to follow, finding their way across the stormy waters and conceptual mess. Consequently, we need holistic thinking on a global scale when developing our military educational systems for the future.

The teachers are either going to transform the educational system or not. For the demanding journey they need some guidance, some shared principles (e.g. pedagogi-

cal), and they should be aware of some *key dimensions* to be successfully dealt with on a daily basis.

If then the teachers are going to transform the educational system how are they going to do it? In brief, by researching and actively seeking for better *understanding* of the world and by improving their *action competence*.

The world is changing but how about the development of ourselves?

Traditionally, a good soldier has been understood as an individual actor on a battlefield. For him, just *knowing how* to win and survive has been the only relevant goal. Hence, the need for theories (*know-that*) has always been rather difficult to explain and to understand.

The officers' education has focused strongly on *individuality*, and *social communities* have been a peripheral issue. Generations of officers have been encouraged to compete among themselves and the best will survive to be nominated as the highest commander. No need for real cooperation and for some kind of community has been seen. And there is no need for lifelong learning because passed exams on courses is all that is expected and wanted.

Often it seems that we as teachers do know all that an officer student needs to know also in the future. Consequently, the main emphasis has been on a *transmission* kind of education – information packages are sent to students for use in future situations. Presently, because of our basic assumptions, we are collectively interested in the promise of distance learning and its effectiveness in the transmission process.

If and when a military educational system needs to be transformed, no pedagogical research is needed. All what is needed is educational "transformation" executed in a centralized top-down manner. A soldier (each person serving in the military organization) is seen just obeying orders made by others than teachers. What about then the decentralized practice of our teachers in lecture rooms and practice areas – must we just forget it while "transforming" our education?

Here it is emphasized that these and many more of our basic assumptions are indeed flawed and need to be at least reconsidered if we are going to achieve an effective educational transformation.

Some key dimensions of our military educational systems for the future

No doubt (military) schools, colleges and universities are changing, but how are they fundamentally developing[3]? Around the globe, individual practitioner-teachers are still giving

lectures to "passive" students whose dominant motive for schooling seems to be simply getting grades and passing tests. The (military) educational system seems to be close to failure; seldom does *a systematic* success of school reforms come to the fore.

If then educational "transformations" executed in a top-down manner are not the final answer to our challenges, how do we need to face these situations? How can we guide our decentralized school system in practice? In order to understand how it could be possible, we have to figure out some *key dimensions to be balanced* in daily actions and activities.

These key dimensions are as follows:

- **theory and practice**
i. We do know more than we can tell (knowing how) but we also need some theory (knowing that) in order to improve our competence and performance in all levels of our social systems. On the other hand, we are living in the midst of information overflow, and are having major difficulties to make sense of it. In a way, socially we *do know more than ever but understand less.* When we have a clear purpose in mind (e.g. to solve a practical problem or more holistically learning to cope with the environment) we should globally seek more knowledge[4] actually socially navigating[5]/following cognitive trails while learning the landscape[6].
ii. When choosing theories to be put into practice we need some shared criteria for that[7] or how otherwise can we justify our theoretical choices?
iii. Information is not *the* resource but knowledge could be seen as such. Via, e.g., the Internet we could get plenty of information and it is our task to make knowledge out of it. It could be argued that not just knowledge but actually *knowing* is *the* resource of our age. Having said this it is interesting to remember the basic hierarchy between data, information, knowledge, and *wisdom.* Maybe in the future we will not lump higher order concepts such as (practical) wisdom into knowledge?[8]

- **old and new**
i. Previous generations have not solved our problems and we cannot solve our students' problems on their behalf. Human civilization has come to what it is mostly by its capability to socialise (i.e. teach) to younger generations in a systematic manner what is already known[9]. When the complexity of our social reality keeps increasing we have to concentrate on problem solving capabilities and ways to create new solutions to our problems also in our military organizations. *Hence, in the future we need progressively inquiring students and officers.*[10]
ii. We are used to developing solutions on a continuous basis, but the reasons behind these solutions need to be made more visible and justifiable. The reason to act in a traditional way cannot be only "because we are used to doing so". *Therefore, understanding understanding comes to the fore*

