ROZDZIAŁ 9

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AN INTRODUCTION TO LESSONS LEARNED AND BEST PRACTICES SHARING AS A CHANCE FOR IMPROVEMENT IN AUTOMOTIVE CORPORATION

1. DEFINITIONS AND INTRODUCTION TO LESSONS LEARNED AND BEST PRACTICES IN AUTOMOTIVE

Nowadays we live in the World of globalisation. Corporations are opening new locations in low cost countries. We are not surprised that FIAT, General Motors (GM), Toyota are located in Poland, FIAT in Romania, PSA Peugeot Citroën (Peugeot Société Anonyme) in Slovakia, etc. Renault is locating its factories not only in France, but as well in Spain, Turkey, Slovenia or even with brand name Dacia in Romania, Renault-Samsung in Korea and Nissan which is located in Japan. There are many rumours at nearly all automotive OEM (Original Equipment Manufacturer) about either building factories or looking for Tier 1 or Tier 2 suppliers in China (PSA for instance has one in Wuhan). Delphi the leading global supplier of mobile electronics and transportation systems, including powertrain, safety, steering, thermal, and controls & security systems, electrical/electronic architecture, and in-car entertainment technologies has approximately 171,000 employees and operates 159 wholly owned manufacturing sites in 36 countries [17]. Toyota is and shall be considered as reference to the most effectively managed OEM in automotive industry. In 2006 Net Income was 11 681 millions of US dollars and ROE (return on equity) was on the level of 14% [22]. In comparison we shall add that Renault had earned 2 943 millions $ [21] and General Motors had lost 1 978 millions $ [19]. “Toyota Way” is based on several foundations. One of it is **kaizen**, in Japanese: 改善, which means "change for the better". The English translation is of this word "continuous improvement". Kaizen is a daily activity whose purpose goes beyond simple productivity improvement. It is also a process that, when done correctly, humanizes the workplace, eliminates overly hard work (both mental and physical), and teaches people how to perform experiments on their work using the scientific method and how to learn to spot and eliminate waste in business processes [24]. Toyota is wining because they are making small steps every day. The J.R.R. Tolkien’s aphorism can be a good

explanation: "*Little by little, one travels far*." [20]. What we have learned is that we are leaving in one world, one "global village" and the corporation that want to be competitive needs to develop systematically. Coming back to DELPHI and its 159 manufacturing sites in 36 countries, if we would treat those plants as completely independent locations that are not cooperating, we would need to implement 159 separate continuous improvements. Their performance would depend only on initiatives of their own employees. But when we will think about the main goals of manufacturing locations, we will see that it's productiveness, not creativeness. We can try to see the corporation from different perspective. Maybe we should treat those 159 locations as one organism and share some good ideas and solutions between them. Please try to assess which situation seems to be more effective:

- Each of 159 sites are developing every second day one improvement and they are implementing it only in their own locations. There is no time to deeply analyse problems and the solution will be implemented without its previous validations.
- Each of 159 sites are developing and optimising two projects. During half of the year they are able to analyse all possible failures with FMEA (Failure Mode and Effect Analysis) and other tools and share their results with other plants. Besides proposing best projects, all plants are implementing improvements developed by other sites, if they are of course applicable.

It's not hard to imagine that effect of synergy in second case will be extraordinary. We shall add that even very good ideas can be farther improved. There is one key word that is widely used to call these kind of solutions: Best Practice.

Best Practice - can be defined as the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proven themselves over time for large numbers of people. The term is used frequently in the fields of health care, government administration, the education system, project management, hardware and software product development, and elsewhere [17]. Example can be found in the 1968 Summer Olympics where a young man named Dick Fosbury revolutionized high-jumping technique. Using an approach that became known as the Fosbury Flop, he won the gold medal (in a new Olympic record height of 2.24m), by going over the bar back-first instead of head-first [24]. However, it is often noted that demonstrated best practices can be slow to spread, even within an organization. According to the American Productivity & Quality Center, the three main barriers to adoption of a best practice are a lack of knowledge about current best practices, a lack of motivation to make changes involved in their adoption, and a lack of knowledge and skills required to do so [17]. One could ask, what do we need for those Best Practices? Why we cannot work as we were doing it in previous years? Why we are obliged to develop? Those questions shall be answered. The whole automotive industry is improving, products are both getting cheaper and as well they must have better quality. If automotive suppliers want to be competitive they need to increase capacities of their assembly lines and secure better and better quality level. Customer is continuously trying to negotiate the prize, but as well he is giving harder and harder quality targets. And as Albert Einstein said it's "*insanity to do the same thing over and over again and expect different results*" [20].

