

**Susanna Mandorf**

## **Strategic Management of Complexity**

**Mastering of Complexity in small and medium-sized enterprises (SME) within a Balanced Scorecard (BSC)  
Analysis for the special case of the additional Perspective  
"E-Business"**

**Doctoral Thesis / Dissertation**

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**Strategic Management of Complexity**

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**Mastering of Complexity  
in small and medium sized enterprises (SME)  
within a Balanced Scorecard (BSC) Analysis  
for the special case of the additional Perspective “E-Business”**

**by**

**Susanna Mandorf**

**2009**

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## Abbreviations

AI	artificial intelligence
APS	advanced planning system
approx.	approximately
BSC	balanced scorecard
CAD	computer aided design
CAM	computer aided manufacturing
CAP	computer aided processing
CIM	computer integrated manufacturing
DSS	decision support system
e-	electronic-
e-business	electronic business
e-commerce	electronic commerce
e-financial	electronic financial
ED	editor
e.g.	example given
EIS	executive information system
ERP	enterprise resource planning
etc.	et cetera
fig.	figure
info	information
IS	information system
IT	information technology



MIS	management information system
NN	neural networks
p	and the following page
pp	and the following pages
ROI	return on investment
SME	small and medium-sized enterprises
Univ.	University

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# 1. Introduction

## 1.1. Issues of the Thesis

We stand at the beginning of the **age of digital revolution**. Now it is also time for small and medium sized enterprises (SME) to manage the step from the brick-and-mortar structure to the click-and-mortar structure. Some of them should be able to adjust to the organization structure of virtual companies.

The author was working as a managing director of a medium-sized enterprise in the real estate sector for many years and tried to bring the company from the brick-and-mortar status to a modern company that uses IT and business intelligence methods to restructure for the challenges of the new century. This thesis is about the author's experiences, when she introduced a new information system using e-business and tried to develop her company into a learning enterprise.

She saw that many SME failed in that restructuring and lost their market position because of ignorance against the need of the new market processes. Everything changed because of the introduction of digital economy. Most of the SME had no clear strategy for such a change and despaired with the choice of a strategic management tool for such a restructuring. They had to manage a lot of **difficulties**, like less qualified personnel, a low capital assets and capacities, and they had to overcome many internal and external barriers against a structural change of the business processes.

Many managers said that economic environment had become more complex and that it was easier in former days to manage changes in the company's conditions. The old leaders had made strategic decisions intuitively out of their experience or thumb-rules and the complex environment did not allow that any more. After the Basel II agreement of the European Union appeared, the banks demanded business plans and made rankings to grant loans. For many SME that was an absolute new situation. They had to change their managerial thinking completely. At this time many of the long-standing and famous family businesses in the real estate sector were closed down, some of them more than seventy years old, because the owners or managers were not able to adjust to the new conditions.

The author thought about what could help her company to deal with a rising complexity and initiated new management strategies. She decided to enlarge the **Balanced Scorecard (BSC) analysis**, which was a new management method of the beginning century used by many companies to support reorganization.

Several arguments encouraged that decision.

It was an important criterion that the BSC analysis is a holistic approach, because after the credo of simplifying and reducing of business relationships the holistic approach had been again preferred in the strategic management.<sup>1</sup> The **return to holistic view in strategic management** means a combination of partial analysis of the company's strategic business areas or departments and a consideration of their interdependencies. So synergies can be determined and taken into account by the planning.

In the late 1990ies the BSC analysis by Kaplan/Norton became a very popular holistic approach of the strategic management.<sup>2</sup> Also SME record experiences with that management tool. Meanwhile it established as a typical instrument of strategic management research. That is a good reason to use it as an example of a fundamental holistic method in the analysis. After more than ten years of practical experience with the BSC analysis there is enough literature about this method. In general it can be used as a framework to install an information system (IS) in the company and to analyze the complexity of the environment.

KAPLAN/NORTON suggested an **enlargement or change of the BSC perspectives** to be able to adjust the scorecard system to the individual situation of each company.<sup>3</sup> They were aware that their four classic perspectives were not the central dimensions for every time, but need to be adjusted, when the economic environment of a company changes. Exactly such a change happened, when the digital economy appeared. That is a main reason, why a new perspective is important to consider the e-business strategy.

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<sup>1</sup> STAEHLE, W.H. (1999): Management, 43.

<sup>2</sup> KAPLAN, R., NORTON, D. (1992): The Balanced Scorecard, 71

<sup>3</sup> NIVEN, P. (2003): Balanced Scorecard, 39.

