SYSTEM VIABILITY OF ORGANIZATIONS AND THE AETIOLOGY OF ORGANIZATIONAL CRISIS

A Quantitative Assessment of Stafford Beer's Viable System Model

SYSTEMISCHE LEVENSVATBAARHEID VAN ORGANISATIES EN DE ETIOLOGIE VAN ORGANISATIE CRISES

Een kwantitatieve toets van Stafford Beers 'Viable System Model'
(met een samenvatting in het Nederlands)

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Michael Dominik PFIFFNER

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Promotoren: Prof. dr. S.G.L. Schruijer

Prof. dr. J.P.P.E.F. Boselie

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Committee: Prof. dr. M. van Bottenburg

Prof. dr. A.J. Meijer

Prof. dr. E.F. Loos

Prof. dr. P. Curşeu

Prof. dr. A. Wierdsma

1 Abstract

1.1 Abstract in English

Michael Dominik Pfiffner

System Viability of Organizations and the Aetiology of Organizational Crisis

A Test of Stafford Beer's Viable System Model and a Quantitative Assessment of the System Viability of Organizations for the Understanding and Pre-Emption of Organizational Crisis

Keywords: System Viability, Organizational Crisis, Failure, Management Cybernetics, Early Recognition, Prevention, VSM

Subject of this dissertation is the aetiology of crisis processes which place organizations under existential threats and which often cause organizational demise and bankruptcy. To date, research on organizational crises (OC) has not succeeded in identifying the generic grounds for these detrimental processes in organizations. Instead, by referring to the complexity and to the assumed multi-causality of the phenomenon, research has continued to provide only either general observations or deep singular analyses of often prominent crisis cases, which provide no generalizable insights. To help practice fight OC, other researchers have produced lengthy lists of crisis symptoms or developed multi-theory approaches finding, for example, external shocks responsible for OC, whereas others, using different theories, found the opposite to be the real origin of OC. Dozens of crisis stage models or crisis archetypes have been suggested to spur understanding of the phenomenon. However, from all these findings no sound idea of what governs the aetiology of OC could be derived; on the contrary, all too often the findings were conflicting or incommensurable.

A minimal consensus can be found in literature about some basic characteristics of *slowly developing* OC of *non-catastrophic, non-sudden* origin, which is the research object of this dissertation. The most often men-

tioned traits of such OC are: a) Increasing complexity and, at the same time, decreasing means of remedy in the course of OC. b) Ineffectiveness or adverse effectiveness of conventional management measures towards OC. c) Existential threat to the whole organization as a consequence of OC. d) Often very long incubation time with locally triggered or random place of OC outbreak. e) Unclear or seemingly multiple OC origins.

It turns out that opaqueness and increasing complexity are two commonly reported properties which make OC both difficult to understand and to counteract as a manager, and also hard to explore theoretically.

Many disciplinary approaches to explain and counter OC exist. Marketing, finance, organization, production, HR or IT have *functional* explanations as to why organizations would fail. However, explanations such as too small market share, too high interest cost, inefficient work processes, insufficient manpower or obsolete programming are superficial observations which neglect the underlying shortcomings of OC or indicate problems only after OC has already damaged vital parts of organizations.

Complex, multifaceted and non-transparent phenomena are the research object of systems sciences, which deal with sets of *invariant rules* that are at work in systems and which are decisive for the behaviour of these systems. Because OC *are* complex, multifaceted and non-transparent phenomena, this thesis looks at OC through the lens of system science. Using a systems, or more precisely, a management cybernetic theory called the Viable System Model (VSM) to address those issues, this work has overcome obstacles, observed in earlier research.

The VSM is a topological model of the invariant control structure of any viable system; independent of an organization's individual design. It defines the necessary and sufficient conditions for organizational viability, a fact that makes the VSM interesting for OC research: If the VSM defines the necessary and sufficient conditions for organizational viability and if OC is a process which threatens an organization's viability, then OC must infringe these conditions and, therefore, the VSM conditions can be used to understand and predict OC.

To test this hypothesis the viability conditions of the VSM have been operationalized and translated into a questionnaire. For that purpose, the situation vignette method has been developed, defining idealized control situations and allowing multiple issues of the rich VSM to be evaluated within a limited number of situation vignettes or questions. With it, the system viability of two groups of organizations has been retrospectively evaluated: one group of 74 organizations that experienced existential crises and one group of 61 institutions that did not. To avoid key informant bias effects due to the involvement of management teams which were responsible for the evaluated organizations, the evaluation has been conducted by independent third party experts with a controlled sound knowledge of these organizations.

To take into account the many interconnected and dependent systems, sub-systems and principles of the VSM, a partial least square structural equation modelling (PLS-SEM) approach has been used to establish statistically the causal relationship between the availability of the viability conditions of the VSM and the prevalence of OC in the sample. On the basis of the above 135 cases, a significant and strong connection between system viability based on the VSM characteristics and the occurrence of organizational crises was found.

This means that the null hypothesis of this thesis, that the phenomenon of organizational crisis *cannot* be explained by the system viability of organizations, was rejected or conversely: system viability of organizations is strongly connected with the occurrence of OC. With these findings, the contribution of this dissertation is threefold, it provides a quantitatively underpinned increase in knowledge about the aetiology of organizational crises, a qualitative framework coded in plain language for the early recognition and prevention of organizational crises in practice and a quantitative test of the Viable System Models substantial claims.

For both practitioners and researchers, the findings of this dissertation provide useful starting points on how to pre-empt and further explore OC in the endeavour to protect valuable resources and achievements with businesses and public authorities.

1.2 Abstract in Dutch

Levensvatbaarheid van het systeem van organisaties en de etiologie van crises in organisaties

Een test van Stafford Beers 'Viable System Model' (VSM) en een kwantitatieve evaluatie van de levensvatbaarheid van het systeem van organisaties met het oog op de preventie en de vroegtijdige detectie van crises in organisaties

Sleutelwoorden: levensvatbaarheid systeem, crises in organisaties, mislukking, managementcybernetica, vroegtijdige onderkenning, preventie, VSM

Het onderwerp van deze dissertatie is de etiologie van crisisprocessen die een bedreiging vormen voor het voortbestaan van organisaties en die deze vaak ten onder of failliet doen gaan. Tot op vandaag is er nog geen enkel onderzoek in geslaagd de algemene oorzaken te achterhalen voor deze negatieve processen binnen organisaties. Omwille van de complexiteit en de aanname dat er verscheidene factoren verantwoordelijk zijn voor dit fenomeen, blijft onderzoek steeds opnieuw ofwel algemene opmerkingen, ofwel zeer specifieke analyses van opmerkelijke gevallen naar voren schuiven die geen generaliseerbaar inzicht bieden. Om deze crises in organisaties te helpen vermijden, hebben onderzoekers uitgebreide lijsten van crisissymptomen opgesteld of verscheidene theorieën ontwikkeld die bijvoorbeeld externe schokken verantwoordelijk stellen voor deze crises. Andere onderzoekers daarentegen maken gebruik van andere theorieën om net het tegenovergestelde aan te halen als oorzaak van crises binnen organisaties. Er werden al tientallen crisismodellen of crisisarchetypes uitgewerkt om een beter inzicht in het fenomeen te krijgen. Maar in al deze studies werd nooit verwezen naar wat aan de bron kan liggen van deze crises; de resultaten waren daarentegen vaak tegenstrijdig of onderling onvergelijkbaar.

De wetenschappelijke literatuur lijkt een minimale consensus te hebben bereikt over bepaalde basiskenmerken van traag ontwikkelende

crises in organisaties met een niet-catastrofale, niet-plotselinge oorsprong. Dit type crises maken het onderwerp uit van deze dissertatie. De meest voorkomende eigenschap van deze crises zijn a) een verhoogde complexiteit en tegelijkertijd, een steeds moeilijker wordende oplossing gedurende het verloop van de crisis. b) ondoeltreffendheid of gebrekkige doeltreffendheid van de conventionele managementmaatregelen voor het oplossen van de crisis. c) gevaar voor het voortbestaan van de hele organisatie als gevolg van de crisis. d) vaak een zeer lange incubatieperiode met lokaal veroorzaakte of toevallig uitgebroken crisis. e) onduidelijke of schijnbaar veelvuldige oorzaken van de crisis.

Het blijkt dat een ondoorzichtige situatie en een verhoogde complexiteit twee vaak terugkerende eigenschappen zijn die maken dat crises in organisaties moeilijk te begrijpen zijn, door het management moeilijk aan te pakken zijn en ook moeilijk theoretisch te vatten zijn.

Er bestaan verscheidene benaderingen vanuit verschillende disciplines die crises in organisatie verklaren en deze willen oplossen. Marketing, financiën, organisatie, productie, HR of IT hebben functionele verklaringen waarom organisaties mislukken. Maar verklaringen als een te klein marktaandeel, te hoge rentekosten, inefficiënte werkprocessen, onvoldoende mankracht of verouderde programma's zijn te oppervlakkig en negerenonderliggende tekortkomingen of wijzen alleen maar op problemen nadat de crisis al belangrijke onderdelen van de organisaties heeft aangetast.

Complexe, veelzijdige en niet-transparante fenomenen vormen het onderwerp van de systeemwetenschappen die te maken hebben met invariante regels die in systemen aan het werk zijn en die beslissend zijn voor het gedrag van deze systemen. Omdat crises in organisaties complexe, veelzijdige en niet-transparante fenomenen zijn, gaat deze thesis dieper in op crises in organisaties vanuit het standpunt van de systeemwetenschappen. Omdat er gebruik wordt gemaakt van een systeem-, en meer bepaald van een managementcyberneticatheorie, het zogenaamde Viable System Model (VSM), beoogt dit werk tekortkomingen van eerder onderzoek te overwinnen.

Het VSM is een topologisch model van de invariante controlestructuur van een levensvatbaar systeem; onafhankelijk van het specifieke ontwerp van een organisatie. Het legt de noodzakelijke en voldoende voorwaarden voor de levensvatbaarheid van een organisatie vast, wat het VSM interessant maakt voor onderzoek naar crises in organisaties: Als het VSM de noodzakelijke en voldoende voorwaarden voor de levensvatbaarheid van een organisatie vastlegt en als een crisis een proces is dat de levensvatbaarheid van een systeem bedreigt, moet een crisis in een organisatie deze voorwaarden schenden en de VSM-voorwaarden kunnen dan ook worden gebruikt om crises in organisaties te begrijpen en te voorspellen.

Om deze hypothese te testen, werden de voorwaarden voor levensvatbaarheid van het VSM in een vragenlijst uitgewerkt. Hiervoor werden vignettes ontwikkeld waarbij ideale situaties werden vastgelegd en waarbij verscheidene aspectn het VSM werden geëvalueerd. De levensvatbaarheid van een systeem van twee groepen organisaties werd retrospectief geëvalueerd: een groep van 74 organisaties die in hun voortbestaan werden bedreigd en een groep van 61 instellingen die niet in hun voortbestaan werden bedreigd. Om het effect van bevooroordeling door de informanten als gevolg van hun betrokkenheid bij de managementteams, verantwoordelijk voor de geëvalueerde organisaties, te vermijden, werd deze evaluatie uitgevoerd door onafhankelijke experts met een grondige kennis van deze organisaties.

Om rekening te houden met de vele onderling verbonden en afhankelijke systemen, subsystemen en principes van het VSM, werd er gebruik gemaakt van een 'partial least square' structureel vergelijkingsmodel om het oorzakelijk verband tussen de aanwezigheid van de voorwaarden voor levensvatbaarheid van het VSM en de prevalentie van crises in de beoordeelde organisaties vast te leggen. Op basis van de 135 gevallen, werd er een significant en sterk verband vastgesteld tussen de levensvatbaarheid van een systeem op basis van de VSM-eigenschappen en het zich al dan niet voordoen van crises in organisaties.

Dit betekent dat de nulhypothese van deze thesis, namelijkdat het fenomeen van crises in organisaties niet kan worden verklaard door de

levensvatbaarheid van het systeem van organisaties, gefalsificeerd is: er is wel degelijk een sterk verband tussen de levensvatbaarheid van een systeem van organisaties en het zich al dan niet voordoen van crises in organisaties. De bijdrage van deze dissertatie is drievoudig: het verschaft een kwantitatief onderbouwde kennisvergroting over de etiologie van crises in organisaties, een kwalitatief kader in duidelijke taal voor de onderkenning en preventie van crises in organisaties in de praktijk en een kwantitatieve test van de substantiële claims van het Viable System Model.

Zowel voor de beroepsgroep als voor onderzoekers verschaffen deresultaent van deze dissertatie nuttige uitgangspunten voor de vraag hoe crises in organisaties vermeden kunnen worden en hoe ze verder kunnen worden onderzocht.

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6 Glossary

The following glossary definitions of central cybernetic and systemic concepts are owed to Clemson (1984) and Leonard (1990/revised 2004). Minor textual harmonisations were made by the author. The perusal of this glossary is worthwhile as it greatly facilitates the reading of the thesis.

Adaptation: Improving the fit between a system and its environment. The process depends on feedback to tell which alterations work best in the given environmental conditions. Failure of an organization to adapt, leads to bankruptcy, irrelevance or being voted or booted out of power.

Autonomy: Principle whereby a system is able to act as an independent or free agent, without constraint from a higher level system; control of the self.

Boundary: A boundary separates a system from its environment or from its sub and supra systems. Just as there is a subjective element in defining a system, there is a subjective element in choosing a boundary. Defining a boundary is tantamount to defining the thing that is to be considered as a “system” and those other things that are to be considered as the system’s “environment”.

Cybernetics: The science of control or as Stafford Beer puts it, the science of effective organization; a more general and easier to grasp definition than Norbert Wiener’s “communication and control in the animal and the machine”. Its root is a Greek word (“kybernetes”) meaning steersman and that has the right flavour. A steersman in a sailing vessel makes no claim to control of the winds or the tide. His skill depends on sensing and using the natural forces and movements to reach his own goal.

Entropy: A measure of disorder or of the decay of order. In cybernetics and information theory the amount of information corresponds to the degree of order in the system and the entropy to the amount of disorder. Thus, entropy and information are seen as opposing concepts with entropy defined as information with a negative sign. A system maintains its order through the

addition of information. An organization requires new infusions of effort to maintain its vitality and offset its tendency to run down.

Feedback: Feedback takes a part of a system's output and applies it to change or maintain its input. It is based on the actual rather than the potential or expected performance of the system. Feedback may either be negative (error correcting) or positive (trend enhancing). Positive feedback takes an increase in the output back to increase the input; negative feedback takes back an output to decrease the input – and is therefore a stabilizing principle.

Homeostasis: Process whereby critical variables are held within acceptable limits by self-regulatory processes. If the regulatory processes fail, the system or organism goes into a state of catastrophe. Living systems, including both organisms and organizations, generally include many control devices and processes to maintain the stability of their essential variables.

Law of Requisite Variety: A regulator of a system can only regulate if the variety disposed by the regulator is equal (or higher) to the variety generated by the reguland. In management or regulation, the objective of amplification is usually to increase the manager's variety (capability to handle the complexity generated by the operations under his or her control). Attenuation on the other hand is employed in management to prevent the situation being managed from overtaking the capacity of the manager to cope with it. Varieties should be balanced.

Le Chatelier's Principle (see also Homeostasis)**:** Tendency of a system to adjust internally and return to its former state after a disturbance. When a system in operation is hit by a disturbance, the only result may be a shift to its internal point of equilibrium. Whether this tendency is seen as an obstacle (e.g. resistance to change) or a resource (e.g. resilience) depends on the goals of the observer.

Metalanguage: Language of a higher order which is capable of discussing propositions which are undecidable in the lower level language and of discussing the limitations and operations of lower level languages.

Model: A model is an informal or formal representation of a system, made by an observer, to distinguish features of a system which are significant and to predict the consequences of a disturbance or change on the system. An isomorphic model replicates each and every feature of the thing modelled on a one-to-one transformation. A homomorphic model represents the situation as many-to-one transformation, aggregating some features of the original and ignoring others.

Observer: The "observer" is that which imputes purpose to a system. To go even further, the observer is that which *invents* the system by *perceiving* a purposive unity.

Organizational Crisis: Situation or process in which the continuity of a structured entity of actors with the intention of achieving a worthwhile goal is uncertain or threatened and, at least one stakeholder of this entity, experiences this fact as undesirable so that continuity-ensuring decisions have to be made.

POSIWID: Acronym of Beer's aphorism "[The] Purpose Of [a] System Is What It Does." It means that the (observer, manager, superior) *intended* purpose of a system is not necessarily congruent with the realized, *implemented* purpose of this system. POSIWID helps to understand a system by directing the attention to what the system *actually does* instead of what it is supposed to do. What matters are the effects; they reify a system's purpose.

Recursion: When a series of systems is embedded, one within other according to a common pattern, it is called a recursive structure: the same features are repeated invariantly from a system to its metasystem to its metasystem as in a set of Russian dolls. Some models, such as Beer's Viable System Model (see VSM), are explicitly based on recursivity.

Self-Organization: A system may be said to be self-organizing if it can alter its internal structures to increase its level of adaptation. A self-organizing system may move beyond self-regulation to alter its feedback loops and sensory information. If the environment should change, the self-organizing system must change as well in order to remain adaptive. A simpler meaning of the term is the one about systems that start with their parts

separate (so that the behaviour of each part is independent of the other's states) and whose parts then act so that they change towards forming connections of some type.

Stability: Systems exhibiting stability are in a state of balance or equilibrium in which a point representing a measurable value of an aspect of the system remains at rest or moves within set boundaries. Essential variables are those which must remain stable to insure survival or maintain the identity of the system; complex systems have a large number of essential variables which must remain within their limits if the system is to survive and prosper. Systems which are able to return to equilibrium after disturbances which were not anticipated or foreseen by their designer are said to be ultra (meaning beyond) stable.

System: A system is a set of interrelated elements with a purpose as perceived in time by an observer. For a simple system such as a home heating system, there is likely to be general agreement on its purposes, its elements and its boundaries. For complex systems, such as a transportation system, a company, or a code of laws, different observers inside and outside the system may have very different perceptions of purposes, elements and boundaries.

System Viability: Construct in this dissertation for the degree to which an organization fulfils the VSM-requirements.

Variety: Variety is "the total number of possible states of a system, or of an element of a system". It is a measure of the complexity of a system. Variety is a peculiarly useful managerial measure, because as a measure of complexity, it specifies directly the amount of regulation required for a given system.

Viability: Viability is the ability to maintain a separate existence [author's addition according to Beer (2004, p. 1)]. Viable systems have the ability to make a response to a stimulus which was not included in the list of anticipated stimuli when the system was designed (ultrastability). They can learn from repeated experience what is the optimal response to that stimulus. Viable systems grow. They renew themselves – by, for example, self-

reproduction. They are robust against internal breakdown and error. Above all they continuously adapt to a changing environment, and by this means survive quite possibly in conditions which had not been entirely foreseen by their designer. Viable systems are not immortal. Changes beyond the bouncing capacity (speed, duration, extent, quality) of a system may destroy it.

Viable Systems Model / VSM: The VSM is an organizational theory developed by Stafford Beer. As a theory, it is distinctive in several respects, in particular in view of the claim it makes. This theoretical claim is as follows: A social system is viable if, and only if, its structure fulfils a number of requirements, which the theory specifies. Concretely, according to the model, a viable organization must dispose of six managerial subsystems and their interrelationships, as set forth by the theory: (1) System 1 Management of a basic subsystem; (2) System 2 Coordination of subsystems, attenuation of oscillations between them; (3) System 3 Operative management of a collective of subsystems; (4) System 3* Auditing and monitoring channel; (5) System 4 Management for the long term relationships with the overall environment; (6) System 5 Normative management, corporate ethos. Any deficit in this structure will inevitably prejudice the viability of the organization. It must be added that the structure, outlined here only in a rudimentary form, is recursive: also subsystems (e.g. divisions) and super systems (e.g. a holding company) should be structured in accordance with the same principles [author's addition according to Schwaninger (2006a, p. 955)].

1 INTRODUCTION

1.1 Chapter Introduction

Why are organizational crises of relevance? Are they intelligible objects, mere phenomena or pure concepts? How do such crises originate? The first chapter of this thesis addresses these questions, defines the interest of the author vis-à-vis organizational crises, outlines the philosophical stance of the author and specifies the research question as well as the hypotheses. The chapter closes with a short account of the research approach.

1.2 Rationale and Research Context

In Western Europe,[1] 179'662 companies went bankrupt in 2014 according to Bretz (2015, p. 2). An estimated 1.7 million jobs Ballon (2013, p. 8) and billions of money are lost annually from bankruptcy cases of companies. Economic Darwinism, i.e. "*[…] how competition tends to weed out the less fit*" according to Brickley, Smith, and Zimmerman (2009, p. 8), suggests failure of firms to be an inherent characteristic of a market economy. However, bankruptcy cases destroy valuable tangible and intangible assets that could otherwise be allocated for the further development of wealth rather than – as Brickley, Smith and Zimmerman (ibidem) put it – being wasted in the liquidation of *"[…] ill-designed organizations that fail to adapt"*.

Comparable situations can be observed in the public sector. The bankruptcy cases of corporate or commercial firms can be seen as the equivalent of public or governmental organizations which operate inefficiently, or even ineffectively, at high money consumption rates, while essentially operating in idle mode and with low levels of output and value added. Hofmänner (2007, p. 17) names three main reasons for expensive, inefficient public activity:

[1] EU plus Norway and Switzerland

governmental monopoly leading to a lack of innovation and inefficiency; bureaucrats not acting in the public, but rather, in their personal interest and politicians catering for their clientele at public expense.

A closely related phenomenon of non-viability without bankruptcy can be observed with small subunits of big commercial organizations. The big size of the surrounding organization of such units results in a comparably inexhaustible availability of funds, while their inefficiency remains below the threshold of perception of the bigger company. Both public and sub-critical commercial organizations can be said to exist but both fail to serve their originally intended purpose; both are non-viable in spite of the availability of funds, and suffer from a living death.

It can, therefore, be concluded that non-viability and failure pertain to both commercial and public institutions, whether they go bankrupt or not. This dissertation uses the neutral term organizational crisis (OC). It stands for both public and commercial enterprises. Failure in either type of organization every year causes billions of Euros of damage, either in the form of losses or ineffectiveness. As a result, ensuring organizational viability in organizations and thus avoiding failure would be a desirable and worthwhile undertaking.

The genesis of organizational failure can be grouped by its phenomenology: Two courses can be observed, either an unexpected and (perceived) sudden decline or a slowly or gradually developing incremental self-enforcing process of progressive system failure. Zelewski (1994) distinguishes between a continuous and a discontinuous characteristic of crisis formation. Both processes increase complexity, resist standard remedial action and place the existence or the achievement of the purpose of the organization under serious threat. In short: Failure is preceded by Organizational Crisis (OC). In accordance with this, Hwang and Lichtenthal (2000, p. 131) identify two types of OC: abrupt and cumulative – the first striking suddenly and catching management off-guard, while the second accumulates stressors and eventually erupts.

Understanding, early recognition of and pre-empting OC, therefore, would protect valuable assets by allowing decision makers to continuously adapt their organization, according to the demands of the environment. Depending on the progress and severity of a gradually developing crisis process and the availability of necessary resources, a successful adaptation would mean either a gradual production of fit to the demands of relevant environment, a restructuring process to achieve the same or a controlled exit out of an obsolete business field or mandate.

Unexpectedly sudden[2] or abrupt OC, however, by definition leaves no time for adaptation. Survivability of such shocks depends only on the distinct absorption capacity of the individual organization. Survival of such crises requires precautionary decisions, disaster preparedness, resilience, recovery capacity and continuity planning. Ensuring such preparedness, in turn, is a matter of foresight and anticipatory contingency – i.e. prudent – management. With sudden OC, an important differentiation has to be made: Crises may be *caused* or *triggered* suddenly. The first group does not show a latent crisis phase in which crisis causes build up, but an instantaneous crisis caused, for example, by an earthquake in a non-earthquake area or a Fukushima event leading to new legislation to the detriment of an organization. In the second group, causes of crisis develop gradually until a threshold (of perceptibility and/or interference) is surpassed. An example for this group would be the negligence of a market intelligence unit and the subsequent failure of an important investment. While suddenly *caused* crises are a matter of preparedness, suddenly *triggered* crises are most often caused gradually over time or, according to Hwang and Lichtenthal (2000, p. 134), exhibit a period of increasing crisis occurrence probability (incubation) until a threshold limit is surpassed.

Understanding and early recognition of gradually developing OC is the subject of this dissertation. It has been a recurrent topic in academic research and numerous approaches to it have been developed to date. How-

[2] caused by so called “inevitable” incidents such as earthquakes, sabotage or terrorism

ever, a specific *"Theory of Crisis"* is not in sight, as Hauschildt in Hutzschenreuter and Griess-Nega (2006a, p. 28) states. Seifert (2006, p. 319) in her dissertation entitled "The Genesis of Organizational Crisis" states, "*[…] the field of organisational crises is still in its infancy and research findings are not integrated in an overarching paradigm.*"

This thesis does not strive to present *the* theory of crisis but aims to advance knowledge about the aetiology, prediction and prevention of OC by looking at it from a systemic angle and by observing the reverse phenomenon, organizational or system viability. Organizational viability is the *necessary* (see 3.4.1) condition for economic success and, accordingly, without exception, of overriding priority throughout organizations ranks and roles.

A systemic approach will be followed because a major problem with OC is complexity and multi- or even omni-causality, the latter meaning that virtually every organizational aspect may have the potential to be the cause or trigger of the next crisis, not to mention, interaction effects of otherwise subcritical causes. Accordingly, it is the complex genesis and nature of organizational crisis which limits the effectiveness of otherwise proven reductionist approaches or disciplines to successfully understand and anticipate OC. As Appelbaum, Keller, Alvarez, and Bédard (2012) state, "*[…] as organizational crisis* [sic!] *are in a constant state of flux, changing and adapting as the crisis progresses, traditional empirical testing alone will not provide a comprehensive understanding of the events leading to the crisis.*"

The rationale for using a systemic approach is presented in more detail in section 3.2 of chapter 3 covering the theoretical framework of this work.

1.3 Significance of the Research Project

The aim of this work is to identify the causes of OC which pose a threat to the existence of organizations. According to Müller (2013, p. 198), a long-standing turnaround expert, company re-organizations are always preceded by crises, although the need for reorganization becomes apparent a

long time before a crisis emerges. He concludes that with the availability of an instrument for early recognition, interpretation and remedial action, crises would hardly be an issue anymore; this, however, provided that management teams act upon early warning signals in a timely manner.