- **individual and community**
i. The individualistic competition of the students should be balanced by an emphasis on social cooperation, simply because our individual success is directly linked to the health and vitality of the entire network[11]. It is vital to recognize that the jobs will get done more effectively by several kinds of communities and not just by individual officers. Presently the community aspect has been gaining some ground among us partly because the increasing interest in communities of practice[12] (i.e. communities of experts). It needs to be emphasized that also these constellations

could be partly consciously extended and enabled. By communities a school could extend its networks to be effectively used in educational practices.

ii.   The need for active and responsible agents who can effectively collaborate in our community is increasing all the time. In our societies arguments favouring *innovation* are getting louder and louder. It should be remembered that active agents collaborating globally in communities make often such innovations[13] and so the pivotal question for all of us is *how to enable creativity ("innovativeness") and reasonable risk taking to flourish. Is it possible to be a soldier serving in the Armed Forces and acting as an ethical "entrepreneur"?*

iii.   In a learning organization individuals learn, and they do learn quite often in several kinds of communities. Collectively they could create/build knowledge[14] (e.g. conceptual artefacts or knowledge assets). Organizational level features are also very important for the learning organization[15]. *Also for military organizations Transeuropean knowledge building and creation activities are not unique, although they are in a need of expansion.*

- **local and global**
i.   We are acting in locally situated contexts (cf. context dependency of the military pedagogy), causing intended and unintended consequences to emerge. We tend to be unaware of these and hence there is the need to reflect on these invisible issues while making them as visible as possible.

ii.   There is the necessity to be globally aware when trying to holistically understand our operating environment. Also for us as ethical decision makers, the global level is the most urgently needed because ultimately self-interests should be negotiated on a global level[16].

iii.   We should be aware of countless different kinds of perspectives to look into our current reality. Indeed many of these are useful for us when we try to make sense of *the systemic levels of our reality*[17].

- **school and work**
i.   The gap between the school and the workplace needs to be narrowed. Traditionally at school we do talk about the outer reality (e.g., field units, areas of operation, etc.) but now *it is time to act (e.g., enable development, etc.) and not just talk about development.*

ii.   There must be better interaction between the providers of education and the workplace. If we are educating our officers to be as effective practitioners as possible we should recognize the discontinuities between activities of JPFs (just plain folks), students and practitioners[18]. It is essential to recognize that these *discontinuities are not necessities*. Instead of dealing with well-defined problems, students will need to act in a different kinds of situations in which they are meeting ill-defined problems most of the time.

iii.   The school (no matter what kind of a school) educates citizens for a future unknown both to the teachers and also to those outside of the school. Hence, we should prepare our students for flexible adaptation to new settings and problems. Even very demanding issues, at least at the highest levels of the educational systems, need not be forgotten, because we need some research and understanding about the most challenging issues (e.g., our future "possibilities" and "impossibilities" in the case of technological determinism).

How it could be possible to deal with these dimensions at the same time at the same place?

Undoubtedly the challenge is enormous and unfortunately it needs to be met on a continuous basis and even on all levels of our Transeuropean military educational systems. The reality seems to be different around the globe but mostly only the social reality differs a lot. This means that we have different kinds of perspectives for seeing our social reality.

Consequently, no universal "right answer" of our social reality could be expressed, even in an extended version of this article. But this does not mean that we should abandon the attempt to get the ultimate "right answer" – a consistent and understandable explanation of our social reality.

These challenges need to be met at local and concrete settings by the teachers, students and other personnel of the school in question. This emphasis on localness and context dependency does not mean that we should forget the global dimension. On the contrary. We should socially navigate and follow globally cognitive trails while getting a better and better understanding of abstract theories (tools for the development) in use. And this activity demands not just competition, but also cooperation among us.

Cultural-historical activity theory as a tool for the development of the military educational systems

In an age of increasing complexity of our reality our capability to make sense out of it is becoming more difficult. Cultural-historical activity theory (CHAT) is a globally developed theory[19] (in a way, a combinatorial innovation) offering lenses that enable us to make sense of our social reality.

Based on the CHAT we could identify some key questions to be focused on:
- What is and should be the intended outcome of our military education?
- What is and should be the object of our schooling?
- How can we guide our decentralized school system in practice?

According to the CHAT, *subjects' actions can be understood only when interpreted against the background of entire activity system*[20]. For us as well those ancient hunters, the intended outcome (e.g., killing of deer) as well as the object (e.g., the deer) has to have the pivotal position. But all this does not mean that a subject of an activity system (a hunter or a teacher) has no role in the play. On the contrary.