Besides Best Practices organization should share their Problem Solving methods and effective corrective actions. It's worth to notice that there will be some common difficulties that can be seen in every location. For instance no matter which product is being produced in manufacturing sites, most of them will have some kind of connector and pins inside. Coming back to Delphi there is very probable that most of those 159 locations are facing the problem of bended pins. We believe that there might be several thousands of occurrences of this failure every month, both detected internally and externally (Customer Complaints). Learning lessons from past failures is an important source of progress. It's frustrating to see your favourite football team make the same mistakes over and over without learning from them [23]. And from the position of shareholders it's difficult to understand that different plants are wasting their time and effort to solve similar problem again and again. We believe that this is not only the problem of communication between sites but very often one can see it inside even one location. Isn't it true that on daily work employees are facing similar failures and solving nearly identical problems? Imagine situation in which production quality engineers are working alone and they are analysing and defining corrective actions for failures detected during assembly process. They need to understand every single problem that they are facing and are obliged to solve it. They behave as persons that have no experience and are gaining it with time. Maybe this is wrong assessment from our side, but position of production quality engineers isn't stable. People are working on it approximately one or two years and they are being promoted or simply they are leaving the companies. This is not enough time to gain knowledge and really become effective. Summarizing, we can say that companies are solving production quality problems with inexperienced staff that are learning by doing, which for sure is a very good training for engineers, but is in our opinion **muda** (無駄), which is a Japanese term for activity that is wasteful and doesn't add value or is unproductive [24]. The corporation with over 100 sites had lived through probably 99% of problems that production quality engineers are actually facing. Moreover, effective solutions were found, implemented, verified and usually validated. Imagine, that instead of "discovering America" once again, they are defining what is their actual failure that they are dealing with. And they receive reply on the basis of organizational knowledge, experienced gained in the whole corporation. Example of this may be: "in Chinese plant there were similar situation and the root cause of this is fitting perfectly. Corrective action was …, preventive action was … and those resulted in significant reduction of scrap and rework. This solution apply to Your organization in 96%. Second similar case was in Italian plant …". Samuel Johnson said that "Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information on it" [20]. It's very expensive and difficult to have employees that are able to solve every single quality problem, because they experienced so many situations that they are able to say: "I can remember similar case, we have it on one of our products three years ago, and we have done… , which helped". We need to remember, what father of Taoism: Lao-tzu have said: **"***People are difficult to govern because they have too much knowledge*" [20]. Very experienced, knowledgeable engineers are often willing to earn more and become part of management, not necessarily in the same company. Our main interest is to give effective way of sharing knowledge. One theory proposes that experienced decision-makers base most of their decisions on situation assessments. In other words, decision-makers principally use experience for their decisions, i.e. when a decision event emerges, managers select actions that have worked well in similar situations [Sanin, Szczerbicki, Toro 2007:209-223].

Lessons Learned, from the IT (Information Technology) point of view is, knowledge derived from the implementation and evaluation of a program that can be used to identify strengths and weaknesses of program design and implementation. This information is likely to be helpful in modifying and improving program functions in the future [18]. Another definition, used by NASA (National Aeronautics and Space Administration), is experiences acquired in the execution of programs and projects which can provided value-added direction to the formulation and execution of future development and operational initiatives [Ambari et.al. 2003]. We would like to suggest another explication of term **Lessons Learned**:

1. "Something learned by study or experience, an instructive example
    a. An unexpected occurrence such as; a mishap, accident or mistake
    b. Completion of a planned activity
    c. Realization that something different is occurring
2. An adverse work practice or experience that is captured and shared to avoid a recurrence [2]".