Müller's above statement is neither representative nor surprising, considering the sheer number of bankruptcy and failure cases. However, it illustrates the potential benefit of improved understanding of OC aetiology.

Hence, for any kind of stakeholders with an interest in the continuity of an organization, such as entrepreneurs, employees, customers, suppliers or financing partners but also for acquiring entities (Due Diligence) or prospective partners of such organizations, the findings of this study can be of use because early recognition of non-viable characteristics in organizations reduces risk and allows timely preventative measures.

Furthermore, detecting OC proneness is useful for the management of such organizations, particularly as viability analysis complements other subsystems such as early warning systems, Quality-, Risk-, Contingency, Crisis-, Foresight- or Continuity-Management tools. It provides both qualitative data such as viability appraisals, crisis causes or at least search areas for further analysis of crisis causes.

It is clear, however, that successful managerial application of crisis prognosis knowledge in the individual case, overcoming resistance to change and eventually gaining advantage out of crisis prognosis exceeds the scope of this work. These topics are subject to the particular fields of research.

From a societal point of view, the relevance of this research project is given through its contribution to both the sustainable effectiveness and efficiency of business, governmental and other organizations. The contribution results from the insights gained in this thesis about a set of invariants in the organizational and control structure of such entities, which are decisive for their viability, performance and impact as well as for the prevention of critical developments such as organizational crises. In such a way *viable* organizations increase prosperity and, in the long run, provide more effect at lower

resource consumption than organizations which one-sidedly maximize one single target variable, as the literature review will show.

With regard to the originality and the academic contribution of this work, it can be stated that – to the best knowledge of the author – the Viable System Model[3] together with causal multivariate analysis have not to date been used to explain the origin of OC. Few systemic approaches have been followed to date to understand OC and identify the invariants to control for this phenomenon, particularly not in the light of the opposite phenomenon, namely, the viability of an organization.

This thesis, in using a cybernetic approach, measures the viability of (whole) organizations and compares the results with the prevalence and severity of critical developments in these organizations. A predictive path analysis of crisis causes on the basis of the VSM produces new insights, which directly enhance the understanding of the OC phenomenon, identifies the relevant invariants to influence crisis occurrence and with it informs further research in the fields of prevention, management and remedy of OC.

1.4 Position of the Author

1.4.1 Professional Interest in the Topic

The author has been working in different executive management positions for twenty-seven years, the last sixteen of which as a management consultant and senior project director with a consulting firm in Zurich, Switzerland. The author experienced nine bigger cases of manifest crisis and heavy restructuring with both commercial and governmental organizations. Together with numerous re-organization cases of non-crisis or latent crisis organizations, the author gained deep insights into the field of viability and crisis of organizations.

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[3] Beer (1984, p. 7) uses both designations „Viable Systems Model“ and „Viable System Model“. The latter form is more common and is therefore used throughout this text.

There are two recurrent personal observations with OC in the professional life of the author. Firstly, the vast majority of OC could have been prevented by earlier and smarter action. Secondly, consultants or OC-experts are very often called in late or too late. According to Jaroschinsky and Werner (2015, p. 18), this applies to 70 % of all crisis cases. They add that 65 % of crisis expert assignments take place not before the phase of liquidity crisis or shortly before filing for bankruptcy (ibidem p. 19). Henning, Rózsa, Radner, and Murday (2010, p. 66) report that more than 78 % of organizations in crisis do not seek expert help before the stage of liquidity crisis i.e. when funds and most options to counteract crisis have already been lost.

These observations – together with the fact that a large portion of OC result in bankruptcy – intrigued the author and motivated him to look closer at the phenomenon of OC in order to systematically understand their underlying principles and identify ways to recognize OC at an early stage or, indeed, pre-empt it causing damage to organizations.

Contrary to the often heard assumption, OC is not an obvious situation with red lights flashing and sirens wailing, employees running in the aisles and commands being shouted, indeed, very often, the case is quite the contrary; people in organizations facing crisis care about their parking space or the next Christmas party, without feeling there is an emergency at all and executives deny the fact until they are running out of money. It is the high degree of diffuseness of OC – together with the tendency of the management to refuse the perception of it – that makes it difficult to identify its origins and define appropriate actions to be taken. Parties interested in the topic of OC such as consulting or management science realize that OC theory is still at an early stage – a comprehensive theory of crisis does not exist, as many OC theorists find. Therefore, understanding an OC's causes and principles in theory, while also addressing it in practice in a timely manner is a worthwhile, necessary and demanding task. The identification and operationalization of an appropriate methodological framework to accomplish this task is the aim of this work.

1.4.2 Philosophical Stance

The personal world view of a researcher is built and constantly altered by prior influence, by his or her necessarily unique life experience and by the conclusions he or she continuously draws from them. The same applies for the researcher's reflections about the nature of this knowledge building process. The resulting *individual* epistemological position (i.e. the idea of what knowledge is and how it can be acquired) basically precludes objective observation and interpretation and, as a result, generalizable insights.

To prevent such personal bias and bounded rationality from distorting the process and the results of knowledge creation, a researcher needs to follow a rigorous research approach which minimizes bias effects but instead ensures a logical chain of reasoning that can be scrutinized by third parties. This enables an open-outcome to be reached, with insights that apply in general.

With Popper and Keuth (2005) the author of the present work follows the hypothesis that all knowledge is hypothetical and cannot be verified but only falsified. Consequently, critical rationalist thinking provides the epistemological basis of the author's research.

1.4.3 Monographic Form of the Thesis

Both OC and the VSM are complex constructs. In order to operationalize measure and correlate these two phenomena, substantial and extensive defining, delimiting and explaining of the core concepts is necessary.

A monograph – besides providing the space – allows for the continuity to contextualise and coherently reflect upon and develop the arguments along the research path.

Furthermore, a cumulative thesis format – i.e. in the form of a sequence of articles in scientific journals – would have rendered the iterative working and ameliorating process between the different chapters difficult.

1.5 Research Question

The aim of this work is to answer the question about the origin of OC using Beer's closed theoretical cybernetic framework, the Viable Systems Model (VSM), and examine the relationship between viability of organizations (in this work referred to as "system viability") and the occurrence of organizational crises. The research question therefore reads:

"To what degree do the necessary and sufficient conditions for organizational viability, as defined by Beer's Viable System Model, predict Organizational Crises?"

Beer (2004, p. 1) defines the term "viable" with reference to the Oxford English Dictionary as "*able to maintain a separate existence*", and elaborates: *"An organization is viable if it can survive in a particular sort of environment. For although its existence is separate, so that it enjoys some kind of autonomy, it cannot survive in a vacuum."*

Organizational Crises, on the other hand, are processes that *threaten the very existence* of an organization.

Accordingly, the rationale behind the research question is the following:

If the VSM defines the necessary and sufficient *viability criteria* for organizations and…

…if OC is a process which threatens an organization's viability, then OC must infringe these conditions and, therefore, the VSM conditions can be used to understand[4] and predict OC.

This seems to leave open the case of constant crisis management of non-viable entities with the permanent aim of averting failure. Technically, this objection is correct because turnaround management precisely compensates for non-viable behavioural aspects of the respective organization.

[4] At least to the extent to which these criteria are intelligible and can be operationalized

However, such constant turnaround management would come at the cost of substantial resource consumption and would not be sustainable or competitive in the long run.

To exclude the possibility of the above rationale taking on a purely superficial and semantic meaning and to ensure the material validity of the above rationale later on in this work, the terms used will be clearly defined to confirm the meaningfulness of the above; furthermore, the underlying theoretical model (VSM) will be explained in detail and examples will be given.

1.6 Hypotheses

The research question of this study asks about the degree to which the viability criteria of the VSM are in fact predictors for OC. To test for this characteristic, hypotheses have to be formulated which can be tested by comparing viability and crisis variables statistically.

In natural sciences, very often absolute – i.e. deterministic – relationships are assumed. This is in sharp contrast to social science hypotheses, where as a rule hypotheses assume probabilistic (in the sense of likeliness that an event will occur) relationships because the measurement of social concepts underlies numerous and intense disturbances that cannot be totally foreclosed. Furthermore, social sciences deal with non-deterministic research subjects such as humans, complex socio-technical systems or society.

Accordingly, the hypotheses of this project read:

H_0: There is no significant predictive relationship between system viability and crisis occurrence.

H_1: There is a significant predictive relationship between system viability and crisis occurrence.

The term system viability in the above hypothesis refers to the viability conditions set out by the Viable System Model (VSM) and the operationalization of it in the present project. The term crisis in the above hypothesis refers to the definition and operationalization of OC in the present project. The term occurrence is operationalized continuously as a degree of crisis severity, rather than dichotomously in the sense of a crisis or a non-crisis state.

1.7 Research Approach

This dissertation follows a quantitative approach of theory-led deductive reasoning; with it, it answers the research question of whether system

viability predicts OC. Statistical testing is used, to examine the proposed hypotheses by conducting a causal analysis on the grounds of OC.

The quantitative base of the analysis is provided by a survey which has been carried out with 135 crisis- and non-crisis organizations.

1.8 Thesis Overview Chapters and Contents

This dissertation is structured in the following way.

Table 1 Structure of Dissertation

1 INTRODUCTION		
Rationale and Context	Project Significance	Position of the Author
Research Question	Hypotheses	Research Approach
▽		
2 LITERATURE REVIEW		
Definition Organizational Crisis		OC and Economic Darwinism
Provenance of OC		OC as Systemic Phenomenon
Development of OC		Body of Research OC Aetiology
Established Models to Understand OC		
▽		
3 THEORETICAL FRAMEWORK		
Conceptual Basis	VSM as Sc. Theory	Man. Cybernetics & VSM
The VSM		
▽		
4 RESEARCH DESIGN		
Revisiting Research Question and Hypotheses	Research Model Conceptual Model	Measuring Instrument
Data Collection	Questionnaire Design	Respondents
▽		
5 RESULTS		
Data	Data Analysis	Bivariate Statistics
Multivariate Statistics		Hypothesis Testing
▽		
6 DISCUSSION OF FINDINGS		
Re Reviewed Literature	Re Extant OC-Theory	Praxis Implications
Re Methodology		Philosophical Considerations
▽		
7 CONCLUSION		
Summative Claim	Limitations	Contrib. to Knowledge
Contribution to Literature	Conclusions for Managers and Scholars	Future Research
▽		
8 REFERENCES		
▽		
9 APPENDIX		

2 LITERATURE REVIEW

2.1 Chapter Introduction

Organizational crises (OC) and Beer's Viable Systems Model (VSM), the theory used in this dissertation, are not easily understood concepts, neither for business people nor for researchers. OC as well as the VSM are holistic and systemic concepts which abstain from the classical reductionist paradigm and in this respect, for some people, may even contradict the common school of thought. This is, on the one hand, due to unusual concepts such as the emergence of characteristics in systems (i. e. when a system becomes more than the sum of its parts) or due to the idea that accurate investigation can mean looking at the whole of a system instead of breaking up the object of inquiry analytically in any detail. It is, therefore, important to cast an intense light on both concepts OC as well as the VSM, to prepare the ground for the subsequent research steps.

Systems theory and the VSM (the latter in detail) will be introduced in the theoretical framework chapter, which follows this literature review on OC exhibiting a strong emphasis on OC aetiology. "Aetiology" from the ancient Greek αἰτία (aitia) for 1. accusation, charge, cause; 2. well-founded complaint; 3. bear responsibility, liability, accusation; 4. occasion, cause, reason for something and "Logos" ιόγος (logos) for 1. speaking, speech, 2. theorem, proposition; 3. account(ability); 4. ratio, relation, proportion; 5. reason, rationality as Gemoll and Vretska (2010, p. 505) point it out; i.e. the term aetiology refers to the theory of causation.

The field of OC is not only still in a pre-paradigmatic stage, as Seifert (2006, p. 319) puts it, but is also inherently controversial. Burns-Nurse (2002) even asks, *"Organisational Crisis – Is there such a thing?"* In her working paper, she denies any objective truth of OC when she concludes, "*Organisational crisis is an abstraction […] observable only through the behaviours and personal constructs of the organizational players […]*". However, Burns-

Nurse (ibidem) points to the pragmatic consensus within the OC literature about the existence of OC. She recognizes the practical utility of such a convention insofar as it would help gain a clearer understanding of the influences on and behaviours associated with organizational crises.

This position corresponds that of the author. In a sense, OC is a specific explanation of the way in which an organization may develop. However, in case of OC this development is against the will of stakeholders and that is why they call it a crisis, a term which has predominantly negative connotations. It is the designation of an unwanted everyday reality in organizations, which needs to be profoundly understood in order to develop and take effective countermeasures. This applies independently of whether or not crises exist in an ontological sense.

2.2 Etymological Definition of Organizational Crisis

The literature review on the aetiology of OC starts with a definition of the basic etymological terms “organization” and “crisis”. It is the aim of this section to make sure the meaning and the further use of these terms and their synonyms are clearly defined in this dissertation.

2.2.1 The Term Crisis

According to Gemoll and Vretska (2010, p. 481), the word crisis stems from the ancient Greek κρίσις (krísis) where the word had three groups of meaning: 1. separation, discrepancy, dispute; 2. selection; 3. decision (either court or aesthetic). The term crisis is etymologically related to κριτήριον (kriterion) as a decisive factor or measure for judgment and κριτικός (kritikos) in the meaning of critical which again stems from κρίνειν (krinein) to decide or distinguish. The “process or point of decision” is being common to these meanings.

The often heard idea that the Chinese term for crisis also means opportunity is unsubstantiated. With the same (false) justification one could

identify a crisis as a "*dangerous machine*", as Wirz (2009) puts it. She calls this a modern legend. It also remains unclear whether the initial translation of the term crisis has a strict synonym in Chinese.

For the modern use of the word "crisis", Tulloch (1997) quotes from the Oxford Dictionary: 1. a. decisive moment; 1. b. time of great danger or great difficulty; 2. the turning point of a disease. Here, again, a common factor can be identified, namely, the "process or point of decision". But there is a new added aspect of threat (danger, difficulty, disease) and outcome (turning point or bifurcation) for better or for worse.

Ernst (2008), referring to the Greek origin of the term, explains that starting from the 17th century in the French language and from the 18th century in the German language, the expression crisis was used for situations which demand actors to take a decision or concrete action. He adds that the term was increasingly utilized for problematic situations of all kinds that could not be solved with conventional problem solving techniques but demanded specific crisis management measures. Referring to sociological crisis theories, Ernst states that a crisis was regarded as perturbations of relations within a system or between the system and its environment, thus threatening the continuity of the system or vital structures of that system [own translation, rephrased].

In summary, the term crisis in general refers to a situation or process which is decisive for the *continuity* of something that, in the eyes of an observer, is intended to continue to exist.

An organizational crisis then is a state or process in which the continuity of an organization is threatened and at least one stakeholder experiences this state or the potential outcome of it as undesirable (for the definition of organization see the next but one paragraph).

A case of management vulgarity or even cynicism is the idea of "crisis <u>*as*</u> an opportunity". An OC puts an existential threat on an organization; accordingly, the associated risk precludes any seizing of opportunities that would expose an organization to such risk. Although the definition of crisis

above does include opportunities, it does so only to the extent that an inevitable OC (besides the risk) *also* provides (brings with it) an opportunity (in the sense of a moment of action) for improvement. Taking advantage of such an opportunity in / during OC may provide advantage to the system. But no one would take the risk of an OC to seize an opportunity. Opportunities *out of* crises have to be differentiated from crises as opportunities. Crises, as such, are by definition never opportunities. Consider, for instance, how many people would call a market opportunity or a long-awaited financing offer for a project a crisis.

Pretending that a crisis exists with the aim of pushing employees as a management technique ("*You want change? Use crisis.*"), on the other hand, not only throws up ethical issues but also jeopardises the relationship of trust between the management and the employees and wears out quickly as an effective management approach.

2.2.2 The Term Organizational

The word organization is derived from the English word organ, which stems from Latin organum for tool, which in turn stems from the ancient Greek οργανον (organon). Gemoll and Vretska (2010, p. 583) name three groups of meaning for οργανον: 1. device, tool, 1a. war-machine, 1b. musical instrument, 1c. sense organ, bodily organ; 2. [human] exponent, advocate; from ancient Greek, έργον (ergon), work, thing, deed.

Summarizing these meanings, organ is "something that does something in a higher context".

Organism, as a combination of organize and –ism, is a term from the 17th century for an array of organs, uniformly structured as a whole, which, in the 18th century, acquired the meaning of independent creature, living animal or plant.

The term organization stems from medieval Latin "organizare"; in the 15th century, also used for the act of organizing and, in the 17th century, for the nature or condition of man. According to Pfeifer (2010, p. 955), under the

influence of the French Revolution, it acquired the meaning in the 18th century of state institutions, commercial or political entities, systems and establishments and, from the 19th century, the systematic preparation of co-operative procedures and working processes. From the 20th century it referred to association of persons and parties (own translation).

In summary, the word “organization” is used to depict “a structured entity of actors with the intention of achieving a worthwhile goal”.

2.2.3 The Term Organizational Crisis

Summarizing the above definitions, an organizational crisis is a situation or process in which the continuity of a structured entity of actors with the intention of achieving a worthwhile goal is uncertain or threatened and, at least one stakeholder of this entity, experiences this fact as undesirable so that continuity-ensuring decisions have to be made.

This definition serves as a preliminary working definition of OC in this dissertation. Later, based on the insights of the literature review and VSM theory, it will be refined and honed (see 3.5.6).

2.3 The Term Organizational Crisis in the Scientific Literature

2.3.1 Pre-Standardized Stage of the OC Term

Organizational Crisis is an important term but not the only one dealing with pathological states of productive social entities. Literature dealing with the OC phenomenon uses several terms, each stressing slightly different aspects. The following terminology matrix refers to articles and monographs on the topic and lists the most frequent OC terms. As can be seen, many matrix combinations can be found. Column / row combinations such as “Corporate Collapse” indicate the terminological choice of the respective authors, e.g. Argenti (1976).

Table 2 OC Phenomenon Terminology Matrix

	-	Organizational	Business	Corporate
Failure		Mellahi and Wilkinson (2004)	Altman (1984) Balcaen and Ooghe (2006) Wu (2010) Platt (2004)	Hambrick and D'Aveni (1988)
Collapse		Rudolph and Repenning (2002)		Argenti (1976)
Crisis	Pauchant and Mitroff (1992) Mitroff and Anagnos (2001) Fink (2002) Kovoor-Misra, Clair, and Bettenhausen (2001) Weick and Sutcliffe (2007) Boin and Lagadec (2000) Peltola (2012) Hermann (1963)	Hwang and Lichtenthal (2000) Carmeli and Schaubroek (2008) Nunamaker, J. F, Jr., Weber, Smith, C. A. P., and Chen (1988) Seifert (2006) Bill Richardson (1995) Nystrom and Starbuck (1984) Probst and Raisch (2005) Fischbacher-Smith (2014)	Lin, Liang, and Chen (2011)	Abatecola (2012) Dubrovski (2007)
Burnout Dysfunction Decline Distress Death Spiral Disaster		Greve (2010) McKinley, Latham, and Braun (2013) Heine and Rindfleisch (2013) Trahms, Ndofor, and Sirmon (2013) Cameron, Whetten, and Kim (1987)	Mittelstaedt (2005)	Altman and Hotchkiss (2006) Stocker (2006) Hambrick and D'Aveni (1988)

The table shows that the nomenclature is manifold as are the connotations of the term, which gives an indication of what is to date an unconsolidated state of theoretical discussion in the field. The term “organizational crisis” might eventually develop into the standard term, as Seifert (2006) supports in her dissertation on the genesis of organizational crisis. Even though Table 2 shows that a substantial body of literature uses the simple term “crisis” for OC, this use must be criticized. With respect to OC, this denotation is etymologically and operationally under-defined and should not be used for scientific purposes as it not only encompasses business phenomena but also those from economics, psychology, the medical field, the finance sector, from military or from history, each with different meanings and purposes.

In the German-language scientific literature, the terminology for OC has undergone greater standardization than in the English literature, and the term “Unternehmenskrise”, i.e. “corporate crisis”, prevails. However, the author has chosen not to use the related English term but the one of OC. This is, firstly, due to the fact that, although the term “corporate” originates from corpus / body in the sense of an entity, today it has a predominantly commercial connotation, whereas “organization”, in this respect, is more neutral and applies for all kinds of productive social entities. This is particularly true for the German term, where “Unternehmen” (literally: “undertaking”) has a primarily commercial meaning in the sense of “business”. Secondly, the term OC has been chosen for standardization reasons as will be explained in the next paragraph.

2.3.2 Terminological Standardization

Seifert (2006), in her dissertation focusing on the genesis of crisis, qualitatively analysed forty-nine research documents with regard to the content of the OC term. She (ibidem) p. 66 ff obtained three clusters of meaning for the term organizational crisis: The first cluster’s material content was “potential negative outcome”, the second centred around “internal / external mismatch” and the third meant “disaster and actual damage”.

Seifert opted for the first cluster – “potential negative outcome” – which is congruent with definitions of a large part of the OC literature as well as that of this work. “Potential negative outcome” – as put earlier – includes the standpoint and interpretation of an observer (“negative”) and at the same time puts the emphasis on the final result of the crisis process (“outcome”). The meaning of the second cluster – “internal / external mismatch” - is analytic and precludes other causes, while the third already presupposes that damage occurred.

A standardization of the denotation and connotation of this central term in the field of OC adds to a more consistent, stringent and progressive development in the field. This is another reason for choosing OC as the central term of this work.

2.4 Organizational Crisis and Economic Darwinism

For 2013, Creditreform (2014, pp. 2;17) reports nearly 300’000 cases of business bankruptcy or one bankruptcy case every 23 seconds during business hours for western, central and eastern Europe. Since bankruptcy cases are always preceded by organizational crises, the number of OC cases is even significantly larger than the number of bankruptcy cases.

Bankruptcies destroy assets, jobs and personal efforts on a large scale and impose direct and indirect costs on society. From a population perspective, this extinction principle corresponds to the (eco-)logical “weeding out of the less fit effect” of economic Darwinism as Brickley et al. (2009, pp. 8;10) describe it. They argue that over the longer run economic Darwinism produces an inventory of efficiently organized firms, while the rest accordingly dies out.

Darwinism is a meaningful concept in life sciences; it explains the transformation of *species*, not individuals (primarily) by the principle of selection. With regard to the present social research project, however, the question arises as to what degree knowledge, awareness and consciousness of a selection principle change these rules. Humans and human communities (organizations) are active reflecting organisms, in contrast to animals, plants and ecosystems, which are passive acquiescing organisms (disregarding the existence of the non-knowledgeable, non-aware or non-conscious representatives of the first kind). Evolution is a self-organizing process on the basis of a set of rules that affects organisms which are *not conscious of* this process. Operating a business, however, is usually an active process in which it adapts itself before becoming extinct (i.e. the Swiss watch industry in the early 1980s), changes the rules of the game or makes new ones. Admittedly, underlying this active consciousness principle in business, the passive unconsciousness principle of evolution is still effective. Organizations which do not make use of active control may be “evolutionized away” or randomly adapted.

There is another reason why economic Darwinism provides an insufficient picture of the “weeding out of the less fit” with organizations. The answer has been given by the geneticists Dawkins and Vogel (2008, p. 667). Evolution does not work on the level of units or harmonically balanced wholes, but on the level of the *parts* of these entities. Some birds survive because of the form of their beak, rabbits due to the colour of their fur. But what “survives” on the basis of such differences is the respective gene in the gene pool of the species but not the individual being which will always die. Individual survival is not an option for biological entities but only for social ones.

The fact that *characteristics* of entities survive rather than wholes or entities may also be the plausible answer to the question of why some organizations would survive a specific external shock, while others would not: Organizations which exhibit the characteristic in question are (more) vulnerable to a specific shock (than others); however, other characteristics may still allow for the specific vulnerability or weakness to be compensated for and make these organizations survive, despite the presence of the specific characteristic.

In any case, the price of accepting economic Darwinism mechanics in the market economy with a shrug is high and neglects the principle of opportunity cost of the alternative use of the respective resources. Preventing a larger portion of wasteful bankruptcy cases by timely adaptation to produce fit with the environment or to exit in a controlled and timely way would increase wealth. Preventing organizational crises as the *antecedents* of bankruptcy would serve the same purpose.

2.5 Internal or External Provenance of Organizational Crisis

2.5.1 External Shocks and Self-Serving Bias

Managers – and sometimes overly compliant consultants – confronted with situations of organizational decline or crisis can be observed to shift re-

sponsibility by blaming external reasons such as economic weakness, industry downturns or otherwise adverse circumstances for crisis situations. While shifting responsibility to external forces may be an understandable personal copying strategy (called Self-serving bias), it is, nonetheless, ineffective in terms of securing the continuity of an organization in crisis. Compare two organizations; one is anticipating a change in customer demand, the other is not. Eventually, when the demand changes, the second organization experiences an OC due to its inappropriate countermeasures, typically blaming the environment for being unpredictable and the competition for cross-subsidizing its price calculation. The first organization has reserves available, changes the product portfolio and, after an introduction phase, stays in business. The management of the second organization reports an external shock to its stakeholders; the first reports a success in its intelligence and innovation units. What the second organization calls an external shock is, in fact, the repercussion of the failure to install and maintain important organizational functions. We will see later in this dissertation that monitoring the environment, interpreting the observations with respect to one's own situation and acting upon it is one of the basal traits of any organism capable of surviving.

2.5.2 External Shocks: Conflicting Theories

Academia, too, deals with the question of an internal or external aetiology of organizational crises. Mellahi and Wilkinson (2004) propose an integrative framework following their analysis of the academic discourse about exogenous or endogenous causes of organizational failure. Firstly, they scrutinized the deterministic position, which is mainly based on Industrial Organization (IO) and Organizational Ecology (OE) theory and, secondly, they looked at the voluntaristic school with its origin in Organization Studies (OS) and Organizational Psychology (OP).

The authors criticize that, due to an overly deterministic position, the deterministic school can detect "*only the crudest and most extreme external effects by their research methods*" (ibidem p. 27). Proponents of the deterministic school take the view that rapid change in the external environment

produces unadaptable market actors, leading to surges of extinction in the respective population.

Blaming external circumstances – such as the state of the economy – as the sole cause of organizational crises also contradicts logical reasoning: If the economy or industry was exclusively responsible for the failure of a specific firm, why then would some firms survive under the same circumstances? This question and a similar one posed by Mellahi and Wilkinson (2004, p. 27) refer to the general principle that the equal cannot affect the unequal equally.