What is and should be the intended outcome of our military education?

Here I would like to use a Finnish example about the intended outcome of our educational activities. Using the methods of MBO (Management by Objectives), the final outcome seems to be "the number of graduated students". Another key objective for us in Finland seems to be "level of feedback". But is this really a final outcome of schooling in the FDF or elsewhere?

As mentioned previously we should narrow the gap between the school and outer activities simply because ultimately we are going to educate officers able to cope effectively in the real world – not just in school[21]. If so, what this does mean to our *assessment practices?* In a way these practices try to measure how the learning has proceeded, and hence how we understand the learning is the crucial question. It should be remembered that learning is not just acquiring more knowledge but also a more or less permanent change in how we act[22]. If knowledge is in question, how do we make sure that the student makes some conceptual changes if students preconcepts are not challenged during the learning process? Consequently, students have some essential resources as expertise and knowledge to be used in the learning process.

The assessment practices need to be recontextualized and not decontextualized as has traditionally been done[23]. John Biggs argues that decontextualized assessments are appropriate for assessing declarative knowledge but why could not the use of theoretical knowledge have been assessed in a practical situation[24]? Quite often the knowledge taught in school is "inert"[25] and not conditionalized (recontextualized) to show in what kinds of situations the theories may be useful.

Not just where and how the assessment should be done but also by whom it should be done is crucial to consider. In practice this means also self- and peer-assessment practices assisted by the use of, e.g., the practicum, group projects, learning logs and portfolios[26]. For justifiable self- and peer-assessment practices we naturally need some shared criteria.

While searching for such criteria we should not forget two very important concepts. One is *action competence*[27] and the other is *understanding*. Among us it seems to be a widely shared fact that as a result of our educational activities, graduating officers should be, for a start, as action competent as possible. This does not exclude the need to get more specific competencies but of course the soil (action competence) is essential for a tree (e.g., a specific competence)[28]. But how to measure this partly intangible action competence, especially when focusing on its social and ethical dimensions? Or do we have to forget such unmeasurable features just because of this

unmeasurableness? Hopefully not.

To make good ethical decisions is such a complex task. Only general principles can be applied. But this does not mean that we should forget the need to have some shared ethical principles which offer some basis to produce assessment criteria. According to Thomas Donaldson and Thomas Dunfee (1994; 1999) we should have some general principles governing our morality (our activities) and their two main candidates are as follows:

> "Local (economic) communities may specify ethical norms for their members through microsocial contracts (clarifying authentic norms)"

> "In order to be obligatory, a microsocial contract norm must be compatible with hypernorms (specifying legitimate norms)."

The crucial point is not just the result (the codes of conduct) but the process to identify *authentic* and *legitimate* norms of the community. Having said this it seems to be justifiable to ask *what kinds of authentic norms do we have in the FDF and in our educational system?* Under these authentic norms it is possible to pick up some examples of unethical behaviour to be as the accelerators for our organizational learning processes. These practicalities offer a natural way to proceed on the path of teaching ethics[29].

When trying to figure out what should be the outcome of our schooling it is essential to concentrate on *understanding*. This is not a new phenomenon; it has been an important candidate for this position since John Dewey[30]. Obviously to understand is something more than just a subjective "ah-ha" feeling, but how do we socially justify understanding and what kind of criteria do we need for that?

Understanding is understood as a precondition of intelligent action[31] just as an intelligent action is often an indication of understanding. How about, then, a student who acts "intelligently" but did not know why he did so? Obviously to act intelligently and effectively is not the same as to understand.

In this phase we have to dive deeper into the secrets of understanding, and John Biggs has given us an interesting tool for that with his SOLO taxonomy (Structure of the Observed Learning Outcome[32]). Here the intent is not to focus on the levels of preunderstanding but on real understanding in an academic sense. According to the SOLO taxonomy this means focusing on the levels of relational and extended abstract level. By the relational level, Biggs means that in the case of understanding, "seeing the forest is needed instead of just seeing the trees". In other words, this idea means

that concepts do have a systemic nature and in this phase the systemic nature needs to be done into visible form (i.e. a concept map). Here it is easy to recognize the parallel with the ideas of the CHAT (more precisely, e.g., with Vygotsky).