Oscar Wilde said that: "*Experience is the name everyone gives to their mistakes* [20]". This phrase is very good explanation, why employers are prizing so much experience during recruitment process. It's very probable that candidate who was working three years, had made many different errors during that time and there is chance that he will not do it again. And as was said by Vernon Sanders Law: **"***Experience is a hard teacher because she gives the test first, the lesson afterwards* [20]". Rémy de Bernardy, an experienced project management consultant is suggesting: "The next time you make a mistake, write it down. It can help you from time lost to unnecessary duplication of effort (which erodes morale) to financial losses from wasting time and resources. No matter how trivial the problem might be, document the error. By something as simple as maintaining a log that documents all errors, such losses can be avoided. If this log is updated and shared between all others at all times, we have a unique chance to learn from mistakes (of others and their own). However, the process usually stops here, with mistakes documented for sake of formality and filed away only to never be seen again [23]". Consulting is based on using lessons learned from one company to another one. Enterprises are paying a huge money and choosing for instance Accenture, Ernst & Young, PricewaterhouseCoopers, because they not only have possibility to work for the biggest corporations in the World, but have tools to share knowledge, which is their most valuable asset. Does it mean that their lessons learned processes are 100% effective and there is no place for improvement. We can find comments from users and managers that are in contradiction to this statement. Users are for instance complaining that it's a pain to weed through all the irrelevant lessons to get to the few 'jewels'. There should be better an easier way to find the lessons that pertain to them and that it takes almost two weeks to review the lessons in the database, who's got the time for that? Managers are saying that despite the processes and procedures in place to capture and share lessons learned, they see no evidence that lessons are being applied toward future success [Cowles 2004]. Those opinions confirms that there is still a lot to be done in the subject of Best Practices and Lessons Learned.

2. DEFINITION AND INTRODUCTION TO KNOWLEDGE MANAGEMENT

Knowledge Management (KM) comprises a range of practices used by organisations to identify, create, represent, and distribute knowledge for reuse, awareness and learning. It has been an established discipline since 1995 with a body of university courses and both professional and academic journals dedicated to it [24]. While general management is concerned with physical and human resources, knowledge management refers to the allocation of knowledge assets as a means to improve organizational processes. KM goals are usually described in terms of knowledge assets. Due to the nature of knowledge assets, organizational processes tend to improve as knowledge assets are shared and leveraged among organizational members [Weber 2207:333-346]. The expression "avoid re-inventing the wheel" has become the catch cry justification for KM principles [Sanin 2007]. All knowledge is in some sense social and cultural and cannot be isolated out of the research process and is, therefore, inherently bias laden. Finally, by accepting that the research process is not neutral, it may be argued that science is subjective [Kane et.al. 2006:141-152]. One aspect of Knowledge Management, knowledge transfer, has always existed in one form or another. Examples include on-the-job peer discussions, formal apprenticeship, discussion forums, corporate libraries, professional training and mentoring programs [24]. Nowadays different technological tools, like applications based on advanced databases, the Internet, groupware technologies, are developed to support this transmission process. We should introduce Polanyi's distinction between tacit and explicit knowledge as a foundation [Neve 2003:47-54].

By definition, **tacit knowledge** is knowledge that people carry in their minds and is, therefore, difficult to access. Often, people are not aware of the knowledge they possess or how it can be valuable to others. Tacit knowledge is not easily shared. One of Polanyi's famous aphorisms is: "*We know more than we can tell*" [24]. A well-known example is when Socrates is leading the uneducated slave Meno to a solution of an advanced mathematical problem. By inductive and deductive questions, Socrates deducts the right answers. By using the information a person already has, adequately formulated questions can support him/her in articulating and structuring the knowledge [Neve 2003:47-54]. **Explicit knowledge** is that which has been or can be articulated, codified, and stored in certain media. It can be readily transmitted to others. The most common forms of explicit knowledge are manuals, documents and procedures. Knowledge also can be audio-visual. Works of art and product design can be seen as other forms of explicit knowledge where human skills, motives and knowledge are externalized [24]. On basis of Polanyi's distinction between tacit and explicit knowledge as a foundation, there was constructed a two-by-two table with four modes of knowledge creation (see fig. 1), and *combination* (from explicit knowledge to explicit knowledge):

- **Socialisation** is a process where tacit knowledge can be attained without language. A person can learn by observation, imitation, and practice, as the key to acquiring tacit knowledge is experience.
- **Externalisation** converts tacit knowledge into explicit knowledge. For example, metaphors and analogies play an important role in articulating tacit knowledge that is difficult to express in language.

- **Internalisation** converts explicit knowledge into tacit knowledge. The process requires action to be deeply rooted in it, where learning is a way of assimilating the knowledge.
- **Combination** – during this phase of knowledge creation "different bodies of explicit knowledge are combined" when individuals communicate through meetings, email, or on the phone [Neve 2003:47-54].