Furthermore, the deterministic school denies any influence of management in assuming that firms accept the inevitable fate of the verdict of the environment. Consequently, this would absurdly imply a uniform probability of default vis-à-vis external shocks and, at the same time, above average profits for unmanaged organizations because organizations which renounce unnecessary overhead costs would have cost advantages over managed firms. Indeed, if they add no value, it would be impossible to explain why organizations have management at all.

Moreover, the irrelevance of management would, in the first place, be inconsistent with the foundations of the deterministic school, such as the economic Darwinism or the evolutionary principle, due to the basic assumptions that resource consuming characteristics that add no value (to survival) tend to dissipate over time.

This line of argument can be closed chronologically. If the aftermaths of earlier action or omissions of a management team have made the organization vulnerable to external effects, the argument of external *causation* collapses because the vulnerability to external shocks would indeed be caused by poor management practice in the first place.

Analysing the opposite voluntaristic viewpoint, Mellahi and Wilkinson (2004) identify at its core the idea that decision making is more important than the external context. In the body of work expounding this stance they found several lines of argument: Groupthink Theory, Upper Echelon Theory,

Curse of Success and the Threat Rigidity Effect Theory. Accordingly, the authors criticize the eclecticism of this theoretical approach but also the over-reliance on internal factors and the dearth of an environmental perspective. As a complement to this analysis, they refer to a number of management studies in the field that substantiate the influence of management on organizational crises. Mellahi and Wilkinson (2004) conclude, in an overly mono-causal manner, that "*failure is linked to internal adequacies in dealing with external threats.*"

Table 3 lists the central theses of the two conflicting theories / schools, provides antitheses and syntheses on each level and as a conclusion.

Table 3 Conflicting Theories on External Shocks

Approach A	**Deterministic School based on Industrial Organization and Organizational Ecology Theory**	
		Assumptions
Thesis 1	"Rapid envoronmental change (external shock) produces unadaptable actors and surges of extinction."	- All organizations are equal - No or only insufficient reaction is possible
Thesis 2	"Management has no influence on or against external shocks"	- External shock is either unpredictable or - External shock cannot be counteracted at all
Antithesis 1	"Some / many organizations survive an external shock"	- Not all organizations are equal - Reaction / withstanding is possible
Antithesis 2	"Management can produce circumstances for survival"	- Resiliance can be built actively - Stochastic differences ("luck") may help to withstand / survive - Accordingly, trial and error may help too
Synthesis A	"External shocks have an impact but can be withstood"	- Individual situation of organization is relevant
Approach B	**Voluntaristic School based on Organization Studies and Organizational Psychology Theory**	
		Assumptions
Thesis 1	"Decision making is more important than the external context"	- Organizations depend on internal decisions rather than on external circumstances.
Thesis 2	"Rational thinking can handle the effects of external shocks"	- Supremacy of rational thinking - Fallacy of feasibility
Antithesis 1	"Complexity and power gradient between environment and organization is arbitrarily large in fav. of the environment"	- Potential for adverse effects is sufficiently large - External shocks are not "directed"
Antithesis 2	"Experience shows, that rational thinking cannot solve all problems."	- Timing, understanding, lack of knowlegde irrational or arational problems limit the potential of rational thinking.
Synthesis B	"Management (and luck) have a significant influence on the effects of external shocks but cannot completely control it."	- External shocks or management are relative constructs
Synthesis C Conclusion	"External shock effects and management are mutually influencing concepts, the outcome of their interaction depends on the combination of the properties of both."	- Organizations are affected by external shocks to the degree they are vulnerable to the shock effects - Populations are affected by external shocks to the degree they exhibit similar characteristics which are vulnerable to the shock effects.

Table 3 shows that the rigid positions of the two conflicting theories have to be relativized. A synthesis is possible: External shock effects and management are mutually influencing concepts. The outcome of their interaction depends on the combination of the properties of both.

In this vein, later chapters of this dissertation will show that, by adopting a systemic view, the above internal and external theses can be synthesized and rendered obsolete on the basis of Ashby's Law of Requisite Variety (1960, p. 207) and Beer's (2004, pp. 116–117) Three-Four-Homeostat.

2.6 Suddenly or Slowly Developing Crises

The scope of this research project is on slowly or gradually developing crises. This includes *triggered* crises that break out after some critical thresholds, following a gradual development, eventually are exceeded.

This in turn means that suddenly *caused* crises, where the continuity of an entity becomes instantaneously and stochastically impossible (in an act of nature or will beyond control), are excluded. However, flooding of a vital fabrications site in a known flood plain would imply poor planning and, therefore, not qualify as force majeure or instantaneously caused crisis. Similarly, the captain of a fully equipped ocean liner today could hardly refer to force majeure, when a storm sinks the ship.

2.7 Body of Research on Organizational Crises Aetiology

Critical developments in organizations or OC are the subject of broad interest and the research focus of many authors. The phenomenon of OC is multidimensional (recurring topics in crisis literature were: crisis cause / origin, crisis phases / states, crisis dynamics, crisis effects, crisis emergence / course, crisis recognition / identification, crisis analysis, crisis countermeasures / response, crisis recovery and learning from crisis) and has intrigued

researchers from diverse areas. Accordingly, OC related literature is multi-faceted, adopts a number of different perspectives and spans all successive crisis states, e.g. starting, for instance, with Ansoff's (1975) weak signals of crisis via financial crisis prediction and avoidance of Altman and Hotchkiss' (2006) and Fink's crisis management (2002), through to business continuity planning of Devargas (1999) after a (by default, survived) crisis event.

Despite such broad interest, research on OC so far has failed to generate a comprehensive, coherent theory of crisis. Rather, great diversity and inconsistency in approaching the topic can be observed across the respective scientific literature. Many of these works are of minor relevance for the present work, especially those dealing with later phases of OC, such as crisis containment, crisis management, crisis resolution, crisis recovery or continuity planning. Rather narrow perspectives – such as the avoidance of bankruptcy or the untenable use of crisis as a management technique for change – will be excluded from consideration.

In light of the above, this literature review focuses on works about the aetiology and origin of OC. It is the intention of this work to identify a consistent and closed set of causes of OC and with it contribute to the early recognition and pre-emption of OC rather than identifying coping strategies for missed opportunities of avoiding OC in the first place.

2.7.1 Material Definitions of Organizational Crisis

When reflecting about OC aetiology, it is worthwhile to take notice of the material OC definitions of different researchers in the field. Although in OC research a variety of theoretical approaches were followed and a proliferating terminology is used, researchers adopt a surprisingly consistent position when it comes to defining the phenomenon of OC in general.

Most crisis definitions take up all or several of the following aspects:

Phenomenological aspects refer to what is *recognizable of OC*.

Teleological aspects refer to the *targets affected* by OC.

Praxeological aspects refer to the *action* to be taken vis-à-vis OC.

Aetiological aspects refer to the *chain of causation* of OC.

Psychological aspects refer to *emotions of stakeholders* during OC.

Morphological aspects refer to structural mutations due to OC.

Chronological aspects refer to the *frequency and duration* of OC.

Seifert (2006, p. 80), based on her aforementioned cluster analysis, arrived at the following OC definition, which covers all but the phenomenological, psychological and morphological aspects of OC:

"*An organisational crisis is defined as a situation or period of time in which the survival of the entire organisation is perceived to be threatened. The crisis situation is further characterised by ambiguity of cause, effect and means of resolution, as well as by a belief that decisions must be made swiftly. A crisis is a turning point for better (survival) or worse (bankruptcy).*"

Thus Seifert's definition closely resembles that of Pearson and Clair (1998, p. 66), who more strongly emphasize psychological aspects.

"An organizational crisis is a low-probability, high-impact situation that is perceived by critical stakeholders to threaten the viability of the organization and that is subjectively experienced by these individuals as personally and socially threatening. Ambiguity of cause, effect, and means of resolution of the organizational crisis will lead to disillusionment or loss of psychic and shared meaning, as well as to the shattering of commonly held beliefs and values and individuals' basic assumptions. During the crisis, decision making is pressed by perceived time constraints and colored by cognitive limitations."

Carmeli and Schaubroek (2008, p. 177) consolidate the above definitions omitting the psychological dimension of stakeholders:

"An organisational crisis is a low-probability, high-impact event that threatens the organisation's survival and is characterised by ambiguity of cause, effect and means of resolution, as well as by a belief that decisions must be made swiftly."

Fischbacher-Smith (2014, p. 427) identifies an (antagonistic) relationship between organisational effectiveness and crisis. This has parallels to the approach of this thesis, which opposes system viability and OC. Fischbacher-Smith defines crisis from a predominantly teleological perspective as

"*A complex, multi-level event that exceeds, or comes close to exceeding, the capabilities of the organisation to respond to the task demands that face it and without the need for significant additional (often external) resources being brought to bear. It provides a fundamental challenge to the effectiveness of an organisation in terms of its abilities to prevent, mitigate, or respond to these task demands and processes."*

Fischbacher-Smith's concept of effectiveness addresses the capabilities of an organization to cope with the challenges of a changing internal and external environment which is distorted in crisis situations. This basic idea of balancing demands and capabilities is close to Ashby's concept of requisite variety, yet, despite Fischbacher-Smith's reference to Ashby (ibidem p. 425), he does not use the term.

Boin and Lagadec (2000, p. 186) clearly emphasize aetiological aspects in their definition of OC. They see today's crises as amplified by a dynamic interaction of factors such as incalculable risk, network effects, immediate mediatisation of incidents and abrupt change in collective perception. Fink (2002), p.15 in contrast, defines OC as: "*[…] an unstable time or state of affairs in which a decisive change is impending – either one with the distinct possibility of a highly undesirable or (...) desirable (...) outcome,*" underlining teleological aspects of crises, as do Pauchant and Mitroff (1992) with their definition of "*[…] crisis as a disruption that physically affects a system as a whole and threatens its basic assumptions, its subjective sense of self, its existential core".*

Rosenthal, Boin, and Comfort (2001) define crisis as a "*threat to the core values of a system or the functioning of life-sustaining systems which must be urgently dealt with under conditions of deep uncertainty*". This crisis definition, from a more governmental point of view, argues morphologically (values and systems were affected) but besides physical damage the definition addresses core values and with it *abstract damages* of crisis.

An early crisis definition is that of Hermann (1963, p. 64), who limits the scope on teleological, chronological and phenomenological OC aspects: "*An organizational crisis (1) threatens high-priority values of the organization, (2) presents a restricted amount of time in which a response can be made, and (3) is unexpected or unanticipated by the organization.*"

As set out above, Norbert Wiener called cybernetics the science of control and communication in the animal and in the machine, which – explicitly without the opposition of Wiener, as Beer notes – was cut by Beer (2004, p. ix) to: "*Cybernetics is the science of effective organization.*" From the viewpoint of cybernetics, Beer (1994a, p. 349) refers to teleological as well as aetiological aspects when defining OC: "*What counts as a crisis is the expectation of loss of control: in other words cybernetic breakdown in the institution. This does not refer to an inability to impose decisions: it means that the institution is out of control itself".* With this definition, Beer identifies crisis as the absence of homeostatic stability due to an unbalanced variety (i.e. com-

plexity) in management or, in short, as a *system failure* defining OC from a purely functional point of view.

Based on systems theory, Logan (2005, p. 268) proposes the following definition of OC as "*[…] a state that a system achieves, when a perturbation or series of perturbations entirely destabilizes a system […] to the extent that the system must provide the appropriate response […] in order to maintain its viability and/or identity.*" In this phenomenological definition, the perturbation (agonist) is the cause, the regulator or management (antagonist) counteracts whereas OC depicts the effect, which can be observed as a system state or mode.

Although very different in nature, a set of commonalties in these OC definitions can be found: exceptional destabilisation of core system functions; ambiguity of (counter-)measures; inadequacy of means; loss of control; achievement of the purpose of the organization questionable or impossible.

Below, in section 2.7.2, when comparing crisis stage models of different authors the five definitional aspects of OC used above will again be encountered.

2.7.2 Crisis Stages

In the pertinent literature, there is agreement that an OC has several stages. Designation, number, duration or characteristics of these stages, however, differ markedly, as Table 4 shows, which is based on Krystek and Moldenhauer (2007, p. 35) and has been updated, complemented and translated by the author. Again five main groups of stage definitions are observable. These categories are mentioned below, accompanied by a generic description of the main consecutive steps in the course of crisis per group:

The *phenomenological* crisis stage perspective refers to the recognisability of crisis with: normal operation, latent crisis, acute crisis and outcome of crisis.

The *teleological* crisis stage perspective refers to the targets that are affected by crisis with: strategic crisis, sales crisis, profit crisis, liquidity crisis and insolvency.

The *praxeological* crisis stage perspective refers to the action that should be taken vis-à-vis crisis with: prevention, detection, containment and regaining control.

The *aetiological* crisis stage perspective refers to the chain of causation of crisis: failure, exposure, denial, overshooting, overwhelming.

The *morphological* crisis stage perspective refers to the fact that crisis changes organizational structure: stability, transformation, instability, resolution (either disintegration or new stability).

Most authors organize their crisis stages chronologically along a generalized crisis lifecycle which is indicated at the head of Table 4. The various crisis stages are then assigned graphically to this sequence by dividing lines. In contrast to this chronological order, Greiner (1972) bases his well-known crises sequence on an ordinal scale of growth phases, while Hermann (1963, p. 66) does not list consecutive stages but rather typical relationships between crisis and selected organizational variables. Eventually, some authors mix two or several crisis categories in their definition of crisis stages.

The row “Cybernetics” is also an addition of the author and integrates an aetiological interpretation of crisis stages, based on cybernetic principles in the lifecycle sequence. It shows two rows, the first indicating that, from this point of view, crisis is a latent phenomenon that always lurks beneath the surface due to the inherent organizational instability. The second row shows the antagonists of instability, which counteract the tendency towards entropy.

From the table, it can be recognized that later works more often include the “pre-“ or “not yet” crisis stages as relevant for crisis development. In Table 4 the abbreviation “C.” is used for the word crisis in order to save space.

The column on the far right of Table 4 is a further addition of the author. In abbreviated form it indicates the category to which the individual crisis stage sequence belongs, according to the above categorization.

Table 4 Crisis stages due to various authors since 1963

Crisis Phases / Authors	Not yet Crisis	Crisis Phases						Anymore Crisis	Type / Category
		Formation	Prevention	Avoidance	Acute Onset	Coping	End		
Abatecola 2012	-	decline			C.			-	pheno
Appelbaum et al 2011	incubation		detection		C.		recovery and learning		pheno
Greve 2010[5]		lower demand	lower productivity	uncertainty	lower commit-ment	structural decay	loss of control	despair	unconscious toleration of org. suicide	teleo
Hoverstadt 2009[6]	failure to ensure intelligence		failure to detect change	change hits organization	operational instead strategic reaction		denial and distress	-	aetio
Schulenburg 2008	-	potential C.	latent C.		acute C.		post-critical C. phase (outcome)		pheno
Grape 2006	-	strategic C.	profit C.	liquidity C.	insolvency			-	teleo
Seifert 2006	stability and success		increasing instability	resolution					morpho
Mittelstaedt 2005	operational issue	strategic issue		survival issue				-	teleo
Platt 2004	corporate transformation		turnaround management	C. management				-	mor-pho-praxeo
Bennewitz, Kasterich 2004	-	strategic C.	product and sales C.	profit C.	liquidity C.	acute threat	collapse	-	teleo
Fink 2002	-	prodromal [*unspecific preparatory*] C.		acute C.	C. resolution				pheno
Krystek 2002	-	potential C.	latent C.	acute controllable C.	acute un-controllable C.			-	pheno
Hauschildt 2000	-	preliminary cause of C.	latent C.	manifest C.	insolvency			-	pheno
Toepfer 2000	issue man. / risk man.	C. precaution (preventive) C. management		C. resolution (re-active) C. management				-	praxeo
Finsterer 1999	-	strategic C.	profit C.	liquidity C.	turnaround			-	teleo
Neubauer 1999	-	C. formation	C. early detection	C. presence	C. solution strategy			learning from C.	pheno
Toepfer 1999	-	C. prevention	early detection early warning early intelligence	limitation, mitigation of damage	recovery			learning from C.	praxeo
Schulten 1995	-	potential C.	latent C.	actual C.				-	pheno
Zelewski 1995	-	potential C.	latent C.	actual C.				-	pheno
Clasen 1992	-	unconscious C. initiation	unde-tected C.	internally detected C.	externally detected C.	end of C.		-	pheno
Pauchant Mitroff 1986	-	signal detection	preparation, prevention	crisis	containment limitation	recovery		learning	praxeo
Mueller 1986	-	strategic C.	profit C.	liquidity C.	insolvency			-	teleo
v. Loehneysen 1982	normal situation	potential C.	latent C.	acute C.				-	pheno
Albach 1979	-	-		1. loss of trust, 2. secret talks with creditors, 3. crisis gets public, 4. bank-ruptcy and breaking up or, 5. settlement and going concern, 6. success of restructuring visible				-	mixed 1.teleo 2.praxeo 3.pheno 4.teleo 5.teleo 6.pheno
Roedl 1979	-	latent phase	subacute phase	acute phase				-	pheno
Roethig 1976	-	latent C.		acute C.				-	pheno
Argenti 1976	-	bad man-agement	non-financials symptoms	number and severity of symptoms rapidly increase, denial	circulus vitiosus[7]	insolven-cy			mixed
Turner 1976	normal	incubation		precipitating event	C. onset	rescue	salvage	full cultur-al read-justment	pheno
Britt 1973	-	phase of erroneous trend(s)		C. phase	coping phase			-	pheno
Cybernetics	latent C. due to organizational tendency towards instability (entropy), flawed control structure or control ability								aetio
	system viability, continuous learning and adaptation, (requisite) variety engineering								
Greiner 1972	leadership C.	autonomy C.	control C.	bureaucracy C.	next C.				teleo
Hermann 1963[8]	loss of integra-tion	with-drawal of person-nel	intensi-fication of conflicts	reduced internal communi-cation	contrac-tion of authority	stress increases withdraw-al	change in basic stand-ards	conflicts between units	moral drops	control fails	viability seriously challenged	mixed morpho pheno teleo

[5] shortened from twenty original points Greve p. 104 ff.
[6] no crisis- but VSM-specific literature
[7] interpretation of the author of Argenti p. 144-147
[8] Model of crisis influence on organizational variables with feedback cycles, presented serial

Table 4 shows that only a few OC-models recognize the not-yet-crisis phase (second column from left) as relevant for the understanding of OC. Rather often; this phase is not thematised at all.

Some authors address this pre-OC phase *analytically*: Greve (2010) names "*lower demand*", Toepfer (2000) points to "*issue and risk management*". In the same way, analytically but transcending the not-yet-crisis phase into the crisis phase, the following authors characterise this early stage of OC: Greiner (1972) "*leadership crisis*"; Mittelstaedt (2005) "*operational issue*"; Seifert (2006) "*stability and success*"; and Hoverstadt (2009) "f*ailure to ensure intelligence*".

Other authors address the pre-OC stage *conceptually*: Schulenburg (2008) "*potential crisis*"; and v. Loehneysen (1982) "*normal situation*". Along with Platt (2004) "*corporate transformation*" and Turner (1976) "normal and incubation", some authors provide *transcending concepts* which imply a seamless transition from the non-crisis to the crisis stages.

This thesis will show that this early stage of OC is of considerable importance for the onset of OC.

Another phenomenon can be recognized on Table 4: Extant crisis phase or process models are structured incrementally, starting from potential crisis via latent to manifest crisis, etc. Most of these models end with a crisis resolution state (either demise or survival), which ends abruptly as in Figure 1, few models show a post-crisis state.

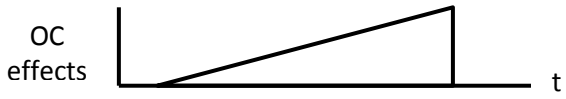

Figure 1 Extant OC process model

The experience of the author in OC cases has shown that neither gradually developing nor suddenly caused or triggered organizational crises end abruptly. Because an OC changes (or corrupts, depending on the stand-

point of the observer) the structure of the system, surviving organizations do not experience a punctuated change for the better.

Instead, it can be observed that with surviving organizations the restoration happens incrementally in the opposite direction of crisis formation: First, short term operative functionalities, such as the sheer ability to act and solvency (ability to pay), will be restored by restructuring processes; second, strategy will be revised; thirdly, the structures and relationships in various respects (informational, procedural and personal) are restored (iterations with the second step are likely to occur) but will normally not return to pre-OC-levels either due to lasting damages or as a result of learning processes. Naturally, in order to conserve resources, such a reverse development of OC occurs in an accelerated mode compared to the course of deterioration.

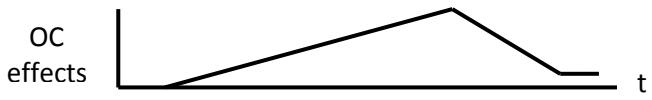

Figure 2 Experience-based OC process model

The experience based OC model – with accelerated reverse development after survival instead of a punctuated resolution – applies better than the extant crisis phase model to organizations which have experienced both a gradual and sudden development of OC. Remembering Beer's notion of POSIWID (the Purpose Of a System Is What It Does), the system has reached a new equilibrium or stable state. After the OC, the system has to resume implementing a new purpose via values, mind-sets, strategy, structure, processes and relationships, and most of these have to be restored or rebuilt – depending on the "impact time" of OC. As with organisms, this cannot be administered but has to develop over time. This necessity to change the purpose of the organization after a crisis, explains why it is a bad idea to just inject new funds into a crisis organization: It would implement its "crisis purpose" and, accordingly, burn the new funds. Change processes in organizations are already a demanding issue, change *after an OC* generates even more demands. Any short cutting of the reversing process bears the danger of triggering the next crisis, similar to the effects of an incomplete antibiosis,

where remaining bacteria cause reinfection or even acquired resistance. The latter would correspond to change fatigue in organizations caused by a sequence of reorganization.

OC organizations after the manifest OC phase remain OC organizations for some time. This may be the reason why so many organizations relapse into OC several times.

2.7.3 Aetiology of Organizational Crisis

The aetiology of OC is of particular interest with regard to the research question of this thesis. The term stems from Greek αίτία (aitia) for accusation or charge and λογος (logos) for speaking or doctrine and means the science of causation or origination. Gemoll and Vretska (2010, p. 23) translate αιτιος (aitios) as “in charge”, “to be blamed for” and as “originator of” or “cause”, while the similar term (p. 178) γενεσις (genesis) by contrast means “birth”, “becoming” or “emergence”, so the two terms show a cause (aitios) and effect (genesis) connection.

Several researchers are especially interested in the aetiology or the causes i.e. the formation process of crises.

Turner (1976, p. 381), one of the pioneers in OC research, has set out a developmental “*sequence of events associated with a failure of foresight*” which lead to crisis. His reasoning about the first two stages provides insights into the subject of aetiology of OC. As stage I of the sequence, he identifies two notionally normal starting points: “*initial culturally accepted beliefs about the world and its hazards*” and “*associated precautionary norms set out in laws, codes of practice, mores, and folkways*”. With these, he finds that cultural aspects are early precursors of OC. Stage II of the sequence, named the incubation period, he explains as “*the accumulation of an unnoticed set of events, which are at odds with the accepted beliefs about hazards and the norms for their avoidance*”. In this incubation period, events not known to anyone, or not understood well, develop and accumulate; organizational intelligence does not suffice for this process to be sufficiently appreciated and in-

terpreted. Only in stage III – "*precipitating events*" – are such events forced into attention, transforming the general perception of stage II. Although Turner (1976, p. 395) does not provide clear answers on how to avoid "*the conditions under which organizational groupings can make gross errors of perception, judgement, and calculation that lead to unfortunate or disastrous consequences*", with his insights he initiated a fruitful discussion about the reasons behind OC.

Although developed with a view to *sudden* crisis, Mitroff, Pauchant, and Shrivastava (1988) propose a "*systems approach*" to crisis management in the endeavour to provide a theory of crisis *management*, which should not be confused with an overall theory of crisis. The authors present two interesting models (ibidem) p. 102-103: a "*preventative model of crisis management*" (reproduced in Figure 3) with four interconnected main factors of crisis prevention and a structurally identical "*crisis creation model*" (see Figure 4) with crisis promoting factors.

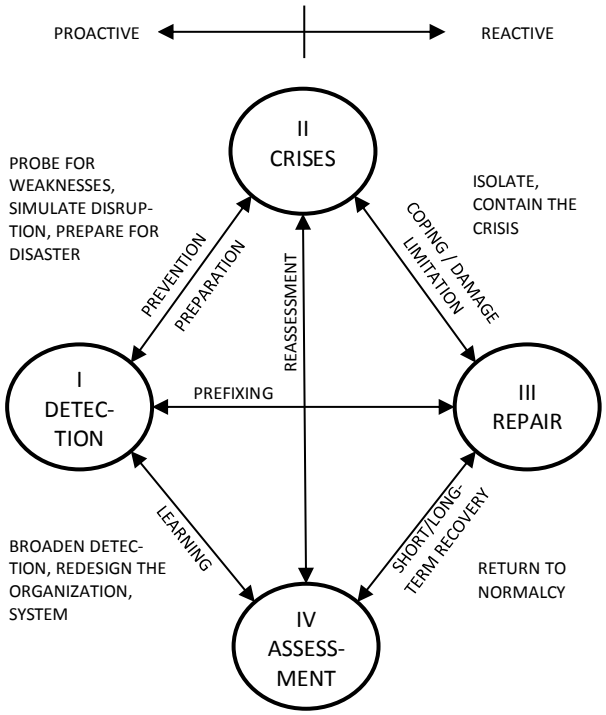

Figure 3 Preventative Model of Crisis Management

In Figure 3, factor I "DETECTION" stands for all systems which scan the external and internal environment for signals of impeding crisis, as the authors state (e.g. risk management, strategic planning, marketing planning, supply chain management, issues management, etc.). Via the prevention / preparation process, this factor is connected to factor II, "CRISES" which indicates that complete prevention is not possible; thus, crisis planning is important. Factor III, "REPAIR", addresses the structures and mechanisms in place for recovery efforts (e.g. continuity management); it is connected back to factor II "CRISES" via the coping and damage limitation process (resilience, crisis management in the narrower sense). The next factor (IV) is "ASSESSMENT", which deals with the awareness of what happened and the efforts to be taken to revise detection, preparation and recovery mechanisms. This factor is connected back to factor I, "DETECTION", via a learning process, provided the organization survived the incident. This factor shows similarities with the "*postcrisis analysis*" of Roux-Dufort (2009, p. 10), who emphasizes the importance of bridging the unusual – which is OC – with the regular – which is everyday managerial practice with their weaknesses and ignorance – in order to "*be aware of recurrent vulnerabilities, their developments and their roots*".

