COMPLEXITY MANAGEMENT IN SME

Organization of Complex Relationships

(A Short Review)

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Abstract

The complexity of companies' environment is growing. Complexity management and restructuring of small and medium-sized enterprises (SME) become big challenges of business studies in the next future. A chance could be seen in the use of e-business strategies and the implementation of information systems in SME to improve their competitiveness. A suitable framework is the holistic approach, virtually represented by the Balanced Scorecard (BSC) Analysis, but SME have to learn how to work with holistic methods first, because they suffer from organizational inertia and want to keep their self-sufficiency.

Introduction

Today's SME are surrounded by a **complex network** of interactions and e-business processes. The complexity of this internal and external situation has extremely increased over the last about ten years. That is why many SME were not able to manage the necessary restructuring and alignment of the complex circumstances.

The European Commission discovered that approx. 200,000 SME are loosing competitiveness and facing bankruptcy in 2009.[3] So complexity management has become an important issue for the near future of European SME to stop that negative development.

Actually the scientists transfer the results of natural sciences on social systems to learn how to deal with complexity, but so far a general method of complexity management has not been established. Because of this methodical lack, scientists often try to reduce the complexity by simple **fragmentation**.

The problem depends on the fact that a fragmentation leaves important synergy effects unconsidered, what can lead to wrong recommendations in corporate behaviour.[4]

Considering the disadvantages of such a reduction, the **holistic approach** seems to be a more promising approach of complexity management in socio-economic systems.[5] It deals with

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[3] www.euractiv.com/en/innovation/commission-expects-bankruptcy-surge-2009/article-180759 for 2009/03/30.
[4] Bea, F.-X., Haas, J. (2005): Strategisches Management, 32.

complexity of relations as a given quality and uses a comprehensive view to support strategic management.

Consequently the successful developments in information management had an important influence in the design of **new holistic frameworks**.[6] An example is the Balanced Scorecard (BSC) analysis.

Experiences show that it has succeeded in many companies with the evaluation of complex conditions and implementation of new strategies.[7] The BSC analysis is open for an enlargement. An additional perspective "E-Business" can be introduced to manage e-business strategies[8] as the company's adjustment to the complex conditions of digital economy. It seems that such a new perspective is a sensitive way of complexity management for SME, because it avoids organizational inertia.

Complexity and Complexity Management in SME

Several SME summits and SME weeks in 2009 all over the world dealt with the idea to make SME more competitive in an **environment of rising complexity**. For example the European Commission in May 2009 discussed the possibilities to support small and medium-sized enterprises (SME).

For next years it has been planned to provide better conditions for European SME by offering more small credits below 100,000 EUR, reducing administrative burdens for SME in Europe and protecting the SMEs' international property rights (IPR) against counterfeiting goods.[9]

On the summits the participating companies discussed typical dimensions increasing the environment's complexity. These dimensions can be summarized in the IGLOO concept for SME:[10]

(I) Innovations, actual especially in the information technology

(G) Globalization and the appearance of global competitors at the domestic markets

(L) Laws and new regulations by governments and institutions

(O) Organizational changes in the processes and structures

(O) Other, often unforeseen aspects, like the actual economic crisis, mistakes of managers, etc.

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[5] SCHMIDT, D. (1991): Strategisches Management komplexer Systeme, 30.
[6] Turban, E., et al (2008): Electronic Commerce, 44.
[7] Kaplan/Norton (2008): The Execution Premium, 17.
[8] Mandorf, S. (2009): Strategic Management of Complexity, p. 157.
[9] Examples: 1st European SME weeks in May 2009, Asian SME summit of June 2009, E-SME weeks of Malaysia on 9th of August 2009. http://ec.europa.eu/enterprise/sme/competitive_en.htm.
[10] Mandorf, S. (2009): Strategic Management of Complexity, 31. The English word Igloo stands for an ice-house and is easy to remember, what has a positive effect on recognition. That is an advantage for SME managers.