An extended abstract level means in practice that on that level the student goes beyond what has already been given. In other words this means that he invents something relatively new (e.g., a new solution to an age-old problem). The seeing of our reality from a fresh but justifiable angle seems to be an effective method for new kinds of solutions[33]. Collectively for us this means that in order to reach this level at all one needs to become familiar with multiple perspectives, effectively socially navigating and following many cognitive trails.

Subjective understanding is not necessarily accompanied by the ability to explain[34] but for an objective societal understanding, justifiable explanations are necessities. When justifying socially the deepness of the understanding we need proper explanations, narratives and even figures (e.g concept maps).

It seems to be justifiable to ask what is the practical meaning of understanding the understanding at the Age of Bologna process? Answering the question means comparing the present educational development practices to the most prominent learning theories of our time (e.g., the synthesized theories of Carl Bereiter (2002) and John Biggs (2003); cf. also, e.g., Bransford, Brown, Cocking (Eds.) (2000)).

In the Bologna process there is an emphasis on the core curricula. The core phenomena and concepts of disciplines are to be identified and practically this means *progressively inquiring in each discipline* and making *concept maps*, as emphasised, for example, by Bereiter and Biggs[35].

One more practical issue about understanding needs to be emphasized. To understand seems to be a *synthesis of acting intelligently and the ability to explain the reasons for own actions.* For an officer student, this means several situations in which he himself is teaching and otherwise showing what he actually has learned. These exercises need also be systematically self- and peer-assessed.

Finally a conclusion could be made. The question about the fundamental outcome of the schooling can not be answered once and for all, but despite that, when continuing progressively inquiring into this phenomenon *action competence* and *deep understanding* should not be forgotten despite some counter-arguments[36].

As a solution to this contradiction I offer a solution in which the traditional analytic primacy of individuals as agents is *balanced* by the analysis of the communities[37]. When balancing we should not lose sight of the whole person's interaction in the world. For the person in question, understanding and action competence seem to be

necessary but insufficient outcomes of the schooling. But for our communities, a new kind of practical activity seems to be a sufficient outcome and it is produced along the dimensions mentioned above.

Do we need passive officers for an autopoietic society?

It seems that we tend to believe our students to be rather passive, capable only of receiving information packages sent by the teachers. But could it be that we tend to forget the real nature of our operational environment, which has always been and always will be a dynamic one demanding extremely active agents? Colonel Douglas Macgregor, speaking of the US Armed Forces, has emphasized that it is unrealistic to expect that military leaders will demonstrate the requisite physical energy, mental agility, and moral courage in war to inspire subordinates to exercise initiative, to innovate, and to take risks if they have been discouraged from doing so throughout their military careers [38]. This emphasis seems to be suitable also for us all.

A good soldier has always thought to first, obey orders. Just do, think less, has been the main idea behind the educational arrangements. Knowing how, not knowing that (e.g. theories), has been the main focus on military education. Why would a soldier need theories if he just proves his effectiveness in practice? How about the need to develop his performance and even his competence – action competence? How about operating in our complex reality - is it really possible to manage and control, e.g., all kinds of organizations and institutions effectively without any proper theory, or is it just an autopoietic issue[39]? Here it is emphasized that indeed some justifiable *social guidance* and *leadership* is needed also in the future when effectively performing at all the systemic levels of our social reality.

John Mingers (1997) has developed a useful typology to make sense of these systemic levels. The crucial question seems to be that while all these levels are *interconnected* they are at the same time *separate*. For example, Gilbert Ryle (1949) speaks about *a category mistake* meaning that "applying concepts to logical types to which they do not belong"[40] is not appropriate for us. In practice we tend to forget this separateness, appropriating without hesitation explanatory tools for example from physics and biology and applying them to our societal level. Could it be justifiable, asks Ryle, while Maturana and Varela have also been debated on the issue[41]?