The above preventative model of Mitroff et al. (1988) illustrates an active crisis prevention loop. With it, the authors prefer "*deliberate organizational intention and intervention*" to detect OC as opposed to "*normal, everyday, unintended managerial programs*", which "*will be based more on luck and happenstance*". This view conflicts with the practice of high reliability organizations such as nuclear power plants, chemical productions or aircraft carriers. These organizations specifically focus on highly reliable *operations* which "*involve[s] continuous management of fluctuations through restoring interrupted balances*", as Weick (2011, p. 25) puts it.

This perspective will be relevant later on in this thesis, when important parts of the above control loop are discussed as part of the cybernetic control structure of an organization.

The second model suggested by Mitroff et al. (1988) is called the "*Crisis Creation Model*" (Figure 4). It shows exactly the same structure as Figure 3 but with reversed signs. This means basically, that mistakes or incapacities in the four above factors would promote crisis, hinder learning from it and regenerate crisis – a vicious circle. Nonetheless, from the perspective of OC aetiology, it is still worth a closer look: The factors "DELIBERATELY IGNORE EARLY WARNING SIGNALS" and "MISSASSESSMENT OF PAST RESPONSES", together promote the "INCREASED CRISIS POTENTIAL" factor which, via the process "NONCONTAINMENT / OVERWHELM" and "FAULTY OR NO REPAIR MECHANISMS IN PLACE" is considered a "*design to have a disaster*", as the authors put it (ibidem, p. 105). We will see later on in this thesis, that these two models address important homeostats in a viable system, which are responsible for the long-time stability (ultrastability) of an organization.

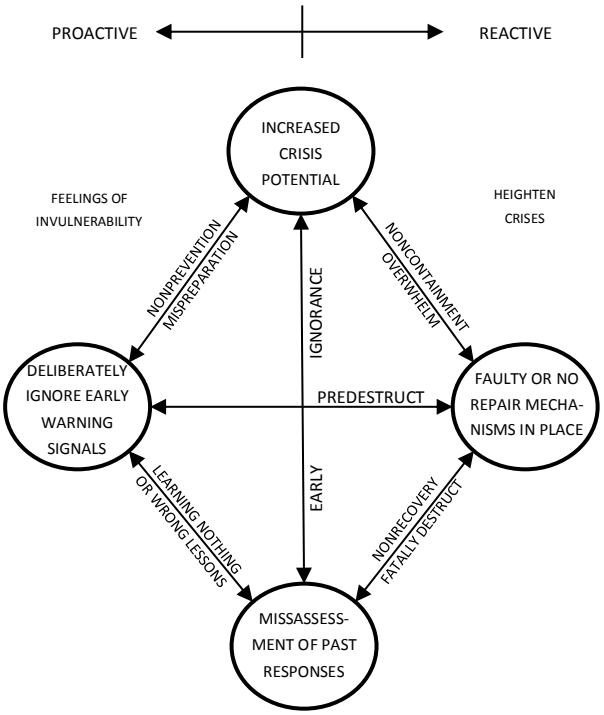

Figure 4 Crisis Creation Model or "Design for Disaster"

Pinkwart (1992), when characterizing OC, emphasizes the multicausal nature of crisis processes, the phenomenon of superimposing and the combined effects of processes as well as the evidence of chaotic process characteristics. Similar to Boin and Lagadec (2000, p. 185), he states that these

effects render the crises as such difficult to recognize, observe and interpret and suggests that this elusiveness of early state crises may be the reason why a coherent and stringent theory of crisis is still lacking. As already mentioned, Burns-Nurse (2002, p. 1) even asks if organizational crisis exists at all. She calls it an abstraction, recognizable only in the conduct and the mental maps of the exponents of an organization as symptoms of rapid change and threat.

Both statements are understandable. Complexity may render the origins of OC elusive as Pinkwart puts it and according to Burn-Nurse, OC might in fact be seen only as a meta-phenomenon or construction. However, the repercussions of OC are tangible and important. This means – that independently of definitional or epistemological considerations – if OC crises are to be better understood and, where possible, avoided, further insights are necessary.

Hwang and Lichtenthal (2000, p. 129) argue that OC is better understood through the way it develops than through typologies and definitions. Referring to the biological concept of punctuated equilibria – which according to Campbell, Reece, and Markl (2006, p. 559) is a controversial idea in evolution theory that long periods of stasis (i.e. balance) are interrupted punctually by phases of accelerated development ("intermediate spurt"). Hwang and Lichtenthal (2000, p. 131) too, distinguish between two types of OC; abrupt and gradual, thus addressing two different aetiologic trajectories of crises. Their crisis dimensions and managerial implications are given in the following table (partly author's own representation). They recognize important differences between abrupt and cumulative crises along what they call the key dimensions of crisis.

According to these authors, the type of crisis this dissertation is focused on (which is *gradually* developing crises), builds up progressively, increases over time and emerges after surpassing a threshold limit of misalignment with the environment. They (ibidem) p. 135 conclude that such cumulative crises are a result of fit deterioration, which can be observed in a pre-crisis diagnosis as signals of incipient degeneration which again provides

opportunities for adaptation before the situation becomes serious. Recognizing the problem of diffuse (or weak) signals, they alternatively suggest establishing degeneration safeguards that keep the organization alert and capable of rapidly realigning itself with the environment.

Table 5 Crisis Dimensions and Managerial Implications

Key Dimensions of Crisis	Types of Crises	
	Abrupt	Cumulative
Build-up speed	Rapid	Gradual
Predictability	Low	High
Specificity	Focused	Nebulous
Crisis recognition	Clear	Fuzzy
Trigger point	Specific evens	Threshold-limit
Probability of occurrence	Time-constant	Time-increasing
Misalignment with environment	One / few aspects	Many aspects
Managerial implication prior to crisis		
Managerial key concept	Risk management	Fit deterioration
Mechanisms if managerial intervention	Audit undue risks	Diagnose degeneration signals
	Manage exposed risk	Establish degenerations safeguards

Table 5 is based on Hwang and Lichtenthal (2000, p. 134).

Although the present dissertation focuses on cumulatively developing crises, insights and recommendations of this dissertation will cover both the abrupt and cumulative crisis types, albeit on different levels of recursion of the organizational system. Cumulative crisis will be addressed by appropriate first order (operational) system functions. Abrupt crisis will be subject to higher order system characteristics such as subsystem decoupling, safety margins or contingency planning in order to pre-empt, mitigate or avoid abrupt OC.

Heine and Rindfleisch (2013, p. 11) arrive at a seemingly opposite conclusion to Hwang and Lichtenthal (2000) with regard to adaptation. They approach OC or, as they call it, organizational decline, from a three theory approach. Combining insights of organizational ecology, path dependence

and a resource based view; they construct an integrative framework of organizational decline.

Referring to the findings of organizational ecology, these authors point out, that organizations which show *operational inertia* have a higher probability of survival than organizations that frequently try to adapt to their environment, as the theory of strategic choice would imply. However, by “inertia” they do not mean “inactiveness” but rather “stability” to reproduce and improve core features over time instead of changing the structure, whenever it seems appropriate.

While Heine and Rindfleisch (2013) consider inertia as a good attribute, Welsch (2009, p. 254), in her dissertation on the influence of organizational inertia on the early detection of OC, concludes that in fact inertia mitigates pre-emption of OC by impairing perception of, and the reaction on, weak signals. She lists eleven characteristics of organizations which promote organizational inertia. Both lines of argument are consistent per se. However, it puts a question mark on the contribution of both concepts in explaining OC. When inertia is both advancing and mitigating crisis at the same time, this raises the difficult question about an *appropriate level of inertia* in an organization if not about the relevance of the concept of inertia towards OC in the first place. From a cybernetics point of view, inertia corresponds to a malfunction of homeostats. Imagine a thermostat (i.e. a decision maker) which has a lower threshold value of 5 and an upper threshold value of 35 degrees centigrade to secure an average temperature of 20 degrees: Intervention would occur far away from ideal (heater on below 5°C, heater off above 35°C), time-lags would make the system sluggish and sensitive to coupling effects. Threshold values of 19 and 21 degrees, on the other hand, would produce hectic, overshooting control action with hazardous self-enforcing feedback loops. Inertia, therefore, is an important but again only a partial aspect of OC prevention.

Several authors aim to predict and avoid OC by collecting and listing observed detrimental conditions that eventually lead to crisis situations. The results of such empiricism are lengthy lists of organizational sins ranging

from “inexperience” to a “lack of dynamic pricing” and from “too many suppliers” to “unexpected loan termination” (Hutzschenreuter and Griess-Nega (2006a, p. 58), (Blöse (2006, pp. 44;57), (Pauchant and Mitroff (1992, p. 26).

In particular, the arbitrary and open composition of such lists, but also the non-directedness (too many - too few customers) of the listed conditions, appear coincidental.

Beer (1974, p. 330) comments that problem lists do not work since problems are system outputs (i.e. symptoms, phenomena, effects) not causes (i.e. the disease). Problems are generated by systems – thus it is necessary to “*[…] look for the imminent crisis in the immanent form*” and change the system because “*[…] the purpose of any system is what it actually does.*” The last sentence is well known as Beer’s POSIWID notion (passim). From an OC perspective, it means that OC, in fact, is the manifestation of a changed system purpose, which drives the system to settle at a new – for an observer, potentially, unintended – equilibrium or basin of stability.

Also with the intention of explaining the genesis of OC, other authors create *mismanagement typologies* such as “technologically vulnerable companies”, “enterprise on breaking buttresses”, “conservative stubborn, uniformed patriarchs”, “enterprise that expands unprepared” and “remaining quantity” (Hutzschenreuter-Griess-Nega, 2006b) p. 60. This attempt too has obvious weaknesses; in front of the diversity that can be observed in practice, mismanagement types such as those above must necessarily oversimplify or, at least, exhibit a substantial lack of differentiation. To put it right, disturbances of systems such as those mentioned above are not per se meaningless with regard to crisis prevention. But in an unsystematically phenomenological formulation, such as those as above, an analysis provides explanations or stimuli that cannot be processed by organizations in a meaningful way. Beer (1994a, p. 27) states that systems react to (at least anticipated) changes in their internal states but not to stimuli directly; rather, they have to be interpreted with regard to a system’s parameters. Systems then modify their internal states until the effects of the disturbance are offset. Typologies such as those above show a substantial lack of information (or requisite vari-

ety) to reach anywhere near an appropriate OC explanation, let alone a basis for action.

A different kind of aetiological OC explanation is given by Wicks (2001, pp. 661–662), who concludes that – independent of so called original causes or triggers of an OC – it is the *institutional framework* which eventually allows OC to happen. As institutional antecedents of OC he identifies regulative, normative and cognitive influences which, together, produce a progressively rigid and mechanical mindset of invulnerability. This mindset distorts risk perception, which hinders the organization and its exponents in taking risk-minimizing measures. This means that the organization is incapable of de-institutionalizing before a crisis occurs, as Wicks (2001, p. 687) puts it. Such a defective culture promotes risk accumulation and amplifies the risks until OC hits the organization.

The interesting thing about Wicks' crisis antecedents argumentation is that he only seemingly disregards crisis root causes, when in fact he suggests that the cause of a crisis is the *system (behaviour) itself* (in Wicks' case the culture of the organization, not the biased perception of one exponent of it) which *produces OC* in the first place. According to this perspective, any kind of perturbations may be the (marginal) cause of the next OC as long as the system exhibits the ill-defined structure, as Wick suggests it.

Following this line of argumentation and supposing that not only cultural deficiencies but a flawed organizational structure in general may favour, amplify or even produce OC, independent of material reasons, then two phenomena of OC that have been discussed earlier could be explained: Firstly, the fact that external shocks do not affect all organizations equally and, secondly, that an OC-inclination may exist which makes organizations vulnerable to (recurring) OC – independent from actual disturbances. In this explanatory model, the limiting cases of a) unrestricted or b) no resources available (or circumstances that surpass the physical limits of the organization) would still apply: If a) the organization survives (living death), if b) it perishes.

Another proponent of the idea of a systemic rather than a material origin of OC is Logan (2005, p. 264), who expands on the above argument by stating: "*[…] crisis research would be better suited if crisis were defined as a type of system perturbation, specifically a type of catalyst for organizational transformation.*" He then stresses the role of the system itself by stating that if the system is inherently flawed, the system *itself* is at fault, not those working with the system. Surprisingly, this author ventures into the idea of beneficial OC. Subsequently, however, he states with particular emphasis that OC should be avoided at all costs. These two statements only make sense, when OC *countermeasures* are meant to provide benefits but not OC *itself*, as stated earlier.

From a different point of view, Scheffer et al. (2009, p. 53) further elaborate on the idea of systemic crisis behaviour when they write that the dynamics of systems near a critical point have generic properties, regardless of differences in the details of each system. They further explain that sharp transitions in a range of complex systems are in fact related and exhibit common phenomena such as critical slowing down, decreasing recovery speed, increase in autocorrelation and variance of fluctuation patterns, flickering (i.e. oscillating between two potential points of stability) and mutual affecting subsystems. However, they admit that such phenomena are easier observed in models than in realistic situations as noise would distort the interpretation of such early warning signals.

The aetiological explanation of crisis of Schulenburg (2008, p. 388) is a little less abstract. He emphasizes that his research findings – besides those on aetiological crisis contribution – provide praxeological benefits in form of guidelines for management action. Schulenburg examined the genesis of OC from a population and economic perspective and concludes that, in order to explain OC, two elements are to be observed: framework conditions [translation of the author] as well as laws.

As framework conditions, Schulenburg recognizes a set of independent variables (the dependent variable being "existential threat") responsible for the development of crisis. With laws, on the other hand, he addresses

cause and effect relationships. For both framework conditions as well as for laws, he draws upon the work on population ecology of M. T. Hannan and J. Freeman as well as Aldrich, Amburgey et al.

A reproduction of the comprehensive body of Schulenburg's findings would go beyond the scope of this literature review. However, the last few relations of independent variables with the dependent variable "existential threat" are reproduced in Table 6. In total, Schulenburg (2008, p. 327) names 59 variables and provides a model with a variety of interrelations between these variables.

Table 6 Excerpt of Schulenburg's Model of OC Genesis (adapted)

Dependent Variable (No.) →			41			Existential Threat
			↑			
Independent Variables (No.) ↓ →			58			Target Disturbance
			↑	↑		
Resource-inputs of Stakeholders			44	19		Capability to Absorb External Shocks
			↑			
Absolute Adaptation Deficits	1	→	3	←	39	Range of Services and Products
Turn away of Stakeholders (3)				↟		
			…	2		Absolute Size of Resource Buffer
50 more Variables ↓ →		…	…	…	…	

Example for the interpretation of Table 6: Turning away of stakeholders is (negatively) related to (44) resource inputs of stakeholders, which is positively related to (58) target disturbance and again to (41) existential threat. Key to symbols: ↑ stands for relation; ↟stands for no relation

Seifert (2006, p. 318) answers the question: "*Why and how do organisational crises develop?*". She finds that the field of crises which are significant phenomena for organizations is still in a pre-paradigmatic stage and investigates primarily the *consequences* of crisis rather than in its *causes*.

Seifert (2006), after a comprehensive literature analysis on OC, names four main contributions of her work to the extant body of knowledge about the genesis of OC. Figure 5, which has been reproduced according to p. 322 of Seifert's thesis, names these contributions.

It contains:

1. Five categories of crisis genesis processes.
    a. Construct 1 addresses the increasing complexity during OC
    b. Construct 2 addresses stakeholder ignorance towards OC
    c. Construct 3 refers to the dropping of options vis-à-vis OC
    d. Construct 4 refers to the dropping of responsiveness during OC
    e. Construct 5 refers to stakeholder risk taking and loyalty in OC
2. An illustration of the crisis genesis process called Framework I with two different levels: (1) Company specific contributors with the above constructs 1 and 4; and (2) Common underlying dynamics with constructs 2, 3 and 5, each subdivided into types of perturbation frequency and crisis phases.
3. An illustration how the five constructs interact in interlocking and mutual reinforcing feedback loops (vicious cycles) called framework II.
4. A differentiation of framework I with respect to four different crisis types of causation and outcome.

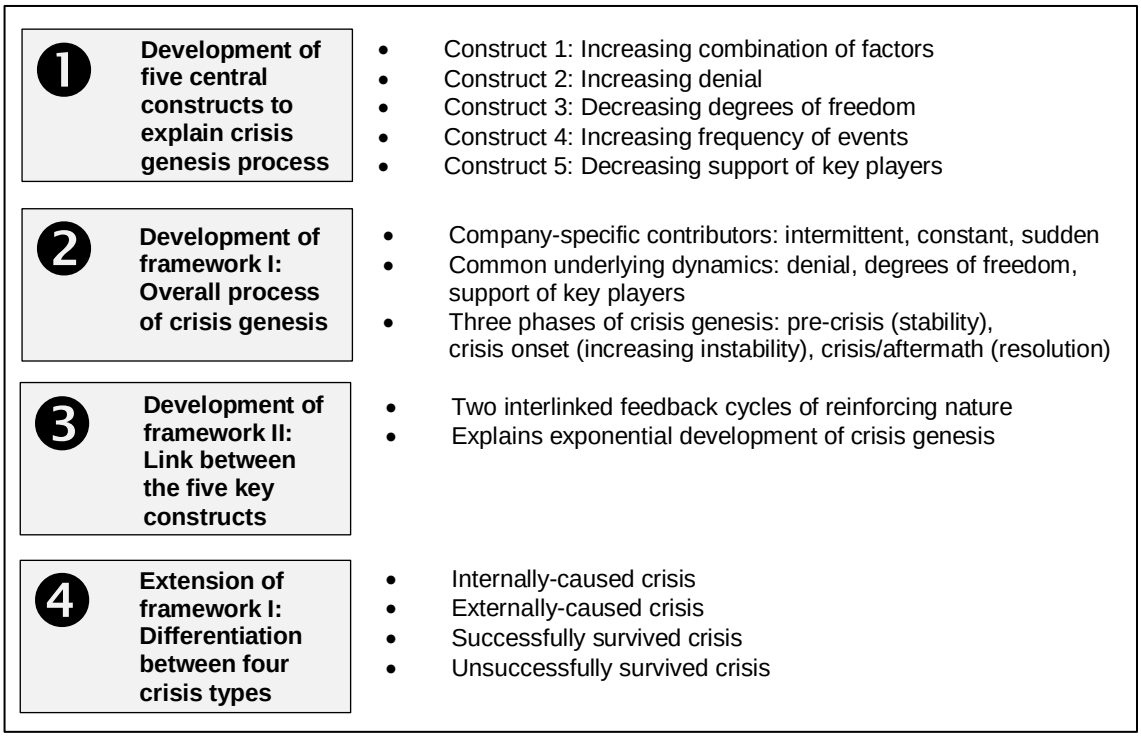

Figure 5 Main Contributions to OC Genesis Seifert (2006)

2.7.4 Ansoff's Weak Signal Concept

Authors frequently stress the importance of early warning signals for the perception and pre-emption of OC. Ansoff (1975), in his seminal article on weak signals, proposes a systematic monitoring of the organization and its environment to identify indicators of future perturbations. Depending on the results of a continuous threat assessment and information gathering about an array of such observed issues, he suggests initiating adequate measures in order to manage (i.e. pre-empt) strategic surprise. Effective early recognition and pre-emption of perturbations however, would correspond to avoiding OC in the first place.

Holopainen and Toivonen (2012), revisiting Ansoff's weak signal concept, concluded that the concept only recently gained a foothold, namely, in the field of future studies, where broader social issues are of interest. This comes as no surprise since the problem with weak signals is the weakness of the signals within the noise of others: Hit accuracy depends not only on the precision of targeting but equally on the size of the target. As early as 1975, prior to the internet, when Ansoff presented his concept, the relationship between noise and useful signals was an issue. In fact, Ansoff then abstained from elaborating on the "how" of detecting relevant weak signals although his approach of processing issues detected once was insightful and, as can be seen, useful for future studies which aim at broader targets. Since then, signal noise has grown exponentially but weak signals are still weak, aggravating the circumstances to detect them. Holopainen and Toivonen (2012, p. 204) 40 years later, note that "*[…] the development of user-friendly and plausible tools and techniques for the mapping and interpretation of weak signals is still in its infancy […].*"

Tempting as it may be, it remains questionable whether the weak signal concept can successfully be developed in the originally intended direction. *After* an event, it is possible to retrospectively identify the relevant weak signals because then there exists a logical chain of cause and effect which can be re-established.

An interesting example in this respect was presented by Marsen (2014), who recommends a narrative-semiotic approach for the analysis of OC. He re-established the circumstances of the Columbia Space Shuttle accident of 2003 using a narrative-semiotic approach to analyse the communications among NASA agents before the accident.[9] As a reminder: A foam strike during the start had destroyed part of the thermal blanket of the spacecraft. The strike had been detected on time and a debris assessment team (DAT) was formed to assess the situation.

Marsden shows (with reservation about the representativeness of the approach) that the discourse culture – and with it a structural trait of this organization – along with agents of different hierarchical levels within NASA played an important role in the failure to prevent the loss of Columbia. With a view on the narrative trajectory, Marsen (2014) states that "*[…] crisis can be defined as an event that disrupts the expected progression of a task and requires urgent decisions and actions to re-establish normal function. In this respect, crisis is analogous to the complication sequence of the narrative as an extreme or disruptive manifestation*."

Marsden thus observes parallels between the event and the communications and cites examples of such complications, which eventually led to the failure of both, communication and the Space Shuttle Columbia. The debris assessment team asked to commence imagery of the respective area of the shuttle in orbit but they did not obtain authorization from the mission management team (MMT) to take pictures of the damage. By circumventing the mission management team, the debris assessment team tried to obtain imagery regardless, and so breached the narrative contract. Meetings and communications with unclear messages, tone and misleading humour followed. In this "narrative struggle" even the clear and emphatic warning ("Yes, it's that serious") of an agent was ignored. In the end, no imagery was ob-

[9] With it in fact demonstrating that the designation as an accident only applies to the foam strike that - by chance - caused the problem, whereas the *loss* of Columbia itself was not only foreseeable but even foreseen. From a cybernetic point of view Columbia was lost due to a breakdown of the control loops and especially of the algedonic loop in the NASA organization.

tained, the fault was not identified and Columbia lost its structural integrity upon re-entry into the atmosphere.

This example shows that by using a narrative-semiotic approach, the grounds of an OC can be established surprisingly well. However, Marsen concludes that the method continues to implement a retrospective approach as the relevant information (and, of course, the knowledge about the event) is *not available* (nota bene: the author does not mean "not knowable") prior to the event. As long as the cause and effect chain is not realized (which is an immanent characteristic of prediction, the chain is only completed with the event) the relation of an unknown cause with an unknown effect remains speculative and accordingly can be established only probabilistically. This is not only due to the overwhelming number of scenarios or the dynamic traits of the problem but also because, prior to the event, there is nothing available, which could be detected; the chain is only probable, but not manifested yet.

This raises the question of whether such ex-ante non-availability of information would also render OC-prediction based on Viable System Model characteristics impossible. The answer is no, because the VSM provides a finite and exact ("necessary and sufficient") number of standard cause and effect chains, which can be examined for deficiencies (to put it very simply).

Besides the difficulty of identifying the right signals out of substantial noise, the – a) extrapolation of such signals into an unknown dynamic future setting; b) interplay with other factors or other weak signals; c) problem of continuous operationalization of relevant content; and d) interpretation of substantial amounts of data – limit the effectiveness of this approach, despite the options that big data processing offers. Last but not least, the ambiguity of weak signals may influence the perception by management which could be tempted to dismiss weak signals as Cassandra calls.

"*Prevention is the paradoxical task of changing an inherently desirable presence in a way that it stays as it is*" as Hafen (2007) puts it [author's own translation]. Indeed, the weak signal approach as a method of prevention

demands the relevance of not-relevant issues, which inevitably produce credibility problems.

It is, therefore, possible that a limitation on not-so-weak signals may be more productive. These may indeed demand increasingly agile effort in counteracting manifested effects but have the advantage of more clarity and unambiguousness and thus less allocation of time and manpower.

2.7.5 Financial Metrics to Predict OC

The prediction of OC should not be confused with the prediction of bankruptcy by credit scoring or insolvency risk models. If the non-viability of an organization can already be observed in its financials, many opportunities to counteract or pre-empt have already been missed and damage has, by definition, already occurred. When also considering the rapidly, even exponentially diminishing scope for action in the course of crisis, then financial metrics can be considered helpful as a late stage measure but are, in principle, an insufficient tool to avoid OC in the first place.

Financial metrics to predict bankruptcy have a long history and culminated in the Z-Score Model of Altman and Hotchkiss (2006) and in artificial intelligence systems used by banks for early detection of credit risks. Such models are effective tools, with Kinzel (2009, p. 36) even coming to the conclusion that with Z-Scores, the majority of insolvencies can be differentiated and predicted. However, Z-Scores recognize crisis effects only when they already have affected the balance sheet and accordingly they are collision avoidance systems rather than navigation and control systems, to use a flight metaphor. Secondly, Z-Scores are based on financial data of commercial institutions. At the time of writing, *The Times* reported about the massively overstated profit of Toshiba, which, for years, substantially relativized the reliability of financially based prediction models. In conclusion, it can be said that, despite its technical effectiveness, the Z-Scores-approach as an output or outcome orientated method misses two major objectives of this thesis, namely, the early detection of crisis processes within the normal course of business and – due to its financial orientation – the prediction of OC with

governmental or non-profit organizations like schools, associations or administrative bodies which exhibit different metrics and financial relations than commercial firms.

2.7.6 Disciplinary Business Failure Prediction Theories

The unsatisfactory explanations of OC causation and the absence of reliable leading indicators of OC drove the author to investigate the literature about early detection of organizational crises. The results of this investigation were sobering. Neither did a theory of organizational crises exist, nor was there a generally accepted framework available to recognize it early. Rather, each area of business administration or business science provides one or several useful and – from a disciplinary perspective – even vital theories, from H. Ford Dickie's ABC-Analysis of 1951 in inventory management, to Z-scores of Altman and Hotchkiss (2006) about financial default prediction, each grasping only aspects (i.e. product portfolio, financials, market orientation etc.) of the overall question of organizational viability or health.

Balcaen and Ooghe (2006) analysed thirty-five years and forty-three models of statistical business failure prediction and concluded with a list of major flaws in such models. The flaws they observed included on the one hand the arbitrary definition of the concept of failure and on the other oversampling of failure firms as well as the neglect of the multi-dimensional nature of failure. Numerous issues have been identified by the authors and they conclude that there is a gap in the literature for alternative methods of business failure prediction and point to the necessity of further research in this field.