We introduced Best Practices, Lessons Learned processes and gave definition of KM, but we cannot forget one very important thing that is the individual's motivation, engagement, and ability to communicate knowledge and experiences to others that underlies the possibility for the organisation to learn. Motivation is often defined by an individual's needs, goals, and motives.

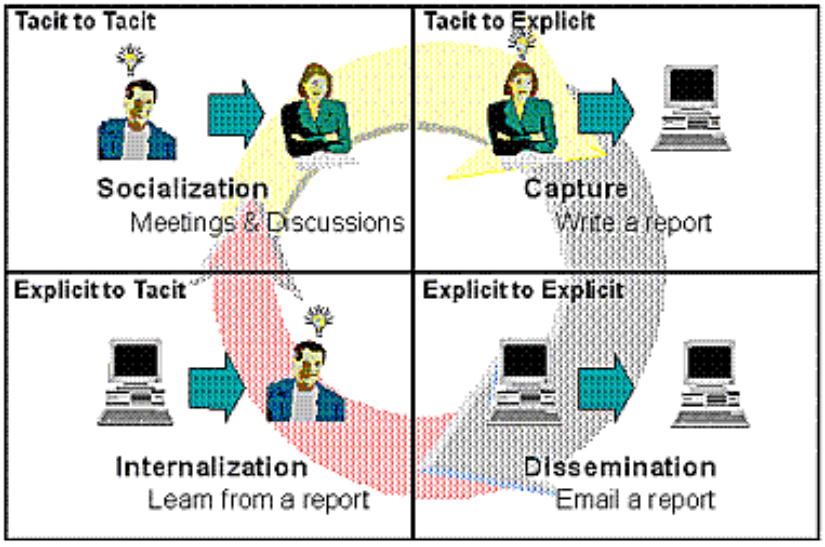


Figure 1. Modes of knowledge creation[1]

Maslow's hierarchy of needs (see picture 2) addresses the following steps: (1) physiological needs, (2) safety and security, (3) solidarity or belonging, love (4) the striving for appreciation, self esteem and (5) to self-realization. The lower level must be fairly satisfied before the next can be taken upon. Traditional organisations are constructed to support only the first three levels in Maslow's hierarchy, that is to say, food, accommodation, and belonging. How can this favour personal development, cooperation, and shared visions [Neve 2003:47-54]? We cannot simply expect from people that they are willing to share their experience. Their knowledge is what they are being paid for and this is not advantageous for employee, if he can be replaced without nearly no effort from his supervisor. There was even a story, about one technician, who to prevent loosing his job, had erased all symbols on a very complicated control board, threw away its manual and became irreplaceable. This was not a good attitude to Knowledge Management, but we should remember that people can behave very strange, when they feel unsecured and they are afraid of loosing their job. Completely opposite behaviour can

[1] Retrieved in October 2007 from: http://www.research.ibm.com/knowsoc/project_summary.html.

be found in the Finnish games industry. Besides competition and market transactions, firms interact by exchanging information and knowledge. This has an effect on what the firms do and that in turn has an effect on how the industry evolves or changes. When asked why they exchange information the managers stated that they do it for altruistic reasons. However, that cannot be the only thing. Another reason could be that this way they can build their personal reputation within the industry and also get personal satisfaction or maybe, because sharing information that you have is a ticket to get the information that others have [Peltoniemi 2007:81-88].

