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Emergence based intelligent enterprises

Inhalt:
The ability to change the organization and the processes to find new combinations of resources and new product ideas, which are accepted by the future markets, is a key success factor. Emergence based organisations support this ability. This paper explains emergence in organizations and shows the key factors to this kind of organization.

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Ansprechpartner: Jochen Schwarzmann

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Kontakt

Safari GmbH Office Mannheim
Goethestraße 18 D-68161 Mannheim

Safari GmbH Office München
Reitmorstraße 4 D-80358 München

Tel: +49 – 621 – 18 144 720
Fax: +49 – 621 – 18 144 740

info@safari-gmbh.de
www.safari-gmbh.de

Emergence based intelligent enterprises

1. Focus on change processes

When talking about intelligent enterprises we should take a look at the term of “intelligence”. Generally we use the expression to characterize a person which has special abilities. The meaning and general use of this word changed, since computers have been used for a wider spectrum of tasks. In former times one was called “intelligent” if he had a broad and detailed knowledge of facts. The key success factors for an information based work were to learn new facts and to remember them. Moreover methods were important to find a way from a defined starting point to a defined result which means the transformation of data with fixed rules. In our logic system rules give us the possibility to develop new facts out of the existing series of facts. This principle we taught computers which can do transformation tasks with better results concerning the three success factors qualitiy, cost and time.

This system was strongly based on experience and worked very well as long as there were no intense changes in our environment. Methods depend on defined preconditions and always produce results of the same type. Therefore they do not work if we have a new stitutation. But how can we behave in an uncertain environment? A kind of meta-methods is needed to develop new methods in order to handle new situations. And in fact, today we call people intelligent, who are able to create new methods.

An enterprise is in a sense similar to a method. It is a concept that should combine ressources in order to reach a defined aim. From this point of view we should not call an enterprise intelligent for the organisation, power and produced results of today but for the ability to find and implement the new methods of tomorrow. The ability to change the organization and the processes to find new combinations of resources and new product ideas, which are accepted by the future markets, is a key success factor.

2. Emerging intelligence

We need a convincing approach to meet the challenge of innovation and complex problems but our conventional methods often reach their limits. When we want to get a grip on a big task we normally think that in the first step we have to understand the entire problem in order to analyze it in the second step and finally define work packages. But many problems concerning an enterprise are to complex to understand in width and with the necessary profoundness. In most cases a problem cannot be decomposed without many interdependencies between the different components of the solution. The economic reality in this point is much more like a network than like a tree. But a network has no central coordinating instance and cannot be controlled like a hierarchical organization. It is not possible to place an intelligence in the center because here no center exists.

The human intelligence consists of a very high amount of neuronal cells, which are also connected to a network. Each of them is of a very simple structure but connected they become “intelligent”. The basic parts of a computer are just switches which can differ between 0 and 1. And moreover we should regard how swarms like bees or ants are organized in our nature. When joint together they behave like one creature with traits that naturally cannot be found in a single one of them but only in the whole swarm.

Looking at these examples the ability to solve complex problems seems to be a result of a network of unintelligent components. Intelligence emerges at places were simple encapsulated parts are linked together. The question is how this works. Here different philosophical streams have different answers. The mechanists think that if we understand all parts of the system and the connections between them, we would know how it works. From their point of view the world is build like a machine. The opposite point of view is that characteristics like intelligence or life do not derive from the system itself. The vitalists follow the idea that there is an external instance additional to the system, which adds something to

turn a dead system intelligent or alive. Intelligence or life is a plus which is not included in the system itself. A philosophical concept in between is the emergence theory, which became popular in the 1920s. According to this thesis systems can develop new and unpredictable characteristics out of interdependencies of the components. In mathematics the deterministic chaos is a good example for the phenomenon of structural emergence. Although there is an exact defined formula, the basis of the operations the behavior of the functions is unpredictable. It has the characteristics of a randomized result.

3. Emergence theory as basis for the intelligent enterprise

An Enterprise with all its relationships is a complex system for sure. If it has emergent characteristics and if we follow the thesis of the emergentists we would have to accept that it is an unpredictable system. This clashes with our common management theory, because all the methods are more or less based on a mechanical view. If you do something defined in a described situation you will get a known result. But how can we behave in uncertain, unpredictable systems?