In practice most of the SME use only the four basic perspectives that are described in the fundamental literature. They do neither dare to create alterations of the perspectives nor to change or modify the shown procedure. These companies need a support, how to add the **e-business perspective** to consider the digital economy. For this reason it is necessary to give stimulation to the business practice, how to handle goals, structures and initiatives of such a new perspective. There is a permanently increasing supply of hardware and software solutions to support or partly take over the processes of the company.<sup>4</sup>

The balanced scorecard respects **soft facts** in its calculations.<sup>5</sup> In the digital economy these soft facts become more and more important. In former times the managing directors of SME often ignored the knock-on effect of soft facts. They orientated mainly about financial figures. But the digital economy has to consider different strategies. Some statistics depict that even up to 80% of a company's profits in the digital economy depend on soft facts. Managers have to learn dealing with soft facts and intrinsic values. As DRUCKER says, the experience of every employee can be used as a source of value added. An employee can never be trained or involved too much, because he/she has a big financial stake in the outcome. When the traditional managers felt threatened by change, bothered by uncertainty, because they preferred predictability and wanted to inclined to change the status quo, now the entrepreneurial manager must be confident in his abilities and has to seize every opportunity for a restructuring.<sup>6</sup>

From this point it is only a short step to the company as a learning enterprise. It was too early to evaluate the enlarged BSC analysis about its contribution to change the company of the example to a learning enterprise, but meanwhile also SME of other business branches have recognized the need of some kind of IT perspective to manage the complex market conditions of digital economy and there is a huge mood for digital revolution.

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<sup>4</sup> BAUMANN, M., KISTNER, A. (2000): e-Business, 109

<sup>5</sup> MORGANSKI, B. (2003): Balanced Scorecard, 48.

<sup>6</sup> Drucker, P. (1999): Management Challenges for the 21st Century, 61.

## 1.2. Structure of the Thesis

### Chapter 1: Introduction

The introduction deals with the issues of the work and its structure. It contains of both here in the report described sections 1.1. and 1.2.

Restructuring of SME to give them sustainable viability in the digital economy is a **complex phenomenon** of today's businesses and the management of complexity with the various management methods becomes more and more important for the enterprises. In former times most economies had fix and clear structured processes. But due to the globalization and the proceeding technology modern companies are forced to handle more complex corporate structures, more complex processes, more complex products and a more complex environment. They are all connected by complex relationships. Actual the holistic management methods are preferred in the literature to manage this complexity problem.<sup>7</sup>

An example for a typical holistic method of today's strategic management is the balanced scorecard (BSC) analysis. So the author came to the solution to use an enlargement of the BSC by a perspective *e-business* to deal with the restructuring of SME from brick-and-mortar companies to click-and-mortar companies.

The **motivation for this thesis** mainly came from two facts:

On the one hand a so called *e-business management* has formed. It would be important to integrate such an e-business management in the top-management of the companies and not outside by third parties that do not know the details of the companies situation and strategies so that they give wrong recommendations.

On the other hand the businesses need an example how to realize the additional e-business perspective of the BSC analysis consequently, e.g. which initiatives could be important to reach the goals, which indicators could be measured. Many SME are in fear to free themselves from the four fundamental BSC perspectives described by KAPLAN/NORTON and introduce other perspectives. So the scorecard

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<sup>7</sup> NIVEN, P. (2003): Balanced Scorecard, 120.

system loses enormous flexibility and adaptability. They need examples and encouragement to add new interesting perspectives to the BSC analysis.<sup>8</sup>

## Chapter 2: Complexity as a typical Characteristic of Companies

As described in **section 2.1.** complexity is a typical quality of natural systems. Diverse complex organisms or patterns exist frequently everywhere in nature.<sup>9</sup> Until now humans are not able to explain exactly, how the single elements of such complex systems act together, which elements depend on each others and how the complex situations can be influenced from outside the system to achieve intended reactions. But scientists agree that complexity is a *general quality* of natural systems and need to be managed.<sup>10</sup>

Because of the fact that scientist do not understand complex phenomenon, they have to be satisfied with the description, definition and classification. **Section 2.2.** shows the **criteria to measure complexity** by MALIK (1984):<sup>11</sup>

- Uncertainty (a process allows different results)
- Variety (of relations and system elements)
- Capacity of Management (of complex conditions, for example: environment)
- Situativity (many possible developments of a situation must be considered)

Due to these criteria system categories of different complexity degrees can be formed.

But even when the management of complex systems could be possible, some important peculiarities have to be considered to avoid engrave mistakes. DÖRNER described already in 1975 which mistakes have to be avoided by the management

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<sup>8</sup> NIVEN, P. (2003): Balanced Scorecard, 39.