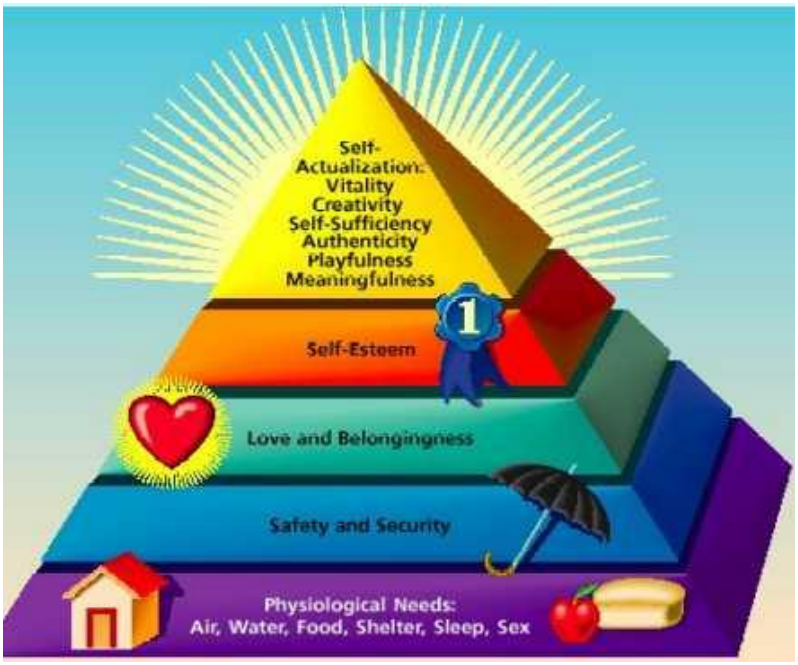


Figure 2. Maslow's hierarchy of human needs[2]

It's worth to notice that Knowledge Management is a very young discipline of science. It was established in 1995 and the time of splendour will come in the future. Scientists a hundred or two hundred years ago could have thought that it was a fascinating problem to understand how the brain works, and they might have built models of it. But they wouldn't have gotten very far because they didn't have the background knowledge [Nielsen 2007]. In XXI century situation has changed. Technology is developing extremely fast. We are able to store, more and more data on smaller and smaller memory drives. In Artificial Intelligence (AI) after another 10, 20 or 50 years of great research in that area it will be the moment when somebody can say: "*Ah, we can put this together*". As for any major imminent breakthroughs in AI, you don't see a breakthrough before it happens. AI success will be in a number of applications, none of which will have the flavor that the original AI people though about, which is: "*This machine is thinking like a person*." Instead, it will use extensive computation and incorporate statistical methods [Nielsen 2007].

[2] Retrieved October 2007 from http://www.normemma.com/armaslow.htm.

3. OBSTACLES AND POSSIBILITIES FOR ORGANIZATIONAL KNOWLEDGE SHARING AND EXCHANGE

Organisations of all types are struggling to learn how to survive in a dynamic environment of increasing complexity. This requires that organisations employ mechanisms to reflect collectively on their experience, make sense of it and assess their investment in learning efforts [Parent, Béliveau 2007:73-80]. Before starting preparation of the tool that will support knowledge sharing and exchange, we would like to present, what kind of obstacles and challenges are being discussed in a literature. For instance Weber in his article [2007:333-346] has presented several reasons, when Knowledge Management approaches my fail:

- *when they do not integrate humans, processes, and technology*. Humans alone are slow and have limited capacities. Any approach that is not associated with processes will tend to fail or to be perceived as failures. Technology is limited to support humans because of its variable accuracy levels when performing simple mundane human tasks.
- *due to lack of leadership support*. Sometimes community leaders are not convinced of the benefits of knowledge sharing, potentially spreading their scepticism to the community.
- *when they rely on inadequate technology*. For instance text databases have limited use to support KM, because these tools only deal with data and information, they do not manipulate knowledge, as required in KM approaches. The verification of knowledge artefacts requires interpretation, what is neither precise nor easy. Therefore, if the submitted artefact is incorrect, the tool may not be able to determine that and guide the user.
- *when they do not properly oversee the quality of stored knowledge*. It is part managerial responsibility; it also relates to the representation of artefacts in an understandable manner.
- *when they do not promote collaboration*. Collaboration is an important means for learning and sharing.

Tran and Nguyen in their article [2007:21-28] are emphasizing the fact that Knowledge sharing is not possible without Knowledge integration, which is a process that enables to obtain knowledge from several systems and unify it size but also cover the whole scope of knowledge of all the systems. Each system is treated as an autonomous unit, it works with private policies and is independent with others. Knowledge integration tools:

- Systems are to be integrated: the knowledge acquisition system is more closely linked with an expert system shell, or a database system is linked to the knowledge acquisition system in order to read data of a domain.
- Various sources of knowledge are to be integrated: it may include text files, data files statistics, rules and facts all contain knowledge about a domain and should be handled by the same system.
- The represent knowledge of various experts is to be integrated either into one consistent domain model or into a model which shows the conflicting views of the domain.
- Diverse knowledge sources with their respective representations are to be integrated, e.g. a taxonomy of domain concepts, possible values of attributes, well-formedness conditions of facts and rules.