In the course of this literature analysis, it turned out that different areas of business administration, e.g. finance, marketing, organization, human resources, strategy, IT, logistics or operations, to name just a few, have each their own explanations as to why organizations fail. Indeed, it cannot be denied that fatal errors in one specific area, such as investing without prior financing, ignoring competition, back and forth organizing, failure to attract and retain talent, misjudgement of demand, overconfidence in IT-solutions or a

disaster with fatalities may each cause a severe organizational crisis and place an organization as a whole under an existential threat. However, such boundless variety or, more precisely, arbitrary “reasons” for an OC only shed light on the simple fact that, more simply, any sufficiently large management error may jeopardize an organization and be the cause of an OC. But, the supposed functional or disciplinary nature of such errors may only be a mirage. The question arises, whether such and other management mistakes are rather local expressions of *underlying invariant principles* which are effective in organizations and which ultimately govern the (non-) occurrence of OC.

A simplified case example may illustrate this view. On 31 December, the organization ABC is alarmed due to a precarious account balance of minus 200k that threatens the solvency of the organization. The finance department establishes that revenues have been smaller than expenses by 200k, marketing department finds that margins have been lower than budget by 200k and production department discovers that output has been smaller than input by 200k. Accordingly, every functional area has its plausible explanation for the account balance of minus 200k. Finance starts a cost program, marketing an incentive plan and production an efficiency campaign to counter the shortcoming. What *actually* happened was a coincidence of an estimation error and a failure to handle deviations actively. Expectations of 1000 had been translated into a plan of 800 when actually 600 materialized. Although the fact was recognized, no countermeasures were taken.

This insight (misinterpretation of the environment and failure to detect and counteract variance), is non-disciplinary and fundamental (invariant basal mechanisms). Nevertheless, it adds value to the improvement process of the individual functional areas.

The three illustrative underlying control principles set out above are taken from the Viable System Model (VSM) of Beer (2004, p. 1) where they were referred to as System 4, 2 and 3. Peter Gomez, Karl-Heinz Oeller and Fredmund Malik, three University of St. Gallen scholars, state in Malik (2008, pp. 69–71), “*[a]pproaches to solving specific partial or sub-problems have*

hardly come closer to the core of management problems, with the exception of the cybernetic way of thinking mentioned at the outset. This is partly because only partial- or sub-problems were investigated, although management always has the entire enterprise as its object of observation. But this is also the case, because partial or sub-problems can be investigated under simplified conditions. With it, often enough precisely those characteristics of a problem are eliminated, that make cybernetic reasoning useful in the first place. Especially from cybernetics, which on the one hand regards itself as the science of system control and on the other hand explicitly considers the factual complexity of real-world systems, it must be expected, that new impulses be set for the further development of management theory and management practice. Without doubt, the most promising direction becomes apparent in the work of Stafford Beer, who must be regarded as the outstanding pioneer of management cybernetics. He is mainly concerned with investigating the core mechanisms of management and combining them into a unified theory. His results culminate in a comprehensive model of the structure of any system, which, in a dynamic, i.e. permanently changing environment, is able to maintain an independent existence." [own translation; emphasis in original].

As will be seen in the following paragraphs, these core mechanisms or underlying control principles deserve closer attention in the context of this dissertation.

2.7.7 Holistic Imperative of OC Understanding

The above case example of the organization ABC suggests that slowly developing OC is intelligible rather in relation to the basic balance and control characteristics of the organization as a whole than with regard to the state or behaviour of single elements, functional areas or characteristics of that organization.

This "holistic imperative" of OC understanding means that a suitable theory with which OC aetiology can be assessed effectively not only should involve a complete model of the organization but also a clear definition of the

interplay of its elements or constituents (invariant principles). This insight comes close to the theorem of Conant and Ashby (1970), who state that "*Every good regulator of a system must be a model of that system*" [emphasis in the original omitted].

The occurrence of (non-)OC can be seen as the success or failure of the overall control *system of an organization.* Accordingly, OC can be understood using a cybernetic approach which is able to describe and make intelligible the organization as a system holistically by focusing on the dynamic interrelationships between the elements of that system.

However, system approaches are not the only theoretical approaches that have the *overall effectiveness of organizations* as their objects. Other theories focus on this construct and might therefore be eligible to serve as a theory and explain the occurrence of OC from a holistic perspective. Eligibility criteria besides the basic theory requirements in the context of this dissertation project are:

A. Holism: A generic non-disciplinary, overall perspective on organizations that allows organizations to be scrutinized in their entirety. Because an OC affects an organization (and puts it under existential threat) in its entirety and may have its origin in any place of the organization.
B. Focus: A main concern with the maintenance, development and sustainable existence of the organization. Because OC threatens the very existence of an organization.
C. Model: A generic representation of fundamental internal functionality of the organization and a set of rules that governs this functionality: An assessment of an organization presupposes applicable criteria.
D. Delimitation: A clearly defined cohesive and finite framework which allows a complete operationalization of its contents (criteria) with which organizations can be assessed. Because it must be clear, exactly which set of criteria shall be applied to all elements (organizations) of the sample.
E. Parsimony: An effective but parsimonious approach the content of which can be operationalized and applied (using a questionnaire) within

the limitations of a research project (number, effort, time, knowledge, understanding and experience of respondents). Because complex and extensive models result in surveys of the same kind. Large questionnaires bear the risk of early break-offs or stereotypes i.e. invalid responses by the respondents.

2.8 Eligibility of Established Models to Understand OC

In this section, established management models of operational effectiveness will be briefly examined with a view to their eligibility to serve as the material basis for OC aetiology research. The eligibility criteria are taken from the last paragraph (A: Holism, B: Focus, C: Model, D: Delimitation, E: Parsimony). The following discussion of the models corresponds to a personal qualitative rating of the author based on literature on the respective models. All considerations that lead to the rating are given; references to the eligibility criteria are made by adding the respective letter A, B, C, D or E.

Established models of *overall* organizational effectiveness which are considered here are the following:

- Balanced Scorecard by Kaplan and Norton (2006)
- St. Gallen Management Model by Rüegg-Stürm and Grand (2015)
- Total Quality Management or EFQM-Model for Business Excellence by the European Foundation for Quality Management EFQM (2016).
- Learning Organization by Senge (2011)
- Viable System Model (VSM) by Beer (1994b)

Despite the variety of these established models, they exhibit an important common invariant: the focus on the capability to produce a desired result or the aim at ensuring organizational effectiveness. Although in case of the VSM the main emphasis is on the viability or longevity of organizations, such sustainability necessarily involves fulfilling the intended or imposed purpose.

2.8.1 Balanced Scorecard

Criteria (see 2.7.9)	A Holism	B Focus	C Model	D Delimitation	E Parsimony
Correspondence	*****	***	***	***	**

***** = strong * = weak

According to Kaplan and Norton (2006) the Balance Scorecard (BSC) was developed in the early 1990s as a measuring instrument primarily for non-tangible assets of an organization. Today the BSC has become a tool for a systematic *implementation* of strategy across all disciplines and levels of an organization (A). It is considered systematic because applying BSC means identifying and actively managing multi-branched cause-effect-chains starting from the "basic resources" of an organization (driving factors) proceeding via "planned measures" to "target achievement", "financial or qualitative (i.e. "balanced") results" and finally to "mission accomplishment" (effects). With a focus on effectiveness (B), BSC allows the cause-effect-chains to be streamlined across the organization from the "learning & growth perspective" where (new) abilities and potentials were fostered, via the "internal / employee and customer perspective" to the "financial perspective" where the results materialize in currency (C). Within these main perspectives (more can be added), the adopter of the BSC maps the interrelationships, establishes performance indicators, measures progress and intervenes to correct deviations. Transparency, comprehensibility and communicability of BSC planning are strengths when implementing strategy. The inflexible nature of the various "programmed" success paths, on the other hand, in business cases where frequent external (environment) and internal change is an issue, has to be considered a clear weakness. Moreover, continuous updating of the BSC consumes both time and resources and requires significant communication efforts. The BSC framework does pre-define generic fundamental relationships (cause-effect-chain, see above), which are, in general, relevant for all organizations (C). Yet, the sheer fact that cause-effect-chains have been defined by an organization does not suffice to base a valid assessment upon them (the chains could be erroneous or irrelevant). The BSC approach does not qualify as the basis of a comparative assessment (C). Furthermore, by

using BSC as a conceptual basis, only organizations can be included which have already introduced a BSC.

2.8.2 St. Gallen Management Model

Criteria (see 2.7.9)	A Holism	B Focus	C Model	D Delimitation	E Parsimony
Correspondence	*****	*****	***	***	*

***** = strong * = weak

In the 1960s, the rampant specialization of business administration into isolated disciplines such as marketing, human resources, manufacturing and accounting caused a "*productive dissatisfaction*" at the University of St. Gallen (Switzerland) as Rüegg-Stürm and Grand (2015)[10] put it. On the basis of a "*fruitful confrontation*" (ibidem) with systems theory and cybernetics, the St. Gallen approach was developed. Today's fourth generation of the model still takes an integral perspective (A) on (the interplay of) the environment, the organization and the (normative, strategic and operative) management (B). With it, the model emphasizes the complexity of the management task and defines six core categories (environmental spheres, stakeholders, exchange relations with stakeholders, organizing principles, processes and modes of development) each comprising between two and seven subcategories (D). The model is considered to be a working tool and a reflection aid (C) for an in-depth analysis of the management task. Accordingly, the model provides a comprehensive collection of "topics to be considered" rather than prescriptive rules or criteria.

It is exactly this richness of the model (E), which makes it unusable for a holistic assessment of a larger sample of organizations. It is not possible to separately consider 22 dimensions qualitatively (and mutually) with a view to the business model of the specific organization in question and with no reference (value) to evaluate an organization against a benchmark or target state (C).

[10] www.sgmm.ch

2.8.3 EFQM TQM Model for Business Excellence

Criteria (see 2.7.9)	A Holism	B Focus	C Model	D Delimitation	E Parsimony
Correspondence	*****	****	*	*	***

***** = strong * = weak

The EFQM Model for Business Excellence was developed by the European Foundation of Quality Management, based on Deming's insights about quality management in his seminal work "*Out of the Crisis*" Deming (1982) . It is a widely known system, called Total Quality Management (TQM) and covers all ("Total") aspects of an organization (A). The model, according to EFQM (2016), focuses on the sustainable existence and development of the organization (B) by demanding excellence from all aspects of an organization; however, the model is non-prescriptive (C). With the definition of nine "Concepts", five "Enablers" (Leadership, Strategy, People, Partnership & Resources, Processes, Products & Services) and four "Results" (Customer, People, Society and Business), the model specifies important areas (D) and principles (C) of excellence but does not provide a model (C) of the internal relationships or a set of rules to be considered in order to control an organization – apart from the well know plan-do-check-act cycle which, however, is a generic task solving process only and does not provide insights about the overall functioning of the organization (C). With this, the TQM-Model does not offer an analytic reference for the assessment of organizations but rather aims at providing guidance for the installation of organizations "*that meet or exceed the expectations of all their stakeholders*" as EFQM (2016) (p. "Fundamental Concepts") points out. The latter depends on the individual way a user of the model has implemented TQM. With TQM too, the only organizations that could be included in a survey are those which already have a TQM system in place.

2.8.4 Senge's Learning Organization

Criteria (see 2.7.9)	A Holism	B Focus	C Model	D Delimitation	E Parsimony
Correspondence	*****	*****	**	**	***

***** = strong * = weak

Peter M. Senge (2011, pp. 85–87) in his book "*The Fifth Discipline*" remarks, "*[w]e all tend to make "somebody else" responsible – the competition, the press, the vagaries of the market, the government – for our problems. System thinking shows us, that there is no "out there" and that we and this "someone else" are parts of the same system. […] I call system thinking the fifth discipline, because it is the conceptual base on which all five […] learning disciplines are built."*

Learning, according to Senge, allows quicker learning than an organization's competition, which is per se a competitive advantage. Learning how to learn, therefore, is a prerequisite for the development of a sustainable competitive advantage.

Senge (ibidem) p. 8 points out that there are ways of co-operation in organizations, which are a lot more satisfying and productive than the prevailing management system suggests. To ameliorate effectiveness, the ability to adapt and ensure further development (B) of the organization (A), five core disciplines are important: personal mastery on the individual level, (appropriate) mental models that influence and drive the individuals, shared vision of the future to produce commitment, team learning to align endeavours and save energy as well as system thinking which is the basis upon which the other disciplines interact in the business context (C). Senge's approach provides plausible insights as to why learning organizations deliver superior results to non-learning ones; but he does not specify how the five disciplines in an organization (C) can be operationalized and implemented, nor, more importantly, how their availability and effectiveness can be measured. Three of them (mastery, mental model and shared vision) concern personal traits or experiences which are rather difficult to measure directly. Although team learning and system thinking are more collectively observable characteristics,

the five disciplines are hard to detect and quantify in order to relate them to the occurrence of OC.

This diffuseness of the five disciplines in terms of the measurement of their availability, mode of action and effectiveness in an organization disqualifies the approach as a basis for a causal OC analysis.

2.8.5 Viable System Model

Criteria (see 2.7.9)	A Holism	B Focus	C Model	D Delimitation	E Parsimony
Correspondence	*****	*****	*****	****	*****

***** = strong * = weak

In the quest to know how systems (A) are viable i.e. capable of independent existence (B), Stafford Beer started to develop the Viable System Model (VSM). In 1972, he published "*The Brain of the Firm*" and, in 1979, "*The Heart of Enterprise*": "*by then the necessary and sufficient conditions of viability had been established*" as Beer (1984, p. 8) states. Various other theorists and researchers built upon the viability principles that Beer discovered (Schwaninger (2000); Malik (2008); Espejo and Reyes (2011); Grösser (2012); Hoverstadt (2009); Pickering (2010); Jackson (1988) and Leonard (2009a); Gomez and Probst (1995; Rüegg-Stürm & Grand); Clemson (1984)).

The model looks at one recursion level or the "system in focus" of an organization and its relationships to the other levels. The recursiveness principle addresses the fact that "*every viable system contains and is contained in a viable system*" according to Beer (1984, p. 8). Thus the model covers any organization in its entirety (A).

The VSM defines the intra- and interplay of organizational entities in terms of their information, decision and control structure. It does so verbally and in the form of a topological map (C, representational model of the invariant control structure of any organizational system). As a generic model of the invariant control structures, the model can be applied (mapped) to real organizations. By virtue of the finite number of control functions which the model defines, it

is clearly delimited (D). With only five control systems (normative management, strategic management, operative management, co-ordination, operations) and four principles (autonomy, recursiveness, requisite variety and informational connectedness), the VSM is very lean[11] but has a large explanatory power, therefore, the model can be considered parsimonious (E).

These characteristics make the VSM eligible as a theory to test organizations for their OC proneness. In the next paragraph, the VSM will be compared to organizational models of effectiveness. An in-depth explanation of the VSM is available in chapter 3.

2.8.6 The VSM and the Models of Organizational Effectiveness

Organizational effectiveness – the ability to realize a stated purpose - is a core concept in business administration. Many theoretical approaches have been developed, to understand and/or ensure it.

As the four most important models of organizational effectiveness Balduck and Buelens (2008, p. 4) name 1. The goal approach, 2. The system resource model, 3. The internal process approach and 4. The multiple constituency model.

(1) The goal approach, according to Etzioni (1960) suggests that effectiveness is the degree to which an organization accomplishes its stated goals. Hence, an effective organizational system should ensure a controlled and efficient target achievement process. However, the idea of defining valid goals and achieving them, assumes perfectly intelligible and stable circumstances, which does not correspond to today's reality. Therefore, the goal approach does not go far enough to ensure organizational effectiveness.

(2) The *system resource model* for organizational effectiveness regards the organization as a system. According to Cameron (1980) a system is considered effective to the degree that it is able to attract and retain scarce

[11] As an example: The author has worked with grammar school students who, within minutes, learned to use the basic model for the analysis and re-design of their grammar school.

resources (input) from the environment and, furthermore: to transform these resources into an output which is valued by another group of the environment. However, attracting and transforming inputs into a sought-after output alone cannot occur in a vacuum; further conditions need to be present for the organization to be effective.

(3) The *internal process approach* emphasizes the connection between the value adding processes of the organization and the output. This is, because the circumstances when transforming inputs into outputs to achieve goals constantly vary. The *internal process approach* demands that processes must be at hand, which ensure compensation of disturbances or adaptation to changing conditions and this at lowest possible resource consumption (efficiency). However, when assessing organizational effectiveness the question arises, whose goals are to be achieved? Zammuto (1984, p. 606) formulates it in the following way: "*Whose preferences should be weighted most heavily in reaching a judgment of organizational effectiveness?*"

(4) The *multiple constituency model(s)* take(s) into account that systems have different stakeholders (actors) with different perspectives. These actors may have differing interests in the organization and – if so – have different ideas about the effectiveness of the organization. Zammuto (ibidem) distinguishes between *four multiple constituency model* approaches to determine the appropriate values: relativism, power, social justice and evolutionary values and concludes that the construct of organizational effectiveness is not only value based but also time-specific (ibidem) p. 614 because preferences and circumstances can change over time.

However, it seems obvious to the author of this dissertation that the discussion about competing values and its result which is the "right" measure of organizational effectiveness misses the point. Because – as Zammuto (1984) implies – such a power struggle about whose values shall prevail to judge effectiveness (shareholder groups, unions, environmental, homeland or the values of other power groups) does not necessarily, or only by chance, result in a set of goals which is in accordance with the sustainable existence of the organization. Imagine a powerful union maximizing their main value,

i.e. the employment or a shareholder group maximizing fund distribution – both the goals and associated values are incompatible with the long-term survival of the organization. Unless viability is ensured, any other goal is without meaning.

A viable system does exactly that: Guided by a purpose (System 5), it evaluates the organization (itself) as well as the current and (foreseeable) future environment (System 4), ensures effectiveness and efficiency when achieving organizational targets (System 3), co-ordinates (System 2) largely autonomous operative entities (Systems 1) which stand in direct exchange with the local environment (customers) when implementing the purpose.

This integration of the above mentioned aspects of organizational effectiveness together with the ability of constant adaptation to changing circumstances (ultrastability) is called organizational or system viability i.e. the ability to sustain. Viability, therefore, represents the antithesis of organizational crisis, which threatens the existence and, accordingly, the long-term survival of organizations.

2.9 Recapitulation

From the literature review, the following statements about OC apply:

OC exhibits a number of agreed-upon *characteristics* with a view to procedure, experience, causation and avoidance.

The *central property* of OC is that it puts an organization under an existential threat which cannot be averted by regular i.e. day-to-day-business means.

The *resources and options* available to fight an on-going crisis process diminish in the course of the OC process, while the default risk and the management requirements continuously increase during OC.

Once recognized, OC itself is never identified as a chance or an *opportunity* by an organization but always as a *serious threat*. Opportunities may be *worked out* in the process of crisis management but only as a *collateral effect* of fighting crisis, not as a *characteristic* of OC.

The *aetiology* of a crisis process is multi-causal, at least bi-causal: Firstly, a perturbation and secondly, a lack of an adequate answer to it. What counts as a perturbation is unique with respect to the specific organization. What disturbs one organization may not affect another or may at least not cause an OC.

This is why listings of OC causes lead OC research astray: Due to the individuality of organizations such listed generic "OC causes" (e.g. "*too close links to overly mighty partners*" or "*too flat or deep hierarchy or too early investment*" as in Hutzschenreuter and Griess-Nega (2006b, p. 32) may or may not apply at all, may or may not affect a specific organization and, indeed, may or may not disturb an organization's balance, not to mention that the "too"-formulations make such alleged causes as listed above non-verifiable.

An OC *trigger*, in contrast to an OC *cause*, may be just a "marginal perturbation", initiating the crisis process for a specific (particularly susceptible) organization. The earlier a crisis process shall be *detected*, the bigger

the number of possible causes and origins and, accordingly, the bigger the identification problem but also the bigger the chance of pre-empting an OC, before a system is negatively affected.

The last statement makes it clear that an on-going crisis process ought to be identified in the not-yet or latent crisis phase respectively. This would maximize the chance of ending it before the organization is harmed. With regard to the multitude of possible organizational circumstances, an approach to identify OC causes early, should allow a generic application, independent from local circumstances or technical language. Finally, a model to recognize and pre-empt OC should be closed, meaning that it exhaustively defines the conditions as to when an organization is prone to OC.

Several models of organizational effectiveness – for instance, Balanced Scorecard, TQM or the St. Gallen Management Concept – address the organization as a whole, which is a prerequisite when assessing OC causes. However, such approaches are considered to be ultimately too vague, and their parameters cannot be sufficiently bound or restricted to serve as an analytic tool to anticipate OC.

In contrast, when it comes to identifying proneness to OC, Beer's Viable System Model provides a holistic perspective on viability. The model is clearly defined and makes use of a finite set of criteria. Hence it is parsimonious and, additionally, it outclasses later or recent approaches in terms of explanatory power.

Thus, based on the insights of the above literature review and on the evaluation of an explanatory model to understand OC, it seems worthwhile to further explore the VSM. This is with the aim to ascertain whether or not a set of invariant management cybernetic principles – the VSM – can effectively serve as the theoretical foundation of a theory-led deductive reasoning process to explain OC. This will be done in detail in the next chapter.

3 THEORETICAL FRAMEWORK

3.1 Chapter Introduction

The literature review revealed that OC is a complex, multi-causal and dynamic phenomenon, which puts organizations under existential threat. The review of the literature also indicated, that the Viable System Model (VSM) – due to its systemic approach to, and holistic view of, organizations as whole entities – has high explanatory power when it comes to diagnosing the control system of an organization. However, the VSM also has a clear downside: Most users consider it complicated to understand and hard to apply. It is, therefore, worthwhile to further scrutinize the VSM in order to understand and employ it as the theoretical foundation for the study at hand.

Large parts of the community of researchers and managers are, however, not very familiar with systems theory and cybernetics, although both disciplines can be considered mature approaches. It is for this reason that this theoretical framework chapter has been introduced. It presents the theoretical underpinnings of the research approach of this thesis. Complementing this, the reader may find it worthwhile to read the glossary at the beginning of the thesis; it provides short explanations of systems theory and cybernetic terminology.

The section provides the reader with the conceptual background necessary to interpret and scrutinize the research process and its results. A closer examination of the Viable System Model, which builds the core of the theoretical foundation of this work, concludes this part.

3.2 Conceptual Basis: Systems Theory and Cybernetics

Although, systems theory is not one of the central and well known theories in management science, one important statement of systems theory is

well known; it originates from Aristotle's book "*Metaphysics*" and reads (simplified and transferred into modern language): "*The whole is more than the sum of its parts*"[12]. What Aristotle calls the "whole", is what we would today call a "system". A system or a whole is *always* defined (i.e. delimited from the environment and attributed a purpose) by an observer. For instance, one company may be considered by its shareholders (i.e. observers) a profit making machine, another organization is seen by its founders (observers too) as a social institution which has to maximize well-being of a target group (e.g. handicapped persons). Although, totally different in purpose and strategy, the objective common to these organizations is viability, the ability to sustain and realize its particular purpose.

What Aristotle's famous observation addresses is the circumstance that, to name contemporary examples, a car is something besides its parts; software is more than just program lines, organizations are more than an accumulation of resources and a human body is more than a collection of chemical elements or tissues. Some authors speak in this context of *emergent* properties. What *constitutes* a system - as opposed to a "*mere heap*" of elements - is essentially a meaningful *relationship* between its parts. Even with a complete collection of auto spare parts one cannot drive from A to B, unless the parts are related in a *meaningful* way (what sheds light on the other constituting aspect of systems, which is information).

Organizations can be understood as productive social systems, as Ulrich (1970) states. System theoretical approaches deal with sets of *invariant rules* that are at work in systems and which are decisive for the (observer-intended or non-intended) behaviour of these systems.

Adopting a systems approach to understand the phenomenon of the non-intended system behaviour called organizational crisis, this thesis looks at OC from a holistic perspective to avoid a too narrow (i.e. mono-

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[12] Original version in English: "[…] *In the case of all things which have several parts and in which the totality is not, as it were, a mere heap, but the whole is something beside the parts,*[…] " Source: http://classics.mit.edu/Aristotle/metaphysics.8.viii.html (accessed 07.04.2016)

disciplinary) viewing angle. This will balance the current variety or complexity gradient (a concept to be covered subsequently in this chapter) between the explanandum OC, which was too complex to capture for earlier research approaches and the OC-explanation models, which exhibited insufficient explanation power and dynamism in previous studies. The introduction of a more potent explanans (i.e. system viability criteria of the VSM), allows OC-causes to be detected across organizational disciplines and levels. For this the object of cognition must be the *functioning of the system per se* but not some inconclusive achievements or outputs of elements of that system.

This is necessary because organizational crises can originate in any or several areas of the organization, even at the same time. To most managers, especially those not familiar with basic cybernetic principles, it is therefore not clear, what variables to monitor and influence in order to keep the system as a whole alive and achieve goals. For such managers, numerous business disciplines and theories – which in part may conflict with one another – seem to be relevant at the same time. However, specific disciplinary or reductionist analytic approaches often do not suffice to develop a comprehensive framework (the big picture) of understanding for the complex problem of OC.

Heylighen, Joslyn, and Turchin (1999, p. 3) define cybernetics [13] (Greek κυβέρνητέρ "kyberneter"; steersman, κυβέρνησις "kybernesis"; steering according to Gemoll and Vretska (2010, p. 484) and system science as an academic domain in touch with practically all canonical scientific disciplines, such as mathematics, technology, biology, philosophy and the social sciences. Cybernetics dates back to the 1940s and 1950s when thinkers such as Norbert Wiener (who was the first to use the term "cybernetics" in modern times), Ludwig von Bertalanffy, Ross Ashby and Heinz von Foerster established the field through a series of interdisciplinary meetings, widely known as the Macy-Conferences, convened by Warren McCulloch.

[13] Compare lat. "gubernator" for Governor. Kybernetes was first used in figurative sense by Plato 380 BCE and later by Ampère 1834.