<sup>9</sup> MILGRAM, S. (1982): Das Milgram Experiment, Buchanan, M. (2002): Small Worlds, pp. 15.

<sup>10</sup> ULRICH, H. (1968) Die Unternehmung als produktives soziales System, 45.

<sup>11</sup> MALIK, F. (1984): Strategie des Managements, 83.



of complexity.<sup>12</sup> He found out, that **typical mistakes in the handling of complex relations** were repeated several times by different scientists. One of them is for example the disregarding of networks between the system elements by separating the critical data. So many cause-and-effects-relations get lost.

Only when the scientists will not merely describe the complex structures, but also give explanation to rule them, they achieve a real *management* of complexity. The existing approaches even pave the way for such a complexity management by the collection of knowledge about the behaviour of complex systems. Scientists all over the world try hard to resolve this challenge.<sup>13</sup>

**Section 2.3.** portrays the characteristics of companies interpreted as complex systems.

Already in the 1970ies ANSOFF was engaged with the fundamental characteristics of interdependencies. He called the found effects: **synergies**. He classified the synergies into effects that reinforce each other (positive synergies), effects that hinder each other (negative synergies) and effects that are independent of each other (neutral synergies).<sup>14</sup>

These results could be transferred to the interdependencies of companies. For example the reactions of single departments could influence each other by competition about resources (negative synergy) or by division of costs and findings of research and development (positive synergy).

Besides the *internal effects* a company is also influenced by *external forces* from the **environment**.

The environment describes the surroundings of the company. That is the superior system, where the company acts in. The limits of the surroundings blur due to system-overlapping value chains and processes. So an objective restriction of the system's capacity is difficult.<sup>15</sup> Companies are in a permanent process of adaptation to the changes of environment.<sup>16</sup>

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<sup>12</sup> DÖRNER, F. (1975): Problemlösen als Informationsverarbeitung, p. 40.

<sup>13</sup> VESTER, F. (1999): Die Kunst vernetzt zu denken, pp. 18.

<sup>14</sup> ANSOFF, H. (1966): Management Strategie, 100-103.

<sup>15</sup> SMIRCICH, L., STUBBART, C. (1985): Strategic Management, pp. 725.

<sup>16</sup> STAEHLE, W.H. (1990): Management, pp. 47.

With the new “**IGLOO**”-concept the author shows which new influences appeared by the digital economy and how the companies had to adjust to the varying situation. The phenomenon of learning considers such adaptations to the environmental changes. The system becomes a learning system that can develop its own success factors and ability for *self regulation* by its broad knowledge base and collected experiences about methods and reactions of the system.<sup>17</sup>

Due to the learning a system becomes adaptable and viable.

### Chapter 3: Choice of Strategic Framework

In **section 3.1.** the holistic approach is discussed as a framework for the analysis. Today the reduction of complexity is criticized, because usual instruments of reduction destroy the network connections between the system elements.<sup>18</sup> This can cause wrong interpretations and the onset of wrong initiatives in the company. By that reason another change in paradigm of the strategic management happened. Instead of a reduction the **holistic approach** became more interesting again. In the holistic approach the part-analyses of the company are examined of network connections and interdependencies to work out synergies. So the complex network of the system should be kept. In this sense the scientists classify the method as a *management* and no longer talk about a *reduction* of complexity.<sup>19</sup>

A typical holistic instrument of the strategic management in our times is the balanced scorecard (BSC) analysis, which is described later.

A main quality of the BSC analysis is the consideration of **soft facts** besides the hard data of accounting. The importance of soft facts has increased in the last years due to the introduction of IT and the transformation in electronic business processes in the companies.

Studies have shown that in average the share of soft facts about a company's profit can amount up to 80% in the digital economy. So the soft facts are a less

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<sup>17</sup> MINTZBERG, H., AHLSTRAND, B., LAMPEL, J. (1999): Strategy Safari, pp. 240.

<sup>18</sup> BEA, F.X., HAAS, J. (2005): Strategisches Management, 32.

<sup>19</sup> MINTZBERG, H., AHLSTRAND, B., LAMPEL, J. (1999): Strategy Safari, pp. 183.

used potential.<sup>20</sup>

A main problem of soft facts is the measurement. Up to now the economists use cardinal scales that can only give rough estimates. The IT has brought out solutions to support the measurement and interpretation of hard and soft facts.<sup>21</sup>

The calculation of optimal solutions or relevant solution alternatives should support the management by choice of functional management initiatives.

But scientific research did not bring out a comprehensive and suitable decision support system for the strategic management right now. So at the moment strategic management still depends on the abilities and experiences of the top management.