Progress and trend of development that we can observe in Web search engines in recent years can be treated as good visualisation of organisations needs to Knowledge Management User can formulate a request totally imprecise, using different natural languages, making spelling errors, not using diacritics, but at the same time expecting very efficient response. The systems should guess the intention of the user, his/her real needs, so many adapting intelligent procedures based on feedback are developed, the approach of recommended systems is proposed, computer agents are installed, etc [Choroś 2007:127-134]. We can feel the inconvenience of Internet, when we are looking for author of the painting and we don't know the title, style, but only have some picture of it. There is no web search available that is comparing two graphics on basis of its contests not just title, file extension or size. And we really feel that it would be very helpful.

Eppler in his work [2007:291-300] is presenting knowledge communication problems between experts and decision makers:

I. *Expert-caused difficulties* - these mistakes make it cumbersome for the decision maker to grasp the advices of a specialist. Examples are the use of overly technical jargon, starting with details before an overview is given or lacking interest of the expert in related (but relevant) issues.
II. *Manager-caused problems* that leave it unclear to the expert what the manager actually expects from him/her. This makes it difficult for the expert to convey what he or she knows. A manager's reluctance to discuss detailed problems may have major effects on an issue, such as lack of concentration and attention or lack of technical know-how.
III. Mutual behaviour of experts and managers, including their experiences or attitudes (e.g., reciprocal stereotypes and role misunderstandings). Examples that belongs to this group are lacking feedback on both sides, the set-up to fail syndrome, groupthink, and in-group out-group behaviour on both sides.
IV. *Expert-manager interactions*, such as time constraints, communication infrastructure, distractions, interventions from others, etc. The problem of information overload can arise, but as well the hidden profile issue may occur, the background of the participants is not fully revealed or discussed at the beginning of a manager-expert interaction.
V. *Issues that are caused indirectly by the overall organisational context of managers and experts*, such as their organisational constraints and their differing tasks, priorities and interests.

Finally Eppler [2007:291-300] summarizes, when high quality interactions between experts and decision makers can be possible:

I. experts adapt their communication style and content to the needs of decision makers,
II. managers fully brief experts on their needs and give them explicit and regular feedback,
III. experts and decision makers develop relationships of mutual trust and respect,
IV. their interactions are supported by adequate infrastructures and tools,
V. their organisational environment allows them to be transparent and direct in their reciprocal communication.

We should also present Lao-tzu aphorism that is known since 6th Century B.C. and is still very actual:

"He who knows does not speak.
He who speaks does not know [20]".

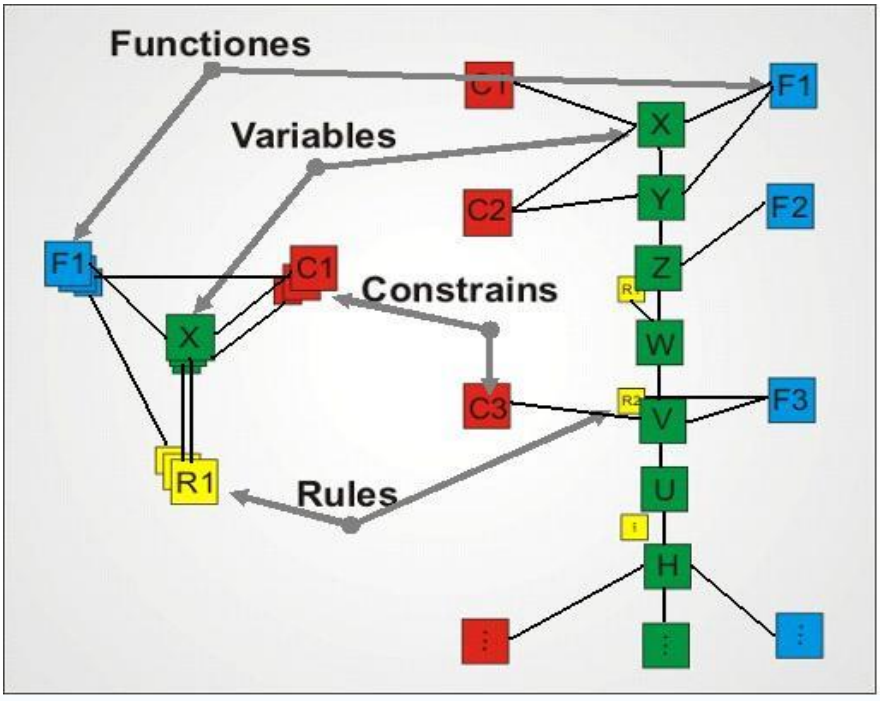
People very often do believe that we should start with sharing those solutions, suggestions, which are the best ones. But does it mean that they think about those most effective or attractive. It shouldn't be surprising that many extraordinary ideas are nipped in the bud, because of author's shyness or grumpiness. Organisation that will be able to stimulate employees, who are withdrawn, to share knowledge, will win a lot. The reason of it is that introverts are very often the real experts in chosen area, but have difficulties in presenting their ideas or training colleagues with their precious experience.