Systems theory or system science according to Heylighen et al. (1999, p. 3) claims that, independent from complexity or diversity of circumstances, one will always find organizational principles which can be described by concepts which are *independent from their specific domain*. Uncovering these general laws would allow problems in any domain and any type of system to be analysed and solved. This systems approach distinguishes itself from the older *analytic* approach by emphasizing the interactions and connectedness of the different components of a system. They add: *«Although the systems approach in principle considers all types of systems, it in practice focuses on the more complex, adaptive, self-regulating systems which we might call "cybernetic"».*

In his dissertation on the origin of corporate crisis, Schulenburg (2008, p. 85) establishes [author's own translation]: "*Overall systems theory seems to provide important contributions for the explanation of corporate crises. […] Firstly, that enterprises as open socio-technical systems strive to balance the demands of their surrounding systems and their service profile* ["service profile" in the sense of capability; authors note] *in order to survive and secondly, how and why homeostasis of a system can be disturbed so that the aforesaid principle* [of balancing; author's note] *can temporarily (e.g. in a crisis) or permanently (e.g. in a system demise) be suspended or retrieved* [that is recovered; author's note]*."* Despite this insightful finding, Schulenburg does not follow this conceptual approach in his dissertation.

The law of requisite variety of Ross Ashby (1956) states that only variety destroys variety. It expresses that, for the adequate regulation of a system (such as an organization, a human being or a country), the regulator needs to have at least as much variety (~ courses of action) as the system being regulated; this implies that a regulator must be able to produce at least as many counteractions as there are disturbances as Heylighen and Joslyin (2002, p. 15) state. Ashby uses the term "variety" as a measure of complexity, i.e. the number of (practically, not theoretically) *possible* states or actions of a system (a light switch (normally) has a variety of two). For a viable (business) system, variety balance is important. It must cope with both incoming

and self-generated variety - otherwise it will be overwhelmed and may spin out of control. To cope with variety, it uses amplifiers to increase its own variety such as advertising, remunerations schemes, IT-systems or consultants to multiply its own variety vis-à-vis specific tasks and/or uses variety attenuators to decrease incoming variety (see Figure 6) such as a clear cut product portfolio (cf. Henry Ford's colour range for the Model T between 1915 and 1925[14]), opening hours, divisionalization or micro-planning to reduce or counteract incoming variety and with it, balance the variety equation. If somebody uses an electronic calculator to solve an arithmetic problem he or she amplifies his or her own variety. On the other hand, looking out for blue cars only to find a friend means using an attenuator and thus decreasing incoming variety (suppressing all other colours). However, as Beer (2004, p. 25) warns, "*[t]he lethal variety attenuator is sheer ignorance!",* it addresses the fact that suppression and a head-in-the-sand attitude – i.e. complete attenuation – cuts off vital information.

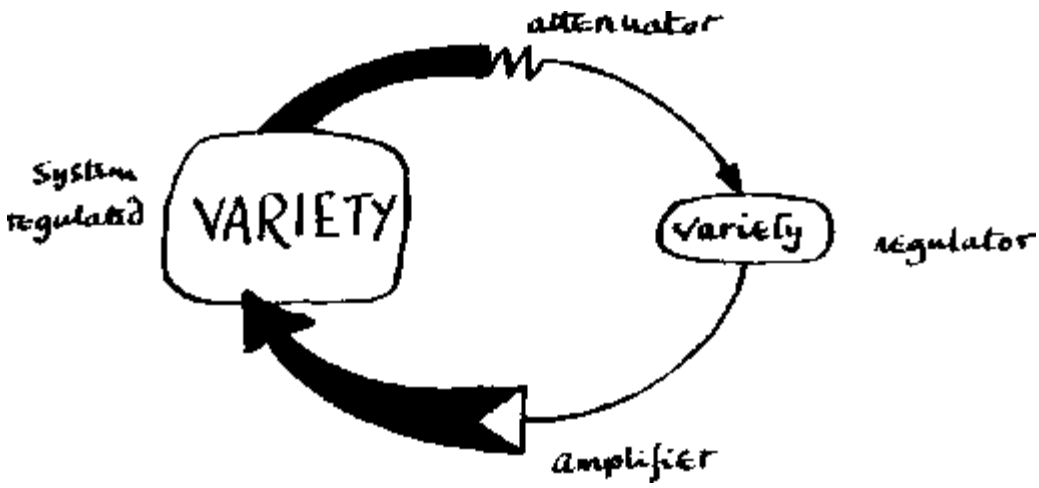

Figure 6 Variety and Regulation[15]

Together with Roger C. Conant, Ashby coined another seminal concept, the Conant-Ashby theorem: "*EVERY GOOD REGULATOR OF A SYSTEM MUST BE A MODEL OF THAT SYSTEM*" [emphasis in original] Conant

[14] "Any customer can have a car painted any color that he wants so long as it is black"

[15] http://ada.evergreen.edu/~arunc/texts.old/beer/book/Disregarded_Tools_Modern.html last visited 22.11.2016

and Ashby (1970, p. 89). The authors present the evidence (ibidem, p. 97) that a "*[…] regulator that is both successful and simple must be isomorphic with the system being regulated.*" [emphasis in original].

In the *methodological context* of this research project, Ashby's law means that the explanatory power of the analytic approach has to correspond at least to the complexity of the explanandum OC (d) to arrive at an explanans (s) of it. Earlier attempts to explain the aetiology of OC failed unnoticed because this requirement was not satisfied. As will be seen, cybernetic viability criteria fulfil the premises to explain OC: d follows deductively from s; s contains universal laws or principles necessary to explain d and s has empirical significance, i.e. is falsifiable.

It is advanced i.e. second order systemic theory – which looks at the entirety of an organization (first order) and at the same time taking into account the observer (second order) – that has the potential to meet this requirement. Cybernetics, according to Heylighen and Joslyin (2002, pp. 2–4), is the science that studies the abstract principles of organization in complex systems. They add that second order cybernetics recognizes the properties of the systems themselves, which are to be distinguished from those of their models, taking into account the observer of the system. This external point of observation allows a view of the system as an entity, without being part of the observed system (although still part of the "observer – observed system"-system depicting an infinite recursion problem).

Accordingly, no individual OC-causes or symptoms or even the damage incurred shall be observed as is the case in most analytic approaches to OC, but rather the *system itself which produces the crisis* in the first place.

The underlying intention of this research approach is to look holistically at a sample of crisis and non-crisis organizations and observe the invariants (as defined by the viable system model of Beer) that are responsible for the functioning or malfunctioning of the organizations as a (whole) system. This is done by taking into account the system as a whole, instead of the individual parts. This analytic extra power comes at the price of complexity: Systemic

analysis uses models – i.e. constructs with a multitude of interrelated sub-constructs – to provide the desired explanatory variety necessary to cope with the complex nature of both productive social systems as well as organizational crisis.

3.2.1 Regulation (and Crisis)

Ben-Eli (2009) defines crisis as a failure of adaptation, while Ashby (1960, p. 54) describes the origin of adaptive behaviour as follows: *"Every stable system has the property that if displaced from a state of equilibrium and released, the subsequent movement is so matched to the initial displacement, that the system is brought back to the state of equilibrium. A variety of disturbances will therefore evoke a variety of matched reactions."* This restoring force concept also known as *Le Châtelier's* principle, plays a central role with regard to system stability. Ben-Eli (2009) gives an illustrative example of such regulation, which is the main discipline in cybernetic theory (see Figure 7, borrowed from Conant and Ashby (1970, p. 90).

A regulator R and a regulated system S interact (solid lines in black and green) so that a disturbance D cannot drive the outcomes (green dot) out of a set of desired outcomes G into the set of unwanted outcomes Z or even into a set of non-viable outcomes X (dotted lines, big red dot) [X is an addition of the author for didactic reasons; set theory rules are not applicable as Z had to be defined as "Z without G"].

In human social systems, as Ben-Eli (2009) states, all the variables R, S, Z, G can be designed. The regulator R, however, is of highest importance as it allows the system to self-organize and adapt.

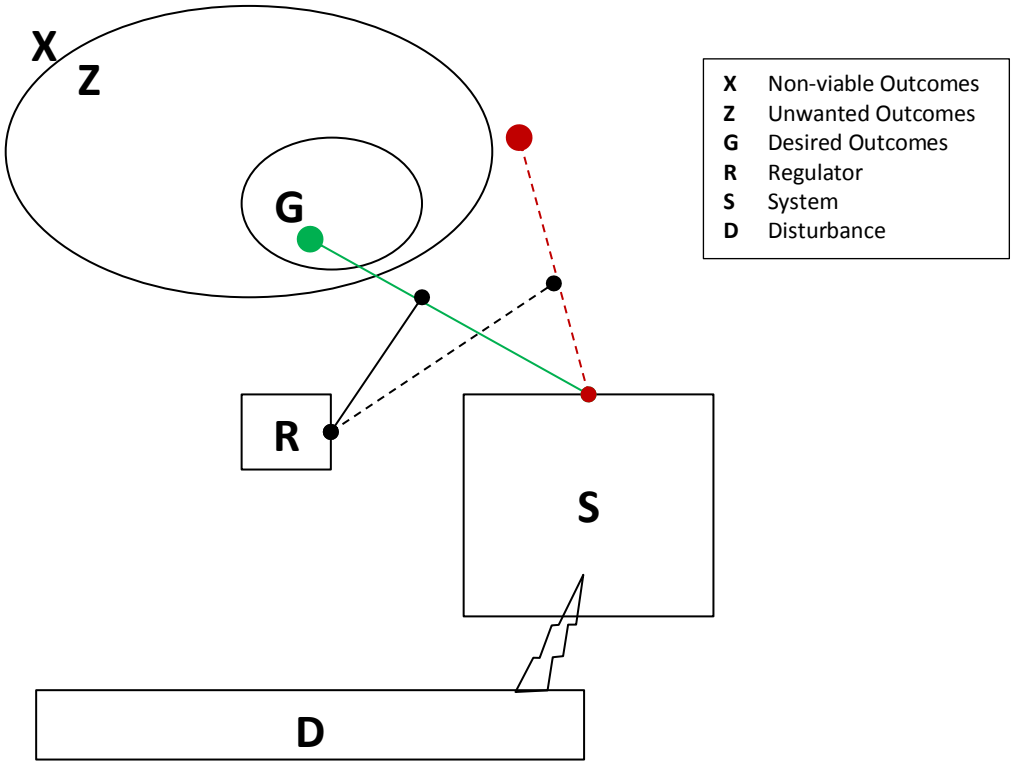

Figure 7 Ben-Eli's Model of cybernetic regulation

The model of cybernetic regulation in Figure 7 follows a *feedback* principle; the disturbance *effect* on the outcome in G (via S) is fed back to the regulator, which acts accordingly. Following a *feedforward* principle, the regulator would already act upon the *disturbance* itself, anticipating its effect on the outcome and counteracting in advance, i. e before the outcome is shifted out of G. Feedforward, however, is far more complex and costly as it presupposes disturbance sensors (which gather and feed forward disturbance information to the regulator) for all possible disturbances as well as prediction algorithms for all disturbances and their interactions effects. In addition, following a feed-forward principle, timing issues would be equally important as otherwise the anticipating regulation impulse, R, would risk driving the outcome out of G before D hits the system.

Ben-Eli (2009) lists three strategies for successful adaptation to disturbances by a regulator, R: first, a fixed decision rule if the conditions of the environment persist; second, when complete prediction of the environment is impossible, Ashby's concept of ultrastability, where sufficient redundancy (slack,

reserves) allows the system to re-arrange its internal configuration until it hits a state which matches the requirements of the environment. Third, evolution, which changes the decision rule itself to amplify regulation for complex environments.

From Ben-Eli's point of view, failure of adaptation is threefold: firstly, a failure of *identification* (of a disturbance (D), such as a gradual loss of customers) due to complexity, epistemological blindness, structural issues or vested interest; secondly, a failure in *response (R)* (on the disturbance, e.g. no customer retention programme is initiated) for the same reasons; thirdly, a failure to *prevent run-away exponential amplification* of deteriorating conditions after a disturbance (substantial loss of customers and accordingly of sales, loss of purchasing volumes and accordingly purchasing conditions) under the pressure of crisis, fear and reflex, which fuels a downward spiral (lack of means (D or H│P respectively) to counteract with marketing communication, further loss of sales (D) and funds (D) and finally insolvency (Z) and liquidation (X)) (see Figure 9).

Presented on a timeline, Ben-Eli's regulator model illustrates the genesis of crisis from a regulation or adaptation point of view. Figure 8 shows a homeostat, where number and timing of regulation effects (ΣR, sum of all regulating effects) offset disturbance (ΣD, sum of all disturbance effects) effects. In the homeostasis model, the outcome (green line) remains within the desired area G (i.e. in balance).

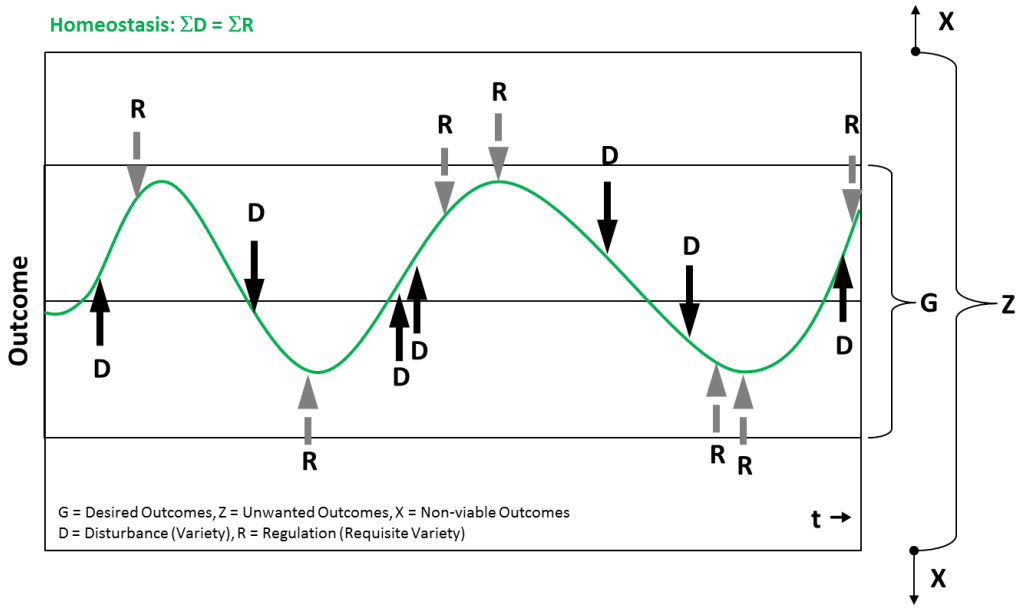

Figure 8 Homeostat where ΣD = ΣR

Figure 9 gives an example for a heterostasis situation, where the number and timing of regulation effects, R, drive the outcome to overshoot into X. Additionally, the graph shows hysteresis or persistence effects (“H|P”).

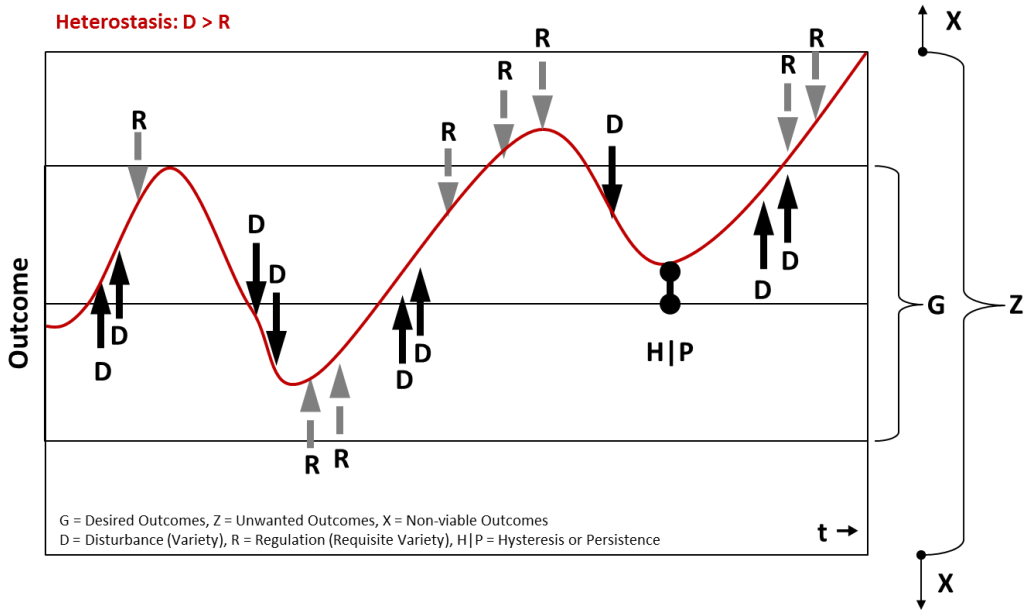

Figure 9 Heterostat where ΣD > ΣR

Ύστέρησις (ancient Greek “hysteresis”; ’lack’, ‘shortage’, lagging behind’) means an effect of an external stimulus on a system, which *lags be-*

hind after the stimulus has disappeared. Persistence (Latin "persistere"; 're-main') or a durable memory effect on the other hand occurs, when a system *sustainably* changed under the effect of stimuli (learning, irreversible effect), which can be seen in Figure 9 at the point designated "H|P". There, the persistence effect entails that the following two disturbance effects, D, cause a build-up effect which eventually drives the outcome (red line) out of G via Z into X despite massive regulation effects, R. From a cybernetics perspective, crisis is the consequence of a regulation failure, namely, a lack of variety in the decision rule itself, or as Ashby (1960, p. 54) puts it: "*Crisis is a failure to produce second order change* […it is a…] *failure to transform the decision rule itself*".

Girolami, Schmidt, and Adesso (2015, p. 757) rediscovering Ashby's work and his regulation model expand the picture of an error correction mechanism to invert disturbance. They (ibidem, p. 759) point to the fact that regulation may act *before* the disturbance (feedforward) and assume that disturbance and regulation "interact" parallel with the system.

Leonard (1990/revised 2004, p. 10), referring to the catastrophe theory of Thom (1975), states that catastrophes are best described by their capacity to transcend stability limits beyond the area of usual fluctuations and that where "*incremental change in a certain direction gives way to abrupt change in another direction […] it may signal a significant opportunity as well as a potential disaster".* Leonard (ibidem) adds: *"Systems approach catastrophe through a region of instability from which they either return to equilibrium, or cross the boundary into a state in which they will either find a new point of equilibrium or fail to survive.*"

These statements imply that crisis is not just the fact that the going gets tougher and tougher, but that, at a certain point, the going gets its own dynamic which, unless different control behaviour is exerted, changes the behaviour of the system in a way that makes it uncontrollable to formerly effective control mechanisms: The *fundamentals* of an organization change without noticing (unnoticed) with the effect that formerly successful control

impulses lose their impact, or this impact undergoes change, and the system goes out of control. Two examples may help to interpret the above.

Organization A is constantly attacked ("D" in Figure 9) by competitor B who plans to take over A's position as a market (share) leader. B accelerates its innovation activities and significantly increases the frequency of new product introduction. A adapts itself ("R") by even faster innovation but fails to adopt a change in technology. "A" further innovates based on familiar technology but loses market share, which is taken over by B, who had adopted the technological change in the first place. A's market share dives below the profitability threshold (enters the area "G" in Figure 9) and eventually A goes out of business (enters "X"): A's ever quicker and more intense counteraction was increasingly ineffective (oscillation) due to a lack of demand orientation based either on insufficient market insight or an inadequate technological response capacity.

As a variant to the above example, imagine large equity and liquidity reserves with A: The bigger this financial buffer, the *longer* A's resilience against the attacks of B; that is to say that financial resilience (only) broadens the area between G and X in Figure 9. Accordingly, survival depends on how well this borrowed (or bought) time is used to adapt to the environment.

3.3 Suitability of the VSM as Scientific Theory

Besides the basic conceptual suitability of system theory, cybernetics and regulation for this research project, it has to be established, whether the Viable System Model can be used as a scientific theory for theory-led deductive reasoning. The VSM itself will be discussed in detail in the following sections of this work.

A scientific theory is a system of coherently connected statements about a phenomenon which refer to empirically testable relationships between variables (definition by Diekmann (2010, p. 141) and Wallace and Wray (2009, p. 67); Jackson (2000, p. 163) answers whether the VSM qualifies as a theory in this sense. First he stresses the model character of the VSM, contrasting it with a methodology, but he concludes that the VSM is based on "*such firm cybernetic principles that it is not difficult to extrapolate […] exactly how to proceed in uncovering the faults of organizations.*" (ibidem, p. 173). Furthermore, he states that the VSM rests upon the science of cybernetics, which ensures that its use generates enormous explanatory power compared with the usual analyses carried out in organizational theory.

Schwaninger (2006b) provides a comparison of theories of viability and parallels the VSM with Miller's Living System Theory (LST), which he finds both to be based upon thermodynamics, information theory systems theory and cybernetics. He states that both theories aim to identify the essential components ("invariants") of a social system that ensure the viability and survival of an organization. He considers that one advantage of the LST is its broader empirical underpinning, while with the VSM he identifies the stronger theoretical claim and falsifiability as well as more diagnostic potency.

Malik (2008, p. 71), characterizing Beer's work, points to Beer striving to identifying the core mechanisms of management and summarizing them in a *unified theory*. "*His* [Beer's[16]] *results eventually culminated in a comprehensive model* [the VSM[16]] *of the structure of any system, which is able to*

[16] Note of the author

survive in a dynamic, i.e. permanently and unforeseeably changing environment", as Malik (ibidem) puts it [own translation].

Considering these statements and taking into account earlier quantitative[17] research projects performed by De Raadt 1987, Crisan Tran (2006) and Frost (2005) who used the VSM as theoretical basis, it can be concluded that the VSM qualifies as a scientific theory to conduct theory-led deductive research.

[17] Besides the quantitative works Crisan Tran (2006, p. 25) refers to additional 18 scientific projects which use the VSM as a theoretical basis.

3.4 Management Cybernetics and the Viable System Model

The Viable Systems Model (VSM) is a theoretical framework of one discipline of cybernetics called management cybernetics. It was developed by the British thinker, scientist and manager Stafford Beer. The VSM claims to define the necessary and sufficient conditions for the viability of any organization (Beer, 1994b, p. 262) and provides the scientific foundation for this project, which aims to make available a substantiated framework for the early recognition and prediction of gradually developing OC. Schwaninger (2000) [author's own translation]: *"Beer's Model of viable systems (in short: VSM - Viable Systems Model) specifies as the only* [existing; author's note] *organizational theory the necessary and sufficient structural requirements for the viability of organizations. It exhibits an extremely high heuristic strength for the diagnosis and the design of organizations of every kind. In addition, it has not been falsified until today". Hoverstadt (2010, p. 87)* states that the model *"can be used as a comparison against an actual organization in order to identify weaknesses, mismatches or missing elements […]".* These strong claims form the basis of the present research approach.

3.4.1 VSM Claim: Necessary and Sufficient Conditions for Viability

The terms necessary and sufficient refer to both inferential logic and deductive reasoning. According to this perspective, these two terms bear meaning beyond the everyday use of the word:

Necessary in the above context means that the VSM requirements (R) are stringent conditions (conditio sine qua non or presuppositions) for the viability of an organization (V) i.e.: Without R no V.

A necessary condition only indicates that an event does *not* occur, namely, when there is no R there will be no V.

Sufficient, on the other hand, means that R inevitably leads to V; however, V could also follow from X: If R then V.

A sufficient condition only indicates that V occurs when R is present but other conditions may also trigger V.

A condition that is *both* necessary and sufficient, therefore, means that R is the only and exhaustive requirement for V. If R is needed for V and is, at the same time, enough for V, then R must be the only requirement for V: If R and only if R, then V.

Beer's claim, therefore, is a very strong one. It actually says that for organizational viability the VSM requirements (R) are the sole and final requirements to ensure viability of an organization, V. This is possible because R, in their capacity as a *concept of control*, assure in the first place the ongoing availability of all necessary situation specific precautions for the viability of an organization. Accordingly, R do not *directly* warrant viability but "ensure that viability is ensured". This second order concept follows the cybernetic rule that complex problems which cannot be solved on a lower level of recursion (due to a lack of requisite variety), can only be solved using the meta-language of the next level of recursion. In other words, the Viable System Model defines the necessary and sufficient *functions* a viable organization must exhibit in order to survive. The *functioning itself* is a matter of the resources in place (persons or systems responsible for the implementation or enforcement of these functions), which have been provided for that specific intended purpose.

Since the *meta-functions* ("meta" here in the sense of higher, beyond, superordinated) are defined as well (e.g. the management function or system 3 which is superordinated to the operations function called system 1) any mal-function (also in the literal sense of the French "mal" for "bad or poor") of responsible functionaries or support systems is detected and dealt with in a viable system.

Malik (2001, p. 71) complements and reinforces Schwaninger's above statement about the uniqueness of the VSM in specifying (R) by pointing to the invariance theorem. This theorem indicates that *viable* complex systems exhibit the same isomorphic control structures defined by the VSM. Malik

(ibidem) p. 84 adds more precisely [own translation]: "*The invariance theorem was deliberately and intentionally not formulated normatively. It does not state that all viable systems s h o u l d be structured according to the* [viable systems; note of the author] *model, but that they in fact a r e structured in this way"* [emphasis in original]. This, however, does not imply that all systems are viable as they may show ill-defined structures.

However, Schwaninger and Scheef (2016, p. 6), contrasting the theoretical claim and the empirical evidence of the VSM (use), name critical points that have been brought forth about the VSM. They cite Ulrich (1983) who, in their view, "*disparages the VSM as the epitome of a "cybernetic logic* […] *producing inhuman conditions, incapacitating and dominating humans*" as well as Amey (1986) for whom the model is "*too general*". These and other critiques about the VSM will be dealt with in section 3.5.4. of this thesis. Schwaninger and Scheef (2016, p. 6), in the context of their empirical study, dismiss the above criticism about the VSM as "*deductive*" and "*normative*" rather than descriptive.

More substantial are the results of their empirical study to test the theoretical claims of the VSM. In a sample of 261 organizations (11 of them public or non-profit), they measured the relationship between 40 independent variables standing for the "*functions of the component of the VSM*" and 13 dependent variables "financial indices" (2 variables) on the one hand and "*a variety of features of organizational culture* [that; note of the author] *are reliable indicators* [proxies, surrogates; note of the author] *of organizational viability*" (11 variables) on the other. Using a confirmatory factor analysis approach, Schwaninger and Scheef (2016, p. 16) found a strong and significant association between the functional levels of the VSM components and organizational viability. They note that the empirical study strongly corroborates the VSM with its underlying theory.

With a view to OC, a statement by Malik (2008, p. 85) is of interest. He states that the detection of pathologic structures – pathologic in the sense of a deviation from the structures as set out in the VSM framework – would naturally allow conclusions to be drawn about the potential behaviour of the sys-

tem and especially on pathological behavioural patterns of the respective overall system.