Michael Polanyi explains interestingly this multilayered reality by saying that these levels *form a hierarchy of comprehensive entities*, for the principles of each level operate under the control of the next higher level. Each level is subject to dual control:

first, by the laws that apply to its elements in themselves, and second, by the laws that control the comprehensive entity formed by them. Also Polanyi did not deny the differences between the systemic levels but actually that these levels are not reducible to the terms of the lower level. [42]

We are living in an age of decentralized and distributed systems where the system is (if not, it dies) interacting (resonating) with its environment[43]. The uniqueness of social systems is mainly caused by human intentionality and relatively free and strong will[44]. To our social systems, struggling with the need to continuously adapt to the complexity of the world, this uniqueness means lots of resources (an individual agent is the motor of the engine of the resource – knowing). Strategically and in practice this means emphasis on the quality of the *human expertise* without any alternatives[45].

How to guide our decentralized school systems in practice

It is traditionally argued that a vision could be an effective tool for societal guidance. In a sense individuals need to clarify what they are going to achieve individually and collectively. Unfortunately in reality visions tend to be just ambiguous statements made in a top-down manner, having only minor effects on the school in question. Not just the content but also the manner how visions are made needs to be reconsidered.

One way out of this ambiguousness is a new conceptualization – a knowledge vision. Metaphorically speaking it is appropriate to say that a knowledge vision determines how an organization and its knowledge base will evolve in the long term[46]. In a sense a school learns and builds knowledge "towards its knowledge vision" by its progressively inquiring individuals and communities but what exactly is a knowledge vision?

The knowledge vision could be seen having two main components: an "absolute value system" or core ideology (core values, the mission or core purpose) component, and a "relative value system" or the envisioned future component[47]. But do we have any problems in this respect because every self-respecting organization seems to already have value statements hanging on the walls of work places?

Unfortunately these value statements are representatives of espoused values and seldom have any practical effect on the personnel of the organization. Instead of these kinds of values we do need to recognize our *actual value settings*[48] and try to make them explicit when developing our activities.

Let us focus on a practical example about the meaning of values. The FNDC has espoused that it values, for example, *expertise*. But what does the FNDC mean by

"expertise" and does it actually value expertise without any socially shared criteria for what constitutes "good" expertise? For a start the FNDC needs to conceptualize the expertise and progressively inquire what expertise seems to mean in our global science society. If there is a need to develop an espoused value to a shared value and even to an actual value of the personnel, the FNDC needs to have an *open dialogue* about values. And not just a dialogue but also an inquiry needs to be conducted by teachers about the actual meaning of expertise. This inquiry needs to be part of the larger aim to develop personal action competence and teachers' personal pedagogical expertise. In other words we are talking about *organizational double-loop learning*[49] *("deep learning")* when our governing values have been taken under deliberate considerations.

Also, the "relative value system" or the envisioned future component of the knowledge vision could have a practical meaning. Instead of a few lines of text, a concept map seems to be a more appropriate solution when envisioning our future. It should be obvious that while constructing the envisioned future component of the knowledge vision, not only individual intuitions and hunches, but also scientific research needs to be done using science as a tool[50].

Finally there is a need to emphasize two main challenges for the process described above. The biggest challenge for us all is the gap between espoused and actual values[51]. The key issue is not just what do you say, but how do you act and what kinds of reasons do you give in order to negotiate them on a global level. Open dialogue and communication is a necessary[52] but not sufficient condition for the development of actual values and deep transformation. In most organizational activities (e.g., schooling or researching) are accompanied and complemented *but not replaced or accomplished solely* by talk and endless dialogue[53]. At least it should not be.