Parent and Béliveau are presenting in their article [Parent, Béliveau 2007:73-80] very interesting idea of **the learning history**, which is the document with a 20- to 100-page narrative of an organisation's recent critical episodes, presented in an engaging two-column format. The right-hand column presents an emotionally rich story of relevant events through the interwoven quotations of people who took part in them, including champions and sceptics, people who were affected by them, or people who observed them up close. The left-hand column contains the learning historians' analysis, which identifies recurrent themes in the narrative, asks questions about its assumptions and raises "undiscussable" issues. The content of the left side of the document is based on recognised research in the areas of systems thinking, organizational effectiveness and organisational behaviours. Once written, the learning history document is disseminated through group discussions with people who were involved in the change effort and others who might learn from it. It brings tacit knowledge to the surface, codifies it and turns it into an actionable knowledge. Even if organisations agree on the importance of organisational learning, they may not be willing to invest the time, courage and honesty it requires. Furthermore, in a business culture where action is glorified, managers often find it difficult to take the time to reflect under the pressures of delivering results, serving a political agenda, identifying problems and finding. In this context, to get the most out of the learning history process, the organisational climate has to welcome contradictions, uncertainty and conflict as learning opportunities. Although the learning history provides a fresh and effective way to study learning and knowledge concepts, it is still at an experimental stage. The potential of this new methodology in studying knowledge transfer activities has not been fully explored. The limitations are primarily those associated with the amount of work involved in a developing a learning history.

4. CONCLUSIONS AND FURTHER RESEARCH

Lessons Learned and Best Practices sharing is certainly very useful and interesting chance for improvement, not only in Automotive industry. Article was focused on proving that there is a indisputable need for having effective knowledge sharing process. Even if its benefits are easy to be presented and understood, there are many obstacles to create it and use effectively. Awareness of them shall be very helpful in designing and creating Smart Knowledge Management System (SKMS), platform proposed by Cesar Sanin in his Ph. D. Thesis [Sanin 2007]. It's a multi-technology (hybrid) knowledge-based decision support system, an integrated tool of rule-based systems,

expert systems, numerical models, self-learning, and intelligent knowledge management technology developed to help managers in the decision-making process. It allows to build the fingerprints (i.e. the Decisional DNA) of an organization by implementing a model for transforming information into knowledge. In his opinion one of the most complicated issues about knowledge is its representation, because it determines how knowledge is acquired and how it is transformed from tacit knowledge to explicit knowledge [Sanin, Szczerbicki, Toro 2007:209-223]. Together with professor Szczerbicki they decided to learn from the most talented and faultless designer in the universe – Mother Nature. DNA (deoxyribonucleic acid) has been judged by many researchers as the most excellent data structure. The survival of information in nature over successive generations has showed the success of the DNA structure, and its mechanisms. DNA stores information for survival of the species, and allows for improvement through evolution. Secondly, the brain has been considered as the most powerful processor and database. The brain stores knowledge in terms of keeping experience from past situations, as well as knowledge from preventive experience of others. Four basic components surround decision-making events: *variables*, *functions*, *constraints*, and *rules*. Following the description of the four components of Set Of Experience Knowledge Structure (SOEKS, see fig. 3), its structure is organized taking into account some important features of DNA.