Based on these strong theoretical claims, an effective theoretical approach to answer the research question of this thesis is available and a closer look on the VSM is worthwhile.

3.5 The Viable System Model

3.5.1 Introducing Remarks

The purpose of this separate section about the nature and the properties of the Viable System Model (VSM) is twofold. Firstly, this chapter shall shed light onto the field of management cybernetics, because even for well-read scholars and experts, a close knowledge of the still rather uncommon VSM cannot be assumed. Secondly, this section is intended to complement the research design chapter and help the reader when assessing the development of the questionnaire for the survey conducted in the course of this research project. To give readers who are not familiar with the VSM a first idea of this cybernetic model, the following graph provides a rough basic graphical reference.

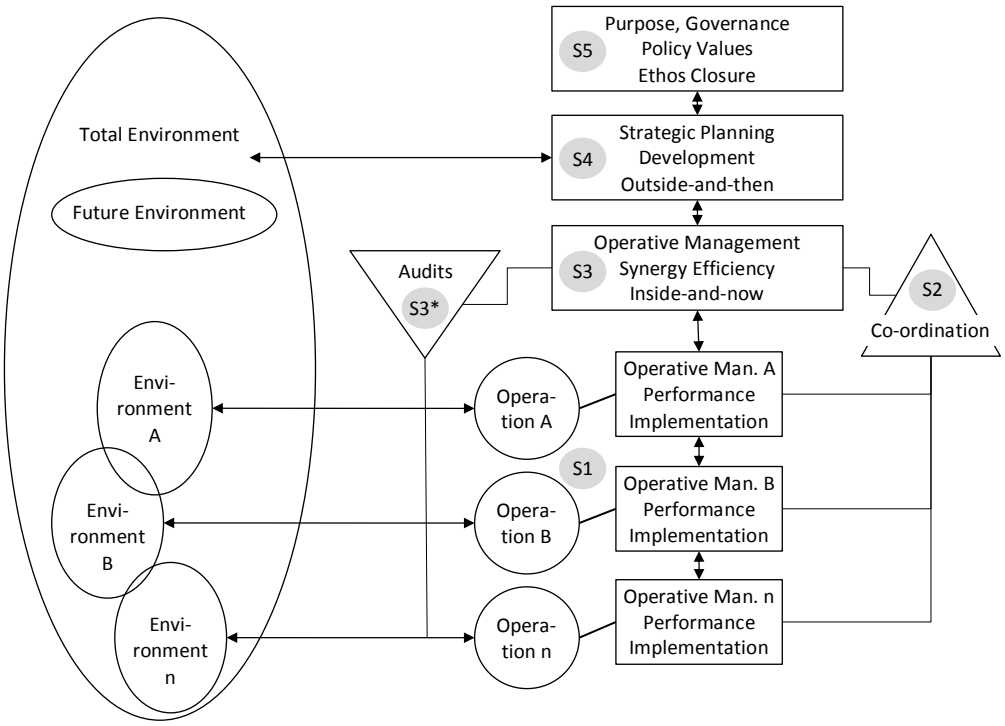

Figure 10 Basic Viable System Model [own representation]

Figure 10 illustrates the six control functions S1 – S5 of the VSM. S1 includes all operating units (here: A, B and n); S2 co-ordinates the S1-units; S3 manages the overall operation (i.e. S1) primarily by a “resources for performance” agreement. However, according to the autonomy principle, the

individual S1 unit manages itself; S3* ("*S3 star*") conducts unanticipated audits to verify line information independently and to understand what happens on the operational level; S4 observes the environment as well as the organization in order to develop, recommend and discuss adaptive behaviour with S3; S5 ensures the realization of the system's purpose and monitors the cooperation of S3 and S4 and takes final decisions, where necessary. S1 units, on the individual level, incorporate (aligned) S5 – S3 functions (not shown for simplicity reasons) and may themselves have sub-units. On the other hand, the overall structure depicted in Figure 10, may be one S1 unit of the next higher level of recursion (Russian doll principle or recursive structure). S1 – S5 are the necessary and sufficient control structures for any viable system, as the VSM-theory postulates.

3.5.2 Reception of the VSM

The VSM – although already sixty years old – has not to date been widely disseminated in management circles in the way that other management theories like business process re-engineering or total quality management have. While the management cybernetic scientific community still wonders why this is the case, to the author it seems clear that conventional (reductionist-analytic, non-systemic) theory has extended its original range, drastically using information technology and processing. With it, the advent of more far-reaching theories with higher explanation power was delayed and postponed. Conventional theories still satisfy the management community because the questions this community asks are themselves derived from the old paradigms. The management community, in sharp contrast to informatics itself, where systemic thinking has both posed new questions and delivered new answers (see Masak (2007), may have its respective paradigm shift still ahead of it.

Another reason for the rather weak reception may be found in the VSM literature. The developer of the VSM, Stafford Beer, was a versatile researcher but also an artist. This observation not only refers to his paintings and poems but especially to Beer's writing style. As original as Beer's books

are, they depart from standard scientific texts in a way that makes it difficult to operationalize the extensive knowledge they contain. Beer's fellow cyberneticians built on his knowledge with their writings but failed to write broadly understandable introductory texts on the topic with the effect that those who wanted to learn about the VSM had to master Beer's literary work. Exceptions to this rule include, for example, the Beer students and university of St. Gallen scholars, Malik (2008) and Schwaninger (2016) as well as Jackson (2000), who publish(ed) on all aspects of the VSM. It is Malik's habilitation treatise[18], Schwaninger's articles and Jackson's books which provide factually prosaic texts about the VSM which lend themselves to scientific work. To avoid misunderstanding, there are a number of scientific reports on *applications* of the VSM, such as the present one, or readable management literature, such as the books by Hoverstadt (2009), Espejo and Reyes (2011) or others. However, the VSM is observed less frequently as the *object* of research.

Rosa (2016, pp. 6–9), examining barriers to the diffusion of the VSM – besides linguistic issues (terminology, language, dissimilarity to conventional management literature) and the lack of methodological and entry-level literature – identified further reasons for the non-proliferation of the VSM (ibidem) p. 15 ff: namely, a deterrent graphical representation, issues with hierarchy and power brought about by the VSM, a threat to the power and the status of leaders (decentralization), mental maps (traditional linear thinking), intrinsic complexity of the model, [non] availability of expert professionals and insufficiency of courses, unsaleability of the VSM for consulting purposes, little awareness of the existence of the model, and advantages of the model being mostly kept within academia.

Based on Everett Roger's theory about the diffusion of innovation, Rosa (2016, p. 34) argues that "*the VSM is still mostly characterised by conditions that contribute to a slow rate of diffusion*" which, in his view, would be a

[18] The habilitation qualifies the holder for a full professorship and to independently supervise doctoral candidates in many European, Asian and some South American countries.

disadvantage for the transitioning of the so called Moore's Chasm. In his theory called "*diffusions of innovations*" Rogers identifies a sequence of five buyer groups which, one after another, adopt innovations: First, the innovators representing 2.5 % of market share, second the early adopters (13.5 %), third early majority (34 %), fourth late majority (34 %) and fifth laggards (16 %). Moore postulates a chasm between the group of early adopters (which are visionaries and highly value technology and performance) and the larger group of early majority (34 %, which are pragmatists and value solutions and convenience) (ibidem) p. 28. According to this line of argument the VSM has not succeeded in finding new arguments to address the fundamentally different preferences of the larger group of the early majority and with it "leap the gap".

One presumption of the author of this dissertation for the non-proliferation of the VSM might be called the philosopher's stone hypothesis. According to this, the model is so powerful that people would keep the knowledge to themselves once familiar with it, i.e. any attempts to spread the message would then constantly peter out. This is an idea which is similar to one of Rosa's findings (2016, p. 22), who cites an interviewee who suspects that the VSM-knowledge is too valuable to be shared.

And in fact, as soon as one has learned about the five systems and their interrelationship, the VSM quickly becomes a useful and potent tool for the instant analysis of a variety of organizational problems. Relevant answers to questions such as "*Is it a good idea to have the functions Chairperson of the Board (COB) and CEO performed by the same person?*", can be given *and substantiated* impromptu without first doing an in-depth analysis (it is not a good idea because the system 5 function COB and the system 3 function CEO interact in many ways and are part of two very important but also very different management bodies ("homeostats" as will be seen). Accordingly, a personal union would short-circuit the management system, neglect checks-and-balances, cause conflicts of interest and limit the problem solving capacity of the organization): The VSM offers a powerful "*organizational language*".

Rosa (2016, p. 22) lists arguments for a "*present* [….] *moment of transition*" for the VSM to advance from a niche existence into a more widespread audience: increased environmental thinking which is close to systems thinking, frequently occurring severe economic crises, a "*rise of holacracy*" as well as technological progress, which advances new eco-systems.

For methodological reasons Rosa's findings have to be taken cum grano salis; however, they help to pose relevant questions about the dissemination of the VSM.

3.5.3 Why Viability Matters

To start, it is helpful to cite the developer and author of the VSM in the context of this study. In cooperation with Leonard (1994, p. 51), Beer answered the question of when to use the VSM as follows: *"The VSM can be used whenever an entity has survival as an issue"*. With this answer, he emphasizes the parallels between the concepts of viability and survival. Years later, Malik (2008, p. 102) called survival a limiting case of viability. Both statements indicate that the concept of survival is comprised in the notion of viability, although it is not limited to it; there is viability beyond sheer survival.

In his books and articles (passim), Beer defines viability as the ability of a system to maintain a separate existence. Beer recognizes viability as the overall objective for organizations, in contrast to conventional management theory, where the overall objective lies in the maximization of the net present value of the firm's future value stream.

A validated system dynamics model developed by Schwaninger and Grösser (2010), developed to demonstrate the emergence of a crisis, compares two (simulated) groups of organizations with different basic objectives, one being profit maximization (PM), the other viability (V). In terms of *profit*, during the first 2.5 years the PM group achieves much better results than the V group, whereas the V group remains on a stable level. After this period the PM group profit line collapses far below that of the V group. In terms of *value potential*, both groups start high. After one year the value potential of the PM

group decreases continuously, whereas the line of the V group remains stable. The model shows that pursuing a viability objective in the long run yields economic benefits superior to those obtained by the PM group and avoids suffering from boom and bust cycles (Schwaninger and Grösser (2010, p. 317). This is consistent with Jackson (1988, p. 562), who recognizes one characteristic of the VSM as its ability to ensure *both* survival and effectiveness – if implemented appropriately. While the author of this work shares this view, Jackson's statement astonishes given the fact that his later criticism of the VSM denies exactly this point.

3.5.4 VSM Critique

Jackson (1988, p. 560) assesses the VSM and finds the following advantages of the model: the generality of the model, its ability to deal with complex structures, the ability to map command and control structures as well as to design information systems, its effectiveness as a diagnostic tool, its suitability to improve the functioning of organizations and finally the *"enormous explanatory power compared with the usual analyses carried out in organizational theory*" as Jackson (1988) states. He sees benefits of the model in that the VSM, as a scientifically grounded tool, proposes autonomy for the parts of the system, decentralization, a non-hierarchical structure, the effective and efficient pursuit of purpose and, finally, the preventative nature of the VSM against authoritative management.

The VSM has been praised and criticized by scientists of all scientific fields and for several of its characteristics. Beer (1984, p. 13) comments on one of the most often heard critiques about the VSM, namely, that the model fails to consider people, while people should be the basic elements of a viable system. On the surface, this critique seems correct; indeed, there is no mention of people in Beer's topological map (see Figure 13) of viable systems. However, one has to bear in mind that the VSM does not define functionaries but functions: It is not the board member that is mentioned but system 5, not the CEO but system 3, not the safety manual or the production plan but system 2, etc. Accordingly, Beer (ibidem) remarks that what plays a

role is the "*functioning of an element, under whatever constraints that the job entails: not the identity of the element itself.*" Imagine similar circumstances with bylaws (a system 2 function), where treasurers, secretaries or presidents are mentioned but not the proper names of such functionaries: Generalized statements are – by definition – never case specific. While it is true that the majority of requisite variety in a viable system (i.e. the discretion to act of an organization) is created by humans, some functions in the VSM are non-human such as time schedules, manuals, regulations, target-actual comparisons and related communications or plans. To complete the argument, Beer's books are so full of anecdotes dealing with people in specific control situations to illustrate the functioning of the VSM that this criticism can be dismissed.

Jackson (1988, p. 564) notes that the VSM could be (mis-)used autocratically by a powerful group (subversion). He adds that Beer had been aware of this risk and did remark that what would amplify regulatory finesse might do so for good or bad. Jackson weakens the subversion allegation by saying that some traits of the VSM itself act as immunological systems to avoid subversion, such as the decentralizing principle. Autocrats do not like decentralized power, he adds, pointing to Beer's prominent project CYBERSYN in Chile and to the fact that the Pinochet regime abolished the VSM-based governance structure that Beer had installed for the Allende government. But however good Jackson's addition may sound, it is clear that if the VSM is in fact an effective governing model, then this applies independently from the ethical standards of the users. Many organizations or associations use decentralized autonomous substructures to increase effectiveness. Decentralized structures in unethical organizations serve, for example, as "cells" or "families", while positive examples can be found in terms of delegates of well-known NGOs, school communities, or subnational entities, such as states in the U.S or cantons in Switzerland which, in many respects, act independently of the overarching entity. In conclusion, it means making a category mistake when confusing a tool with the use(r) of it: Many great achieve-

ments can be misused by malevolent or thoughtless users; numerous examples remind us of that.

Critics of the VSM also point to the number of variables to be monitored when applying the model (Jackson (1988) citing Sutherland (1975)). In his view, the application of the model to real-world cases can make its advantages disappear. A closer inspection of this argument (information overload) reveals that it is not VSM-specific but valid for any kind of organizational control system and points to the fact that – in cybernetic language – variety has to be attenuated in order to cope with complexity.

According to Jackson (ibidem), Checkland dismisses the VSM principles as "*unexceptional*" in the sense of ordinary, trivial when applied to organizations. Thus Checkland questions the applicability of Ashby's laws outside the realm of physical machines. As Jackson reports, Checkland recognizes in organizations social groupings, appreciative systems or power struggles rather than machines. Similarly, Jackson cites Dachler (1984), who argues "*organismic approaches* [such as the VSM; note of the author] *profoundly restrict our ability to learn about social systems, and prevent the generation of important insights into how they work.*" Such undifferentiated critique is supported in Jackson (1988) who (from the text it is not clear whether he is citing or expressing his own thoughts), in an astonishing argumentative turn, adds that the VSM would *mislead* managers by concentrating effort on the logical design of their enterprises. "*Instead*", he then adds, "*it is shared beliefs that enable organizations to be adaptive and viable over long periods of time.*"

Notwithstanding the unusual form of this argumentation, the material criticisms deserve closer attention. When Checkland prefers seeing organizations as social entities (many other scientists do the same with great success), this provides no argument against seeing organizations from, for example, a cybernetic point of view. Furthermore, Checkland equates the cybernetic perspective to organizations with a machine paradigm and criticizes

the VSM on the basis of it. However, because the machine metaphor is a) not substantiated (what exactly is machinelike[19]?) and b) most likely does not suffice to describe the functions of the VSM, the critique has to be rejected as unsupported. Dachler's point with "*organismic approaches*", on the other hand, most probably points to the *holistic nature* of the VSM. In his view, holistic models, which see a social system as an organism, cannot provide detailed insights about social systems. This view, however, disregards the fact that the VSM is based on systems theory, which explicitly makes the interrelationship of the parts of a complex entity a subject of discussion, as the VSM structure clearly demonstrates. Dachler questions whether social systems can be described by the VSM at all. An answer to this legitimate question has two components. Firstly, as will be seen in the next paragraph, the VSM was developed on the basis of social systems by mapping numerous real world systems homomorphically onto the cybernetic model until an isomorphic map of the invariants was reached. Accordingly, social systems not only strongly influenced the development of the VSM but, in fact, the model was targeted at such systems, as the term management cybernetics implies. Secondly, a body of experience of now fifty years provides a strong empirical base for the hypothesis of applicability of the VSM for social systems.

Finally, the argument of Jackson (1988) (most probably citing Dachler) – according to which shared beliefs would be the factor that enable organizations to be adaptable and viable over long periods of time (p. 566) – remains unclear and unexplained. From a VSM perspective the concept of a shared belief corresponds to pilot controlling the whole system, strategically aligning information or, put differently, to forward feeding (as opposed to back feeding) co-ordinating information into the system to provide strategic guidelines which help to make decision making consistent across the organization. This may sound cold and technocratic for human resources minded management researchers; nonetheless, the necessary and useful strategic aligning of in-

[19] According to *The Free Dictionary* (www.thefreedictionary.com, accessed 07.04.2016) *„machinelike"* means: *„like a machine in uniform pattern of operation"*. This stands in sharp contrast to the flexible, even ultrastable design of VSM-structured organizations with their autonomous units.

formation with employees should be distinguished from a means of ensuring the viability of the whole organization.

De Zeeuw (1986), reported by Jackson (1988, p. 567), hypothesizes that the control paradigm of the VSM would inhibit the constructive development of organizations. This is for two reasons: First, because the once modelled system boundaries become maintained by use; this with a conservative effect on the organization "*which starts to act like a contract*". Second, because purpose is built into the model, this leads to an "increasing dominance of history". According to De Zeeuw, both effects together lead to the neglect of alternatives and make individual and collective competence likely to suffer.

As will be seen, an important feature of the VSM (called system 4) is the continuous comparison of the external environment with the characteristics and facts of the organization and the identification of the need for change on an on-going basis. One control loop (called the 3-4 homeostat) of the VSM can be seen as the institutionalized dialogue between the "outside and then" (environment and future) of the system and the "inside and now" (inner structure and present) of it in order to identify the optimal quality and amount of change which is then to be implemented. The same is done in a more and more refined way on every level of recursion considering the respective local environment and its characteristics. A viable system is in constant flux of adaptation, otherwise it is not a viable system. De Zeeuw's hypothesis, as mentioned by Jackson (ibidem), seems to have confused static organizational charts, which ossify organizational boundaries and strategic mental maps, which institutionalize historic decisions with the dynamic properties of the viable system model.

Checkland (again in Jackson (1988, p. 567)) argues that the VSM would be only one ("*root definition*") of a multitude of possible perceptions of a system, which then would lead to a – one-sided, i.e. too narrow – modelling and diagnosis of the system on the basis of the results obtained.

Checkland's analysis is correct with respect to the viewpoint of the VSM which looks at systems from a control and information flow perspective.

However, he completely disregards the meta-character of this view. Marketing, finance, human resources, production, quality and all other managerial points of view as well as sociological, behaviouristic, juridical or functional perspectives of an organization are not excluded when applying the insights of the VSM but are a source of requisite variety to understand and control the system (cybernetics as the science of management). The VSM, however, focusses on the basic invariants of a system, which must be available in order to live long and prosper; these invariants have to be identified and managed differently in any organization. Imagine the steering wheel of a Rolls Royce and the one of a Deux Chevaux. They may look totally different and may even be attached on different sides of the chassis, but they have exactly the same (invariant) function.

Ulrich, according to Jackson (ibidem, p. 568), among other things that have already been considered above, critiques the VSM for being a means of *tool design*" rather than "*social system design*" and assumes an inability of the VSM to produce "*intrinsic motivation*".

Demanding the production of intrinsic motivation from a cybernetic control and information flow model, first of all, means to make a category mistake. However, by decentralizing power and granting the greatest possible autonomy to the level of systems 1 on all recursive levels, VSM-structured entities provide the best conditions for intrinsic motivation to develop – provided the local management establishes the relevant environment and an employee contributes to his optimal employment in areas of his/her interest. This, however, is not different from the situation in organizations which are – seemingly – non-VSM-structured.

Some reservations about a core concept of the VSM, namely, variety engineering, shall close this VSM critique. Paul Cilliers, in (Richardson, 2005, p. 12), states, for example, that "*[…] complexity is not compressible.*" Thus he refers to the problem of the boundary definition with complex systems (which would leave a model user in the dark as to whether the model is complete) as well as to the (always) non-linear effects of details that have been omitted in a model. Not surprisingly, Cilliers arrives at the conclusion that with

the exception of a 1:1 natural model, there is no accurate (model) representation of the system which is simpler than the system itself (ibidem) p. 13. In doing so, he neglects the fact, that decisions are, without exception, (mental) model-based. This again means that abstraction – as done in models – is not a "problem" but an unavoidable characteristic of human thought and decision processes – and, for instance, medical science or quantum mechanics – would be impossible.

Furthermore, Cilliers view contrasts with that of Leonard (2009b); she points out "*[…] a good regulator-model amplifies the variety of the regulator to a one-many-ratio*" adding the example of traffic control, where the simple rule to drive on one side of the road regulates an indefinite number of other possibilities to use the road space and, of course, prevents an uncountable number of accidents from happening. In her example, reality is highly complex, but nevertheless a most simple model allows it to be explained and regulated effectively.

This raises the question, what *Beer* thought about representational models. According to Pickering (2010, p. 251), Beer did not greatly trust such models, even for similar reasons as Cilliers: Because "*both the firm and its environment are exceedingly complex.*" Why then would Beer invest so much effort in the VSM and why would he still claim that such a model defines the necessary and sufficient conditions for organizational viability? Beer's idea, as Pickering (ibidem, p. 251) puts it, was that representational models should be constantly scrutinized and kept up-to-date with a view to the performance of the system. An organization's activities should be based on projections of the model but these should be compared to actual developments over time. Based on the (expected!) deviations, the model should be adjusted accordingly. With this approach of dynamic or constant adjustment modelling, Beer ensures the accuracy of the model, despite the reservations about the exceeding complexity of the system and its environment.

With a view to the lively and controversial nature of the discussion about the VSM, it can be concluded that the model is indeed considered to be a useful tool by many authors. After all, as Dale Carnegie puts it, "*Nobody*

kicks a dead dog", implying that – to take Carnegie's metaphor further – the VSM-dog is alive and his teeth seem to holding onto organizational situations at least as effectively as other models would.

To summarize: The VSM provides the management of an organization with the relevant points of reference on how to configure the system in order to maintain its existence and achieve set goals.

It also provides a common understanding of the system and a common language to reason, argue or debate it and identify problems and solutions.

Because the VSM serves as an abstract functional meta-language (see next section) the danger of ideology or mental maps is small, as only systemic functional aspects (requisite variety, transducer, recursion, homeostat, etc.) are reified in terminology. This helps to operationalize (in the sense of making manageable) facts, issues and circumstances which have to be constantly re-verbalized anew.

Purposes or values, such as e.g. (non-)profit maximisation, loyalty, competition, net present value, altruism, feminism, etc. are, however, not part of the VSM language, with one exception concerning the viability principle, the principle to sustain.

Nevertheless, when operationalizing and applying the VSM, which is done in the following chapter, the above critique has to be kept in mind. The complexity of the Viable System Model, Beer's often ambiguous language and the model's clear limitation on system control demand caution when using it to understand the equally complex phenomenon of OC. Deductive reasoning not only means testing the hypothesis using theory, it also involves testing the theory in practice: The result of hypothesis testing in turn allows to draw conclusions about the quality of VSM theory.

3.5.5 The Structure of the VSM

3.5.5.1 The Basis of the VSM

As the name implies, the VSM is the generic representation of the cybernetic, i.e. *control and information flow structure* of any organization or viable system. Accordingly, Malik (2001, p. 74) characterizes the model metaphorically by using the paradigm of a living organism that is developing and learning in constant interaction with its environment and with it arrives at a dynamic equilibrium. The paradigm is, however, limited to the control structure of the organism, i.e. the central nervous system and the brain; the basic structural pattern which is a homeostat (from Greek όμοϊός (omoios) of same, equal and δταδίς (stasis) for position, state). Homeostasis in the organism is then the equivalent to monitoring and interpreting critical variables, taking decisions and control (in the sense of steering) the organization.

Thus, the VSM can be seen as a blueprint which shows the *interconnected generic functions* (not: variables or parameters, these are organization-specific) that an organization uses to ensure both *functioning in itself* and appropriate *interaction with its environment* with the aim of staying alive. This blueprint has similarities to, for example, an anatomy book about the human body. Thus a *real world organization*, depicted as a Viable System using the same functional concepts, would be comparable to a real human being depicted in an anatomic chart. Both depictions may look totally different compared to their originals, but would exhibit identical functional units.

The next two figures depict the VSM in more detail than Figure 10 did. Figure 11 shows "*A ROUGH SKETCH OF THE MODEL OF ANY VIABLE SYSTEM ~ Rough it may be – but do notice that it is mathematically exact… / …the RED parts precisely reduplicate the whole*" as Beer (2004, p. 3) added to his typical VSM drawing to shed light on the recursiveness principle. On this generic model (for a more detailed illustration, see Figure 13), one can easily recognize the control functions or so called "systems": 5 (normative management), 4 (strategic management) and 3 (operative management), depicted as three rectangles top down as well as systems 3* (audit) and 2 (co-ordination) in the

form of triangles heading down on the left and the one heading up on the right. Operations (i.e. system 1) can be seen underneath the dotted lined metasystem with two units, one below the other. As stated by Beer, the red structures are exact copies of the superordinated structure, so one can see three organizational levels at a time.

Figure 12 on the other hand is taken from (Beer) (1994b, p. 536) where Beer shows the *fourth* level of recursion of an insurance company, namely, the organization around a specific insurance product. Again the control functions 5 ("PRODUCT MANAGEMENT"), 4 ("ENHANCEMENT OF PRODUCT & FIELD OPERATIONS") and 3 (TRANSDUCTION MGT…) as well as systems 2 ("DAMPING") and 3* ("MONITOR") are easily recognizable. The structure at the bottom left visualizes the product specific environment (functional unit). The structure on the top left with the question mark depicts the general and future environment.