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Notes

1   http://europa.eu.int/comm/education/policies/educ/bologna/bologna_en.html.
2   http://europa.eu.int/comm/education/policies/educ/bologna/bologna_en.html.
3   According to Longman Dictionary of Contemporary English, 2001, there is a difference between change and development. Change is the process or result of something or someone becoming different, but development means the gradual growth (becoming more advanced) of something.
4   Polanyi, 1966; Ryle, 1949; Nonaka, Takeuchi, 1995; Cook, Brown, 1999.
5   Munro, Höök, Benyon (Eds.), 1999, 2.
6   Cussins, 1992, 677-680; 1993, 249-250; Greeno, 1991, 175; Bransford et al., 2000, 138-139.
7   Goldman, 1999, 30; Kuhn, 1977, 321-322.
8   Davenport, Prusak, 1998, 2; Allee, 1997, 16.
9   Tomasello, 1999.
10 Dewey, 1916: 1997; Glassman, 2001, 6; Campbell, 1995; Hakkarainen, Lonka, Lipponen, 2004.
11 Allee, 2003, 236-237.
12 Lave, Wenger, 1991; Wenger, 1998; Wenger, McDermott, Snyder, 2002; Kilner, 2002; Brown, 2003. For more information, see companycommand.com and squad-leader.com.
13 Miettinen, Lehenkari, Hasu, Hyvönen, 1999. A case study about 6 Finnish innovations.
14 Nonaka, Toyama, Byosiere, 2001; Bereiter, 2002.
15 Crossan, Lane, White, Djurfeldt, 1995; Crossan, Lane, White, 1999; Tuomi, 1999.
16 Allee, 2003, 236-237 referring to the evolutionary biologist Elisabeth Sahtouris. Cf. the general principles of the ISCT (integrative social contracts theory coined by Donaldson and Dunfee, 1994; 1999).
17 Mingers, 1997, 303-313.
18 Brown, Collins, Duguid, 1989, 35.
19 Engeström, 1987; 2001; Cole, Engeström, 1993; Lave, Wenger, 1991; Wertsch, 1985; Vygotsky, 1986; Leont'ev, 1981.
20 Engeström, 2001, 136.
21 Bransford, Brown, Cocking (Eds.), 2000, 77-78. Cf. Social pragmatists as Dewey and Rorty.
22 Jarvis, 1999, 104. Cf. Crossan, Lane, White, Djurfeldt, 1995; Crossan, Lane, White, 1999.
23 Biggs, 2003, 157.
24 Bransford, Brown, Cocking (Eds.), 2000, 43.
25 Whitehead, 1929.
26 Biggs, 2003, 184-191; Bransford, Brown, Cocking (Eds.), 2000.
27 Toiskallio, 1996; 2001; 2003.
28 Cf. a difference between competencies (and metacompetencies (self-awareness and adaptabil-

ity), ATLDP Officer Study Report to The (US) Army) and performance (Brown, 2003). There seems to be a gradual shift towards emphasis on (core) competencies, Joint Vision 2020. Cf. Lacquement, 2003, for an interesting initiative for an approach to categories of expertise (core competencies) for an US Army.

29   Cf. four returns emphasised by Toulmin, 1992, 188; especially the return to the particular.

30   Olson, 2003, 145.

31   Bereiter, 2002, 112.

32   Biggs, 2003, 38-41.

33   Bruner, 1996, 13, the perspectival tenet; Takeuchi, Nonaka, 2004, 7.

34   Bereiter, 2002, 110.

35   Biggs, 2003 emphasizes "problem based learning" (PBL) akin to progressive inquiry. Bereiter stresses "inquiry" and his disciple (Kai Hakkarainen) have extended his ideas to progressive inquiry. Pragmatists philosophies of John Dewey are giving useful background for these intentions.

36   Ahonen, Engeström, Virkkunen, 2000, 291.

37   Lave, Wenger, 1991, 49-53; Wertsch, 1998, 16.

38   2003, 208.

39   Luhmann, 1995; cf. Maturana, Varela, 1988.

40   Ryle, 1949, 16-17.

41   Maturana, Varela, 1980; 1988; cf. Tuomi, 1999, 192-200.

42   Polanyi, 1966, 35-36; 85.

43   Maturana, Varela, 1980.

44   Remember the Finnish "sisu" in this context.

45   cf. Hansen, Nohria, Tierney, 1999 who have offered two alternatives: codification and personalization strategies but here it is argued that at least on a national level we do have only one strategic option to choose – the personalization strategy.

46   The idea of science guiding (technological) search in different kinds of organizations. Cf. e.g. Rosenberg, 1974; 2005; Nelson, Winter, 1982; Cohen, 1995; Mowery, 1995; Boerner, Macher, Teece, 2001; Fleming, Sorenson, 2004.

47   Nonaka, Toyama, 2002, 1000-1001; Collins, Porras, 1994, 219-239; Collins, 2001, 193-204.

48   Griseri, 1998.

49   Argyris, Schön, 1974; 1978. The levels of the learning proposed by Gregory Bateson (1972) offer another option to explain what "deep learning" could mean.

50   Cf. note 46.

51   Cf. theories-in-use versus espoused theories coined by Argyris and Schön, 1974; 1978.

52   cf. Morrison, Milliken, 2000, about organizational silence.

53   Engeström, 1999, 171.