According to the interpretation of complexity management as a form of e-business management the market shows a growing demand for e-business strategies, e.g. Internet as a new channel for distribution and information.[11]

Different **sciences** have dealt with complex problems since centuries, e.g. mathematics, statistics, physics, biology. Just like the Greek and the Romans had tried to describe complex relationships and to solve the complexity problem in a mathematical or philosophical way to research about laws of nature and the sense of life. According to that research the complexity can be seen as a typical quality of natural systems. For example, every organism is a system of complex structures and relationships in its environment.[12]

In business studies the complexity problem appeared approx. in the 1970ies, when stable conditions of economy were changing into fast modifying situations and the analysts needed more complex algorithms to interpret and predict those changes.[13]

A big, **unsolved problem** is the management of complexity, because a general scientific method for complexity management of socio-economic systems has not been discovered so far. A simple reduction by dividing the comprehensive systems up into part-systems can destroy the relationships and cause wrong explanations and wrong recommendations to the managers. That could be risky for the system's sustainability[14] and it is one of the main reasons why scientists are actually satisfied with description, definition and classification of complexity.

The complex structures are difficult to evaluate and to interpret. Here is concise overview of some milestones in the development of complexity management:

- In the 1950 BERTALANFFY published his General Systems Theory. He used to compress the complexity of systems and designed his theory based on requirements of system modeling. His theory is still fundamental for the interpretation of complex organizations.[15]

- In the 1960ies ANSOFF dealt with a holistic view and described the characteristics of synergy effects between system elements. He summarized the synergy effects in consistency tables to classify the relationships. [16]

- In the 1970ies BEER compared the hierarchic structure of companies with the organization and the behaviour of viable systems.[17] He interpreted the brain and the spinal cord as the

[11] Baumann, M. Kistner, A. (2000): e-business, 109.
[12] ULRICH, H. (1968) Die Unternehmung als produktives soziales System, 45.
[13] MAINZER, K. (2008): Komplexität, UTB: Paderborn, p. 10 - 12. The new discipline that supports research in economic systems by the transfer of mathematical or physical methods is called "econophysics".
[14] NIVEN, P. (2003): Balanced Scorecard, 120.
[15] BERTALANFFY, L. (1950): An Outline of General Systems Theory, *British Journal for the Philosophy of Science*, Vol. 1, No. 2.
[16] ANSOFF, H. (1966): Management Strategie, 100-103.
[17] BEER, S. (1972): Brain of the Firm, pp. 135.

strategic management and the organs as the company's departments. Also he saw a central criterion of viability in self regulation by feedback control and explained the regulation of complex systems by cybernetic methods.

- During the 1980ies information systems showed increasing performance and most scientists tried to manage complexity by the new software applications. Finally the method was again a fragmentation of complex systems into many part systems that were analysed for themselves. Afterwards the solutions of the part systems were combined to a solution for the complex main system. With the help of IT more difficult algorithms were created.[18]

- After a change of paradigm in strategic management in the 1990ies the method of complexity-reduction by fragmenting the problem was replaced by the holistic approach. As the Balanced Scorecard Analysis shows, this approach works with overlapping views of the complex system that must be combined finally by a holistic view. [19]

- Just in the new century a general method of complexity management is still not in sight. Scientists experiment with soft-computing to improve the holistic approach for better adjustment and prediction of fast situational changes.[20]

Actually the sciences have developed several **classifications of complexity** to find different solutions for different complexity classes. For example in less complex organizations the inset of cybernetic management models is often criticized as not useful and in systems that highly depend on soft facts, like personal values, qualitative indicators have to be discovered first.[21]

MALIK designed an approach to **measure complexity** of organizations by criterions that consider uncertainty, variety, capacity of management and the company's individual situation. He designed system categories of different complexity degrees to show that businesses of different complexity have various demand for complexity management.[22]

The company's size is not related to complexity. Sometimes bigger companies have simpler structures than small businesses. DRUCKER found out that a critical value, he calls **complexity barrier**, determines the difference.[23]

[18] SCHMIDT, D. (1991): Strategisches Management komplexer Systeme, 29.
[19] BEA, F.X., HAAS, J. (2005): Strategisches Management, 32.
[20] AUYANG, S.Y. (1999): Complex Systems Theories, p. 27.
[21] Kaplan/Norton (2008): The Execution Premium, 52.
[22] MALIK, F. (1984): Strategie des Managements, 83.
[23] DRUCKER, P. (1974): Management-Tasks, 664.