**Section 3.2.** discusses the BSC analysis as an holistic framework of the thesis.

The BSC is a scorecard system to evaluate complex relations of businesses. It summarizes the complex information to aggregates and condenses the data material for a better handiness. But it *keeps the complex character* of information.<sup>22</sup>

The BSC structures the information by perspectives. These are useful for part analyses, which are combined in a second step to a complete analysis of the whole company. The classic BSC analysis by the example of KAPLAN/NORTON shows the four perspectives: *financial perspective, customer perspective, internal business perspective* and *innovation & learning perspective*.<sup>23</sup>

In the thesis these four perspectives are added by a *fifth one: the e-business perspective*.

The actual situation of the company can be discovered by its cause-and-effect-relations. They are analysed in adoption of the **value chains** to describe the value-added-process. So both the actual state and the mechanisms to influence the internal processes can be uncovered.<sup>24</sup> To separate the single elements of the

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<sup>20</sup> HERBST, D. (2000): Wissensmanagement, 17.

<sup>21</sup> CUNNINGHAM, P., FRÖSCHL, F. (1999): Electronic Business Revolution, 68.

<sup>22</sup> EHRMANN, H. (2002): Balanced Scorecard, 77.

<sup>23</sup> KAPLAN, R., NORTON, D. (1992): Balanced Scorecard, 71.

<sup>24</sup> SCHEIBELER, A. (2002): Balanced Scorecard für KMU, 12.

value chain it is split into business areas and business units.

Due to enduring changes of the **environment** the company has to adapt permanently its behaviour and also its strategies to the environmental variations.<sup>25</sup> To control the suitability of present strategy the company defines goals to prove, if measures for the implementation of strategy are leading into the right direction. When the expected goal cannot be reached, this causes feedbacks and adaptations of the strategic methods.

#### Chapter 4: Necessity of a fifth perspective e-business

**Section 4.1.** describes why a new perspective e-business was added.

The e-business deals with the steering of companies by methods of the electronic data processing. These are the fundamentals for the management, so that the structure of the company has to be adapted by the possibilities of IT and information systems.<sup>26</sup>

According to that the requirements include well-trained personal that is able to realize the possibilities of e-business and use them for all processes. That is important to develop the complete potential of the IT.

The e-business especially consists of the main area **e-commerce**.<sup>27</sup> In literature it is usually described as the trading by the Internet. The data transfer between the single instances happens by highest speed and the transferred quantities of data are gigantic. Internet is used by (nearly) all modern companies and the traditional business processes are transferred into electronic processes.

In **section 4.2.** the author discusses the **formal requirements of a BSC enlargement** by a new dimension.

The new perspective is assigned by several goals. These goals transfer the company's strategy. Typical goals of the perspective *e-business* could be: cost effectiveness, data quality, data security and data protection or the opening of new markets by inset of electronic supports.

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<sup>25</sup> HORVATH & PARTNER (2001): Balanced Scorecard umsetzen, 99.

<sup>26</sup> CUNNINGHAM, P., FRÖSCHL, F. (1999): Electronic Business Revolution, 34.

Further **the relation of a new dimension to the existing four perspectives** of the scorecard has to be cleared. Because of the interdependencies between the perspectives, synergy effects are expected.

So this section analyses, if the effects of e-business reinforce by measures of the other perspectives, if they diminish or if they are neutral. For example the aspect of costs by building up an information system as a base for e-business management connects the *e-business perspective* with the *financial perspective* of the BSC.

In **section 4.3.** the **fundamental balanced scorecard analysis of the perspective e-business** begins with some general reflections.

At first **typical strategic business areas of e-business** are exposed. Certainly these business areas are different and individual for every company, so only a general analysis can be shown.

Typical business areas of the e-business are for example the administration of the company, which uses the IT especially to support routine jobs, the distribution by the internet as a distribution channel and the possibilities of marketing by e-business measures.

Then **representative business strategies of e-business** are described. Most business strategies were transferred from the conventional business to the level of e-business. Sometimes little modifications were necessary. At the beginning of the millennium many analyses were done to prove if e-business is ruled by other regulations than conventional business. The studies showed that the regulations and laws of economy are the same in both kinds of business that means electronic and conventional businesses. Following by that the strategies of conventional business generally can be used also in e-business.<sup>27</sup> The most famous strategy in e-business is the *diversification* of different product types. Typical forms of the diversification are the one-to-one-marketing, the branding and the creation of lock-in effects. Other highly important e-business strategies are the speed leadership

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<sup>27</sup> JUDSON, B., KELLY, K. (1999): E-Commerce.

<sup>28</sup> ZERDICK, A., ET AL. (2001): Internetökonomie, pp. 1.