One idea would be to replace the complete management by games of chance. For instance the concept could be to throw a coin for every management decision. One side up means to follow a certain idea, the other side up means to stop thinking in this direction. This appears to be a very strange idea, but it would have some advantages. Time, costs and quality are the success criteria for an economic concept. The time that the decision needs is unbeatable. Think about all the problems in daily business that result out of a long delay of decisions. The cost factor is great if you compare the very small onetime investment with the recurring salary of a manager. And moreover the formal quality of such a decision is very good. You know exactly who is responsible for the decision and the decision itself is totally clear. The only question is, if the qualitative result of such a decision is as good as a classical management decision. If we accept an enterprise as unpredictable emergent system, the answer may be that the advantages of such a concept are convincing.

Surely such an approach is not useful to build a stable controllable enterprise. But it may be very useful to find new solutions for new challenges. Remember that the most fascinating and most complex solution, which is the formation of life on our planet, is based on Darwinism evolution. This concept, which is based essentially on the effect of coincidence, is still the current state of science. Mutation and selection are declared as driving factors. Mutation is based on random faults or variations during the reproduction of an organism. The new organisms have to prove themselves in the environment and sometimes they are more successful than the older concepts. In this case they will survive and will copy the successful concept in the future. Perhaps it is possible to realize the reengineering of an enterprise in an analogous manner.

4. A concept for emergence based intelligent enterprises

The industrialism used the concept of specialization to enhance productivity. If we reduce set-up time the productivity increases and with the idea of specialized tasks cheaper workers can become experts. The intelligence of the work was taken out of the single tasks and brought into the organization – the processes. A new cost type appeared with the more complex integration of all relevant steps of the value chain. Transaction costs should be kept low by centrally planned methods and communication ways. Business Process Engineering was used to streamline the flow to achieve efficiency and effectiveness.

This is surely a successful way if the environment is stable but it seems not to be the right way to get a flexible enterprise. Often the focus is on short-term solutions that produce much more costs for changes in the organization and long-term optimization. More and more components had to be integrated in processes and product cycles get shorter. Therefore in most cases the overhead grew. To cope with daily changing situations, the goal to reduce transaction costs with optimized workflows should be replaced with the goal to reduce transformation costs.

Where could the intelligence to adapt the organization to the new needs come from? The central management cannot oversee the problem due to complex interdependencies and many unpredictable developments. But what is about using the creative potential of our employees? In the industrialism we often saw them as human machines, which had to perform tasks where machines were not available or were too expensive. Following the concept of emergence theory, we could build enterprise intelligence out of a network of many employees. No one has the ability to drive a complete enterprise but every one could behave like a neuron in an “enterprise brain”. What has to be done to achieve results with this strategy?

The first step might be to give the employees more responsibility and a wider autonomy in their decisions. The question is: what happens if there is no planned overall strategy which makes sure that everyone follows a common goal? The market based economy shows us that competition between independent suppliers is needed to get long-term optimization of the whole economy. Although the resources are not used ideally if you take a snapshot the results are better because of the competition of ideas. Perhaps such a principle is also useful for the organization of an enterprise.

Some years ago the implementation of such a system within an enterprise was not possible. The transaction cost theory of the Nobel winner Coase explains that we change from market base organization to controlled enterprises at a defined point because of the costs. A controlled transaction is cheaper than a market base transaction. But with the new information technology the transaction cost sunk very fast and with the daily changes in business the advantages of a market system increase. Regarding this theory it seems to be the time to include market principles in enterprise coordination.

A successful approach to make an enterprise flexible, transformable and adaptable is to have very small units. This is because small units can be combined in different ways as it is very complicated to change the components of a system itself (e.g. employees) but it is less hard to bring a component in a new environment with new relationships. With small encapsulated business units like employees or groups of them we can realize that idea. In analogy building such an enterprise follows the object oriented programming principle instead of the former model, which is based on a complete data model with a network of functions on it. Examples for this development concerning enterprises are the concepts of virtual enterprises or fractal factories.