Influence of the Digital Revolution

Complexity theory and chaos theory are directly related. Some scientists make a clear difference between **complexity and chaos**. They describe complexity as a regulated system of patterns which depend on special algorithms, while an absenteeism of such algorithms is typical for chaos.

The chaos cannot be predicted, because it refers to random-disturbances that destroy relations. Other scientists interpret chaos only as a high form of complexity, for which algorithms are unknown.[24] This example shows that scientists still learn about complexity and networks.

The use of ICT/IS can support the analysis and the development of suitable algorithms by controlling a large amount of networked information.[25] Enterprises are in trouble to adjust the extremely fast technological changes. So information management has gained significance in the development of higher performance.[26]

But on the other hand the use of IT and the digital economy development have made companies' structures and environment more and more complex. Additional scientists talk about complexity as a result of information overflow and plead for recognizing only the "relevant information".[27]

DRUCKER believes that the digital economy revolutionises the world of business by creation of complex relationship systems. He thinks that the influence of the digital revolution, especially the Internet, can be compared to the change initiated by GUTENBERG's book-printing.[28] Therefore it is an important requirement for SME to learn how to manage complex systems in order to remain competitive.

Soft-computing, like neural networks and fuzzy logic has been evaluated to recognize system pattern of complexity categories and predict situational changes. Dynamic systems are in a permanent state of disequilibrium or continuous flow equilibrium. Caused by that, they make possible new processes of adjustment and learning.[29]

In the last years first successes have proved the general possibility to use neural networks together with the cascading scorecards of **Balanced Scorecard (BSC) analysis**. That combination could have been an important step in complexity management, because in practice the BSC analysis has developed to be one of the most significant performance measurement systems in strategic

[24] VESTER, F. (1999): Die Kunst vernetzt zu denken, 15.
[25] Steinle, C. (2005): Ganzheitliches Management, 41.
[26] DRUCKER, P. (1999): Management, challenges for the 21st century, p. 102.
[27] MALIK, F. (1984): Strategie des Managements, 83.
[28] DRUCKER, P. (1999): Management, challenges for the 21st century, p. 102.
[29] AUYANG, S.Y. (1999): Complex Systems Theories, p. 27.

management. An opinion poll by Cranfield University in 2003 showed that about 75% of the US companies that do a formal performance measurement, use the Balanced Scorecard analysis.[30]

Even when IT and measurement systems are used, complexity management still remains a very difficult duty and the managers can do a lot of mistakes. Typical **mistakes of complexity management** are described by DÖRNER.[31]

The manager must set *general aims*, has to *regard synergy effects*, must avoid a surplus of *regulation*, should consider the *strategy implementation* and *control* all phases of the process by regularly feedback. Those mistakes are to be avoided by using a systematic complexity management. Actually the holistic approach is the most promising approach for such a systematic management of complex systems.

Therefore the Balanced Scorecard (BSC) analysis by Kaplan/Norton [32] is a suitable framework for complexity management in SME, because it supports the **introduction of e-business strategies** by a holistic management approach. Two possibilities to introduce them can be identified: The IT-BSC[33] with the four traditional perspectives and alternatively the implementation of an additional "E-Business" perspective[34]. In practice SME often show high barriers against a complete restructuring offered by the IT-BSC and the dependence on external advisors. They are more open to testing and slow implementation of e-business strategies as presented by the additional "E-Business" perspective. Their advantage compared with big companies lies in their higher flexibility, which allows them to do restructuring much faster.[35]

The additional "E-Business" perspective seems to be a good solution for SME, because it is based on the proven BSC method, makes SME more open for learning to use the new e-business strategies[36], what makes the implementation more sensitive, and keeps their self-sufficiency.