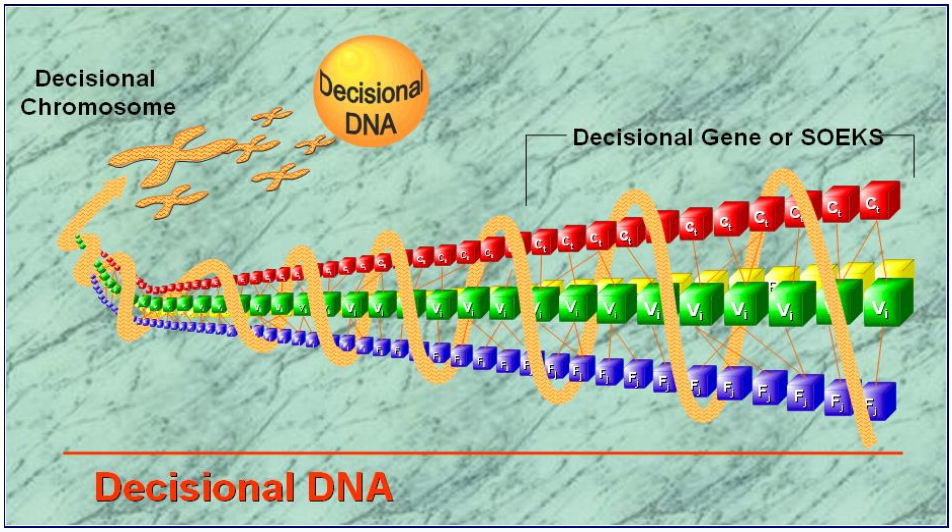


Source: [Sanin, Szczerbicki 2007].

Figure 3. Set Of Experience Knowledge Structure

Firstly, the combination of the four nucleotides gives uniqueness to DNA, just as the combination of the four components of the set of experience offer distinctiveness.

Moreover, the elements of the structure are connected among themselves imitating part of a long strand of DNA, that is, a gene. Then, a gene can be assimilated to a set of experience, and, in the same way as a gene produces a phenotype, a SOEKS produces a value of decision in terms of its objective functions. Each set of experience built after a formal decision event can be categorized, and acts as a gene in DNA. For instance, a formal decision took effect in the production area about a production quantity; the set of experience formed after this decision becomes a gene for the area and could help to shape future decisions in the same field. The SOEKS give advice to the company's areas about how to respond. Sets of experience can be collected, classified, and organized according to their efficiency, grouping them into chromosomes. Chromosomes are groups of sets of experience that can comprise a strategy for a specific area of the company. Moreover, improvements can be made upon some sets of experience by transformations and groups of chromosomes are the decisional DNA (see fig. 4) of the company [Sanin, Szczerbicki, Toro 2007:209-223]. Marvin Minsky, creator of the Frame concept, when referring to knowledge representation says "each particular kind of data structure has its own virtues and deficiencies, and non by itself would seem adequate for all the different functions involved". SOEKS is a suitable representation for formal decision events, which is a decision occurrence that was performed under specific circumstances. That is, under strict established conditions and it is carried out by an agent experiencing some type of knowledge. Any technology able to capture and store formal decision events as explicit knowledge will improve the decision-making process, reducing decision time, as well as avoiding repetition and duplication in process [Sanin, Szczerbicki 2007:71-78].



Source: [Sanin, Szczerbicki 2007].

Figure 4. Decisional DNA

Besides knowledge representation further research will be focused on sharing and distributing decisional knowledge among different technologies. This attribute can be achieved by implementing an **ontology** for experimental knowledge [Sanin 2007]. In philosophy, ontology is the study of being or existence and forms the basic subject

matter of metaphysics. It seeks to describe or posit the basic categories and relationships of being or existence to define entities and types of entities within its framework. In both computer science and information science, an ontology is a data model that represents a set of concepts within a domain and the relationships between those concepts. It is used to reason about the objects within that domain [24]. Ontologies are suitable for many currently existing applications designed for enterprise integration, natural language translation, mechanical engineering, standardization of product, electronic commerce, geographic information systems or legal information systems. The new areas are still added to that list, e.g. medicine and bio-informatics, where logic based ontologies are the way of organizing terminologies resource [Koprowska 2007]. In addition, emerging semantic web systems use Ontologies for a better interaction and understanding between different web-based systems using agents [Sanin, Szczerbicki, Toro 2007]. The main focus of Ontology-based applications in information sharing and knowledge management are querying and classification purposes.

In Automotive industry we shall always remember Johann Wolfgang von Goethe aphorism (both as individuals and as organization):

"He who moves not forward, goes backward. [20]*"*

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