The success factor of such a new way will be feedback mechanisms. Like a mutated organism in the evolution of species a new idea and a new behavior of an encapsulated business object must prove itself in the environment.

5. Implementing emergence based enterprises

One possible realization suited for the service sector may be very small companies, perhaps one-person enterprises, who built a freelancer network. This network acts more like a community than a conventional enterprise. Ideas and methods could be linked and developed in partnership. Offers to external customers integrate services from different freelancers to build a complete solution. Every partner in this network can receive orders from a customer and will hire subcontractors of the communities to fulfill the task. The outcome could be a very scaleable system. In difference to a big conventional enterprise that is very complicated to build, arrange and maintain, the network is a flexible construction. Here internal cooperation and market-based competition are included at the same time, called coopetition.

For a successful implementation of such new structures an intensive and substantial coaching of the people is critical. Here it is not meant to influence the employees directly, but to provide them with a strong basis where they can use creativity and knowledge to build new solutions. This can also be supported by an appropriate infrastructure. The approach to build enterprises for the future may be to build a functional basis like it is done when organizing a state. The task of the management would be the personal coaching referring to

the individual potential of the acting persons and the creation and maintenance of an infrastructure referring to interactions. The idea is to change the focus from a quantitative point of view, like enterprise resource planning concepts did to the handling of qualitative new challenges. If looking at the tasks of a government we can find ideas of how we could build the basis of a partner network. For instance rules for social life have to be defined, to prevent the members from problems in their social organization. Predefined concepts for cooperation, different types of companies, basic laws and courts to solve problems are required. Moreover a common infrastructure has to be built, supply and disposal should be organized etc..

Emergence based effects occur if the connections between the partners are flexible and easy to adapt. From the engineers view standardization is needed, from the social view trust is needed. Standardization seems to reduce the freedom of the people but in fact free decisions are possible now. In order to understand this, we should regard the meaning of streets, which reduce our freedom to drive anywhere but they are the platform, which allows us to travel in an acceptable time from a certain point to another. In a network trust can be build with the experience of other users. With a technical platform we can implement the exchange of experience with swarm effects. A swarm of bees looking for a new home is not controlled by their Queen, but the different bees discover different places and advertise them. Other bees examine the place and give their vote for it or don't. If place is a good one, this will be a self-energizing effect. User forums of electronic shops use a 3-level-hierarchy to handle ranking of products. If you see the author's information as a first level, the customers can share their opinion as feedback. Other customers who read the feedback could give a feedback to the feedback. Such platforms for communication should be implemented for the different transactions in the network.

The system could also operate for manufacture of goods. Formal functional hierarchies will be replaced through content-based hierarchies. This means that there is a hierarchy of combined concepts and parts. Every idea (uniting two or more existing elements to one new in a special manner) for every level should be available on communication platforms like marketplaces. No central instance to control the manufacturing process is needed if the interfaces are standardized. We experienced the economic push for instance at the development of the personal computer. It is important for a powerful innovation infrastructure that not only complete products compete on marketplaces, but also their components manufactured by different suppliers. Companies like Dell will emerge, who configure and test product combinations out of the available components but they do not build the complete product like automobile companies do for example. Steps in this direction can also be recognized in the automobile industry if we look at the platform concept, where parts were assembled in cars on different brands. Another concept can be found in factories, which are like "production hotels". The suppliers share an infrastructure, deliver the parts just-in-time and mount them by themselves in a rented space of the factory.

6. Emergence supporting Tools

The new technological basis allows new methods to bring people together to decide for common goals, to coordinate and to share possessions. But it is important, that they are able to influence the tools. Often enterprises adapted to the processes of ERP tools to fit the requirements of the tools and not the other way around.

For gaining real flexibility, it seems to be the best way to give the employees the potential to build their own tools. They could start with small problems and develop a wider functionality step by step. This is close to the idea of prototyping, e.g. included in the method of extreme programming in the software development. Most important is to encapsulate the solutions like the programmers of object oriented languages. Communication channels have to be designed to realize interaction. Moreover it is necessary to share solutions. We can learn the principle from open source projects and experience once more that encapsulation and interaction is the basis for an emergent development.