Conclusions

Today all companies have to deal with a **growing complexity** of their business environment. One important factor was the IT revolution that changed the terms and conditions for a lot of businesses, brought new competitors into markets and forced enterprises to adjust their business strategies.[37]

[30] Marr, B. (2004): Business Performance Management.
[31] DÖRNER, D. (1975): Problemlösen als Informationsverarbeitung, p. 40.
[32] KAPLAN, R., NORTON, D. (1992): Balanced Scorecard, 71.
[33] BÖH, A., MEYER, M. (2004): IT- Balanced Scorecard, 103.
[34] MANDORF, S. (2009): Strategic Management of Complexity, 57.
[35] HÖLLER, J., PILS, M., ZLLABINGER, R. (1999): Internet, 279-282.
[36] SCHREIBER, G., ET AL. (1999): Knowledge Engineering, pp. 4.
[37] BAUMANN, M., KISTNER, A. (2000): e-business, 498.

As a result they tried to restructure their internal and external processes and relationships, e.g. the development from a "brick-and-mortar" to a "click-and-mortar" or even a virtual organization. Another example is the use of the Internet as a new distribution channel.[38] But those changes overtaxed many SME and extreme problems appeared in restructuring. In Europe about 200,000 SME will be driven out of the market only in 2009.[39]

According to the actual state of the art **e-business management is a high potential management concept for SME** in the complex conditions of digital economy and therefore an important competitive advantage for modern companies.[40] It supports SME in the restructuring process and gives them a solution to manage the growing complexity of the environment. So SME must learn to work with e-business strategies and to use the potential of information systems for controlling tasks and an alignment of their processes to the new strategic goals.[41]

One important aspect is the consideration of soft facts, which have a growing influence on the company's success in the digital economy.[42] Information systems help to uncover these soft facts and therefore have left their role as a *business enabler* and become more and more important as success factor.[43]

Thus SME are forced to control the formal implementation of e-business strategies, keeping the sustainability of their businesses, because in some years the digital economy will have adopted most of the economic processes.[44]

In that case **organizational inertia** of employees and other stakeholders can be a psychological problem. In SME these groups are less computer-literate and often not qualified in e-business strategies. That is a main reason, why they build barriers against an adaptation of digital processes.[45]

On the other hand **restructuring is a very costly project** and SME can not afford to risk a failure of the reorganization processes, because most SME have extremely scarce resources. The credit crunch of the last years after the European "Basel II"-agreement and the economic crisis has made that situation even worse. The necessary investments of SME in technological innovations and structural transformations have dropped.

So European SME lost immense competitive advantages to their competitors from the Asian continent. Previously the European governments could not protect the domestic markets from that

[38] BAUMANN, M., KISTNER, A. (2000): e-business, 271.
[39] www.euractiv.com/en/innovation/commission-expects-bankruptcy-surge-2009/article-180759 for 2009/03/30.
[40] CUNNINGHAM, P., FRÖSCHL, F. (1999): Electronic Business Revolution, 34.
[41] EGGERS, B. HÖPPEN, G (2001): Strategisches E-Commerce-Management, 335.
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[44] ZERDICK, A. ET AL. (2000): E-Conomics, 16.
[45] TURBAN, E., ET AL. (2008): Electronic Commerce, 44.

accelerating globalization processes. The SME are still confronted with their environment's growing complexity. [46]

The **complexity management in SME by e-business management** is one of the big challenges of the coming years, because SME are the biggest European employer and represent more than 50% of the European GDP.[47]

Every SME has to consider individual success factors and cannot copy the BSC analysis of another company. In future soft-computing and technological innovations will improve the information systems to support the customization of strategy design and implementation. In an interim stage on the way to digital economy it is essential for SME that they learn to "love change" and take every opportunity for restructuring.[48]

More and more arguments draw the attention on the advantages of the Balanced Scorecard analysis in connection with a complexity management in SME. While big companies are successfully using the BSC approach since more than ten years, most SME have still to be persuaded.

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[46] http://euobserver.com/19/27931.
[47] www.euroleather.com/smesrd.htm, In 2005 small and medium-sized enterprises (SME) represented about 65% of Europe's GDP
[48] Drucker, P. (1999): Management Challenges for the 21st Century, 61.

[17] MAINZER, K. (2008): Komplexität, Wilhelm Fink Verlag GmbH & Co. Verlags-KG, UTB 3012: Paderborn.
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