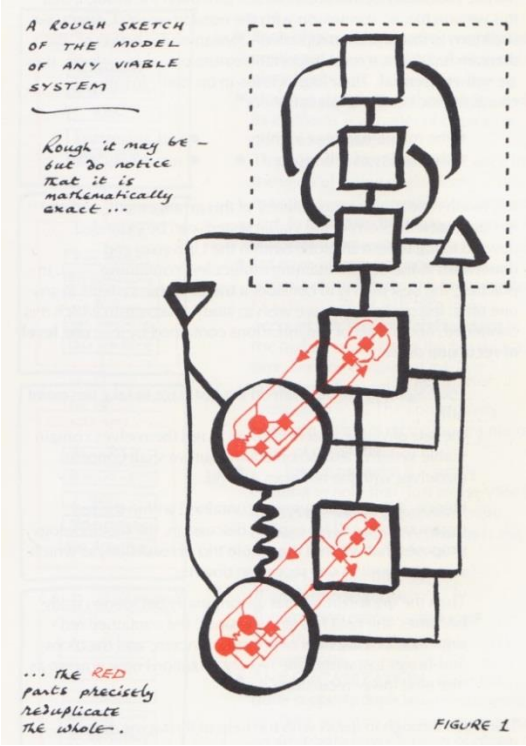

Figure 11 Rough sketch of the VSM by Stafford Beer (2004, p. 3)

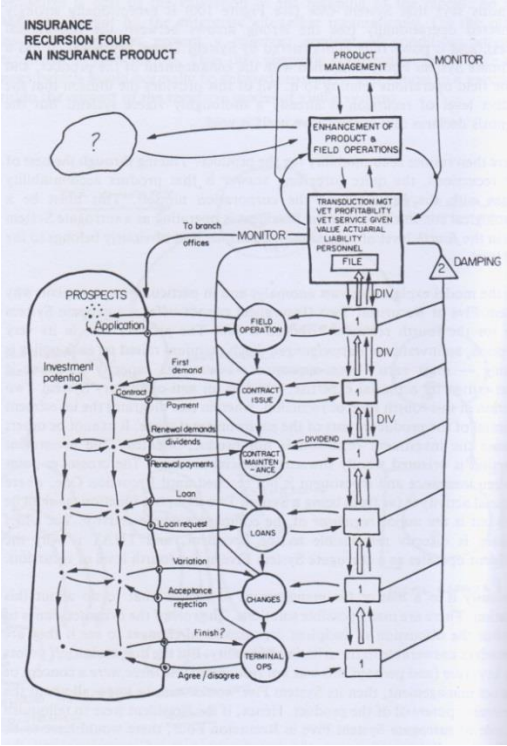

Figure 12 Insurance product as a VS by Beer (1994b, p. 536)

The irregularly shaped area with the question mark represents the origin of the information taken about the development of the market (requirements) for the enhancement of the product and the field operations. The latter, according to Beer (ibidem, p. 535) is a "*legitimate*" system 4 (strategic planning) function. System 1 (with the units FIELD OPERATION, CONTRACT ISSUE etc.) is "*powerfully administered by System 3*" as Beer (ibidem) emphasizes, depicted by strong arrows in the central command line. Beer further concludes that – for reasons not visible here – system 5 is "*void*" because "*product accountability resides with the President of the corporations himself* [two organizational levels further up, note of the author]. *This must be a pathological condition* […]". Hence Beer means that, due to the effective lack of a system 5, the depicted system is not (yet) a viable system.

Beer (1984, p. 9) states that the VSM – after a long history with influences from psychology, neurophysiology, statistics, structure of organic systems, neuro-cybernetics, mathematic set theory, stochastic processes and operations research in the quest to know *how systems are viable* – has been modelled by drawing insights from managerial situations and mapping them rigorously into corresponding scientifically described situations. The term *rigorous model* refers to an engineering method which seeks to model real world systems mathematically and allows the simulation and anticipation of a system's behaviour.

Beyond sheer similarities or analogies, this process yields formulations of conceptual models to arrive at homomorphic topological mappings in which each element of the managerial situation maps onto one element of the rigorous model. From it, invariants between the real managerial and the scientific systems were selected to obtain isomorphic mappings, i.e. one-to-one correspondences which are generalizable in a scientific model, the VSM. *"* […] *there is no way of 'proving' a model:* […] *'falsifiability' remains instead.* […] *more and more* [real world; note of the author] *viable systems were mapped onto the* [*VSM*; note of the author] *model: the invariances held"* as Beer (1984, pp. 9–10) comments on the development process of the VSM [emphasis in original]. He adds: "*We run down the chain of similes, analogies*

and homomorphs […] until the isomorph is reached, testing the insights and invariances as appropriate on the way […]".

Cybernetics and systems theory build the theoretical base of the VSM and are the essential determinants of the VSM: A specifically *interrelated* set of substructures (System 1 to 5) adds up to a superstructure which is called the system in focus and as a whole builds the model of a viable system.

3.5.5.2 The Building Blocks of the VSM in particular

The *system in focus* or viable system is the one in which the observer or user of the VSM is primarily interested. Think of a department or school of a university. It is a) a subsystem of the next superstructure on the next higher level of recursion (faculty) and b) consists of subsystems on the next lower level of recursion (e.g. institutes): Viable Systems contain viable systems and are contained in viable systems. Recall the picture of a Russian doll or conceive of a department of an organization which is a subsystem of the super system called company, while the department itself consists of subsystems called groups or teams which may themselves be viable systems. System of Systems Engineering (SoSE) literature in this respect offers a useful definition. "*A metasystem, comprised of multiple embedded and interrelated autonomous complex subsystems that can be diverse in technology, context, operation, geography, and conceptual frame. These complex subsystems must function in an integrated metasystem to produce desirable results in performance to achieve a higher level mission subject to constraints.*" as Keating, Sousa-Poza, and Kovacic (2005, p. 200) define.

The *recursive structure* of the VSM depicts one strength of the VSM as its allowing of the mapping of arbitrarily complex nested organizational entities literally from the planet level down to single microorganisms.

The definition of viable systems which themselves are contained in (other) viable systems holds as long as subsystems could theoretically maintain a separate existence. In an organizational context, this is normally true for line units but seldom for staff units, i.e. the UK branch of a multinational consulting group could exist as a separate entity but this would normally not

apply to its support or planning units. Indeed, one could take the recursive chain analogy much further, arriving e.g. at viable bacteria in the human body of a firm exponent; however, in the majority of cases this would be meaningless in an organizational context (although, illness…).

Figure 13 depicts the VSM in the version of Beer (1984, p. 15). The *amoeboid structure* on the left illustrates the *total environment* whereas further below, as part of it, the *particular environments* of the different recursion levels are shown. The array of rectangles, triangles and circles on the right represents the VSM. The connecting lines between the amoeboid and the geometric structures stand for the relationships or, more precisely, the exchange of information, matter and energy (i.e. resources) among the environment and the (open) system.

A closer look at system 1 ("ONE" in Figure 13, there are two of them) and the metasystem ("FIVE"-"FOUR"-"THREE") above, Figure 13 reveals that the VSM is structured according to the recursiveness principle: Both the rectangular and the circular structures of the two systems 1 below contain (much smaller) exact copies of the metasystem (5-4-3) and systems 1 and 2. In the upper right corner of the metasystem (5-4-3), it is then indicated that this entire structure is a system 1 of the next recursion level. Looking even more closely one can observe the sub-sub structures which again repeat themselves.

Beer did not relent from stressing that the VSM must not be seen as an organizational chart but would depict the *control structure* of any viable system such as e.g. a cat, a school or a country. The VSM substructures (system 1 to 5), therefore, have to be seen as *control functions* and by no means as people, jobs or organs.

At first glance the VSM might look complicated and resemble a circuit diagram. However, after learning more about its five basic components, the VSM allows systems to be evaluated at any desired depth.

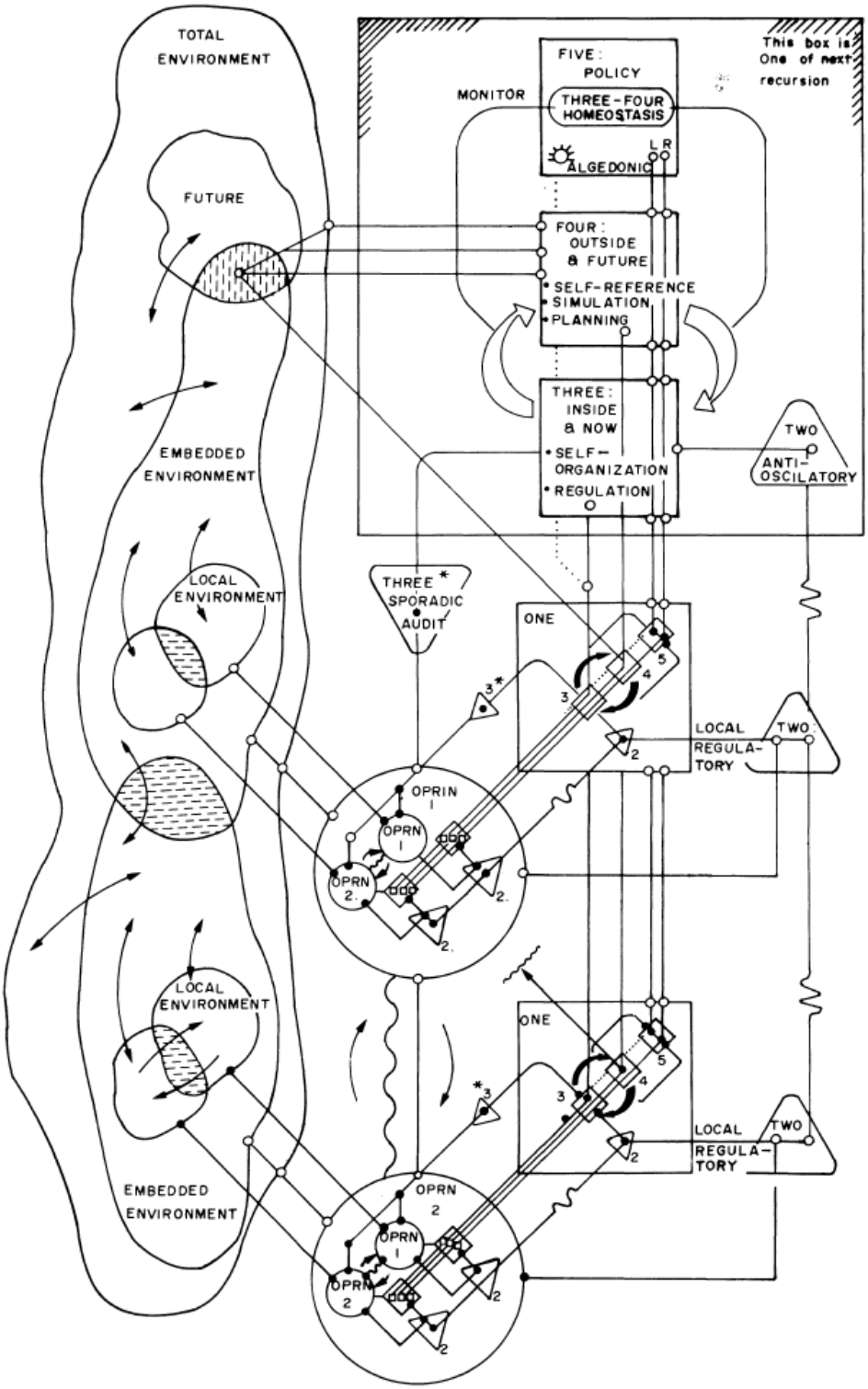

Figure 13 The Viable System Model according to Beer (1984, p. 15)

From top to bottom in Figure 13 the following subsystems of the VSM can be observed. For more detailed descriptions about the VSM, see Malik (2008), Beer (1994a) or Beer (1994b). All the following detailed descriptions

referring to the figures as well as the figures themselves refer to Malik (2008, p. 105). All anatomic examples and comparisons are taken from Beer (1994a).

3.5.5.2.1 System 5

System 5 as the “POLICY” function is responsible for normative management (values, standards, rules, guiding principles), the identification and definition of the overall purpose and the overall goals of the organization, the identity and the organization’s mission in the environment, final decisions (closure) and the monitoring of the system 3-4 homeostat. The latter is the designation for the important interaction of systems 3 and 4 underneath system 5, which balances external (environment) and internal (system) requirements.

System 5 is also the ending point of the internal alarm channel “algedonic loop” (from Greek: αλγος (algos), pain and ήδονή (hedone), joy) which conveys good-bad information across the system to system 5.

Examples of system 5 include the board of directors in organizations, in part the management committee, the parliament of a country or the cortex of the human brain.

Figure 14 as in Malik (2008, p. 136) illustrates in very simplified metaphorical form the fundamental system 5 components: sensor component (I), motor component (II) and the interaction of both (III). System 5 obtains information from system 4 as well as from the algedonic loop (right, dotted line). The circles depict the *preferred state* of the system (very similar to “G” in the regulation model; see Figure 7) based on information about the system, the environment, experience, knowledge, rules, regulation, standards, purpose, intentions, etc. System 5 compares sensory information for consistency with the preferred state. In the event of actual-preferred divergences, system 5 may influence (“R”; compare Figure 7) subsystems (“S”) via the motor component in order to restore congruence with the preferred state (“G”).

This cybernetic description of the “POLICY” function (i.e. system 5) means basically that, in order to realize the (imposed) purpose, the system

and the environment – with a look to the present and the future – are permanently aligned to each other.

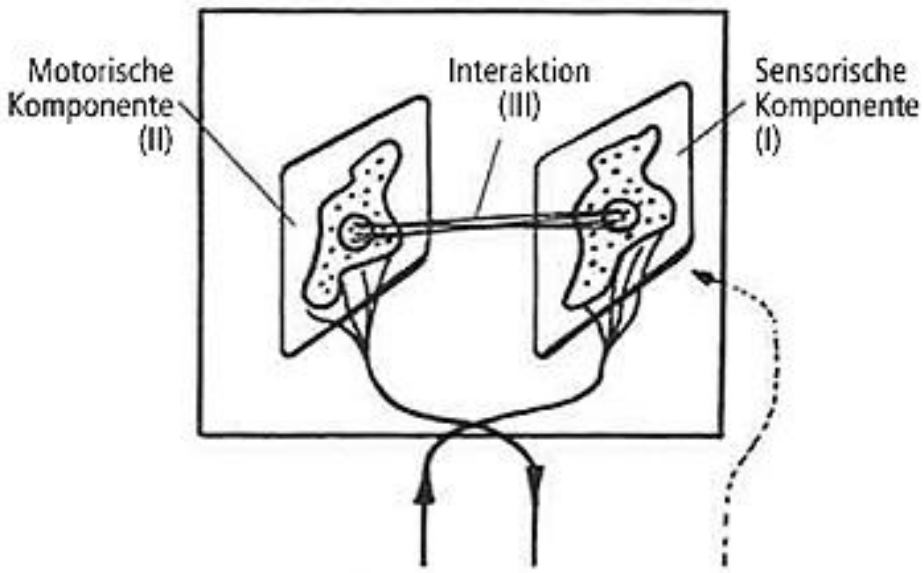

Figure 14 System 5 according to Malik (2008)

3.5.5.2.2 System 4

System 4 is in charge of the so called “outside and then” realm; i.e. it is to observe the system’s total *environment* today and anticipate the environment of the future. System 4 has an internal model of the whole system (i.e. a representation of the organization) in order to perform simulations and what if scenarios. As a planning or staff function, system 4 according to Pickering (2010, p. 248) refers to the notion of φροντίστήριον (phrontisterion, a ‘study room’ or ‘thinking shop’) and develops behavioural alternatives, changes targets or ways to influence the environment in the endeavour to continuously balance the characteristics of the system with the one of the environment. It brings these plans into the discussion with system 3. This institutionalized forum is called the 3-4 homeostat and is the place where internal and external requirements of the organization encounter one another. However, the basic idea of the VSM is better described as based on flexibility and adaptation and accordingly associated with developed “taker qualities” rather than on perfect anticipation and planning. The “Beyond Budgeting” movement is one example of this principle.

Examples of system 4 functions include planning departments in organizations (e.g. marketing research, R&D, corporate development, strategic procurement), staff units, commissions, secret service, strategic intelligence or the debate of (parliamentary) initiatives in a country or structures such as the diencephalon (interbrain), basal ganglia or third ventricle in the human body.

Figure 15, as in Malik (2008, p. 130), illustrates again in very simplified metaphorical form, system 4.

System 4 gains, assesses and distributes or withholds (external *sensory* events ESE (I)) information about the environment ("Unternehmensumwelt"). Additionally, system 4 has a picture of the internal stability (internal sensory events ISE (II)) of the organization at its disposal, which is compared (ESE-ISE) to the external information before it feeds information forward to system 5. Inputs from system 5 then were specified and transmitted as behaviour instructions to realize the inputs of system 5 via the two *motor* components (external and internal motor events EME (III), IME (IV)): EME to gain further external information or to perform operations on the environment as well as IME to implement changes and secure internal stability. IME, besides behaviour instructions, sends information about the external stability of the organization to system 3 to provide it with a reference framework. The information in the algedonic loop (alarm filter (V)) is assessed and evaluated by system 4 in the light of external information. In doing so, reported unusual behaviour of internal units may turn out as correct and adequate.

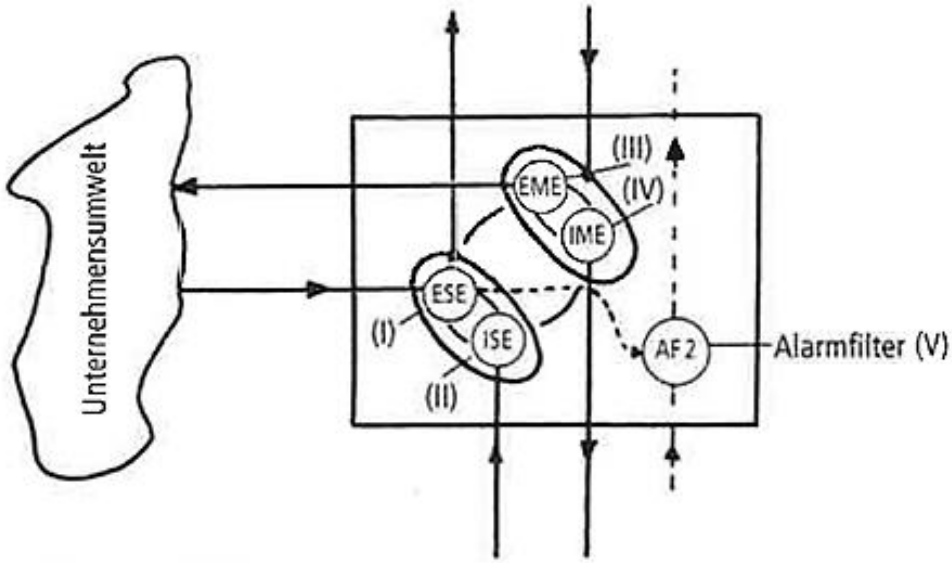

Figure 15 System 4 according to Malik (2008)

3.5.5.2.3 System 3

System 3 is the link between the metasystem (5-4-3) and operations or system 1 and 2. It is responsible for the *overall regulation; overall stability and synergy* of operations in the light of the overarching purpose and goals of the system. At the same time, system 3 must guarantee the requisite autonomy of systems 1, otherwise it will inevitably be overwhelmed by incoming complexity.

System 3 is interested in stability, which is a prerequisite of reliable operation. Its method of controlling operations is the so called resource bargain, which concerns the definition of targets and allocation of resources – very similar to the management by objectives approach. By means of a formal and an informal control loop, system 3 fosters stable operational conditions. The aforesaid informal information channel is system 3* ("three star") or parasympathicus (II). It conducts random checks (audits, quality control, work climate checks, compliance, safety, efficiency, etc.) and accepts information of all kinds in order to check the plausibility of line information flowing from system 1 to system 3, to learn about sensitivities, concerns and the general atmosphere to early recognize and pre-empt detrimental circum-

stances (as e.g. stress) or processes (e.g. alienation or the neglect of safety regulations).

Examples of system 3 include the CEO, CFO, COO, CIO, the executive board of an organization[20] (expert systems or autopilots also act in this area but are only a part of system 3), the government of a country (political executive) or the pons (brainstem), the medulla oblongata (hindbrain) as well as the sympathetic and parasympathetic nervous system.

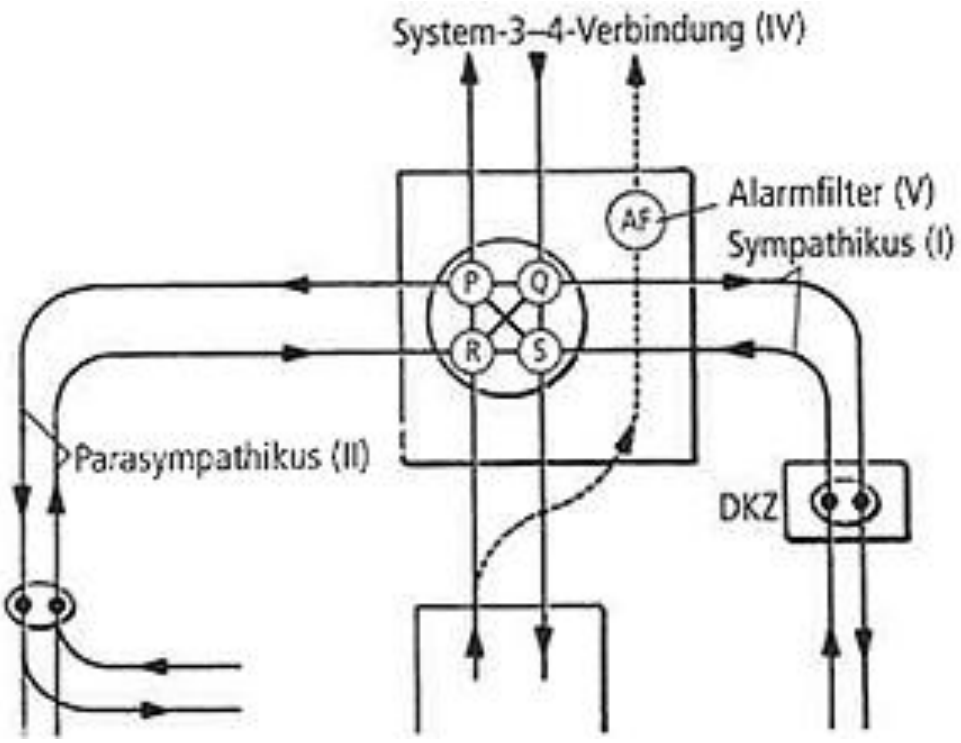

Figure 16 System 3 according to Malik (2008)

The functioning of system 3 is a most complex process which encompasses the interplay of four different homeostats. System 3 is the intersection of many information streams and the central (not *centralized*) decision and management entity, which cares about the stability and synergy of the system as a whole. Again, it has to be said, that these descriptions are based on

[20] for the operative management part of their task, for normative issues they may be seen a part of system 5.

the cybernetic view of the organization, which does not deal with persons, teams or departments but instead with control functions, which in most cases are (but sometimes may not) be assumed by humans.

The following designations (Q-S, P-R, R-S and P-Q) for the four homeostats of system 3 refer to the circular structure in the centre of Figure 16 with the elements P, Q, R and S. The term homeostat means the control interplay between two respective elements. For an easy understanding of the functional descriptions, reference to Figure 16 may help.

Q-S homeostat (sympathetic): Incoming information from system 2 arrives via the divisions control centre (DKZ) in S. If needed, Q asks for more information in DKZ or system 2 respectively. This type of information is “stereotype”, meaning restricted to information about usual (i.e. routine) deviations from plans typical for the sympathicus (I) system. An input-output matrix processes the information and releases instructions via the central command axis at the address of systems 1 to change plans. As an alternative synergy, plans in DKZ may be changed via Q.

P-R homeostat (parasympathetic): In contrast to the routine deviations in the sympathetic system, unexpected deviations and emergencies are processed by the parasympathicus (II) system which has two basic functions. First function: The parasympathicus is the antagonist of the sympathicus. If the latter asks too much from system 1, the parasympathicus counteracts. Second function: Direct registration of developments which are novel and revolutionary and, therefore, cannot be registered by system 1 or 2. This means that every system 1 unit has to have an interface (called “audit ganglion”) to the parasympathetic system in order to trigger action if needed. The P-R homeostat thus transmits information about novel developments or overload symptoms into the input-output matrix. As an output, it generates correcting or re-enforcing measures which directly influence specific operations of systems 1.

R-S homeostat (system 1 - 3 connection): This homeostat is the direct connection between system 1 and 3. It checks the correspondence between

system 1 plans and the specifications of *policy*. Via S, system 1 units obtain specifications from policy level and from them they generate normative divisional plans. Deviations from these plans were (back)transmitted to system 3 via R. Incompatibility between policy and normative plans of the divisions are, therefore, considered in the input-output matrix. As an output, corrective measures were transmitted via S to the divisions. Change requirements can be transmitted to system 4 in parallel if it becomes obvious that autonomous system 1 cannot fulfil the targets.

P-Q homeostat (system 3 - 4 connection): This homeostat integrates information about internal and external stability. It brings in policy specifications and information about external stability into the input-output matrix via Q. P, on the other hand, transmits information about internal stability to system 4, making change proposals at the address of policy.

In the institutionalized debate with system 4 (the 3-4 homeostat which is monitored by system 5 to avoid deadlock or conflict), system 3 brings in the requirements of the “inside and now” realm as just described.

In summary, the P-Q-R-S functional complex (array of homeostats) has the task of constantly optimizing the internal overall performance within an acceptable reference framework of policy and environmental information.

Alarm filter: System 3 has the tendency to absorb information flowing from systems 1 and 2 towards system 4 and 5. This is desirable insofar as 4 and 5 should not be flooded with irrelevant information. However, as seen above, system 4 sometimes needs information from lower level units to properly perform situation analysis and provide action alternatives. Using the alarm filter (AF, (V)), system 3 filters out algedonic (see 3.5.5.2.1 System 5) good / bad information and forwards it upwards to system 4 or 5, comparable to pain or pleasure sensations in organic bodies.

3.5.5.2.4 System 2

System 2 has the task of *co-ordinating* the (normal) activities of system 1 units by ensuring the observation of, or compliance with, operative rules and regulations as well as avoiding conflicts and oscillation (i.e. build up

effects due to positive or self-enforcing feedback loops) among system 1 entities. System 2 knows the resources of system 1 units, the production plan, the capacities, the time schedule, the rules that apply and the co-ordinating sub-systems, etc. It is the most basic sub-system in a system of system 1s and would also develop if there was no meta-system because co-ordination is in the basic interest of system 1 units.

System 2 monitors system 1 units and their performance (input, output, time, cost, quality, safety, etc.). It detects and rejects planned as well as actual deviations. It sets or changes standards to allow for synergies and ensures smooth normal operation. These “regional” control centres (I in Figure 17) of each system 1 unit are connected to co-ordinate system 1 activities. System 2 communicates over lateral channels (sympathicus) via the DKZ (division co-ordinations centre (II) in Figure 17) with system 3, with the latter intervening if system 2 does not have the competence to do it. This is the case in the event of unusual occurrences or when more than two units or the whole system 1 is affected. Strictly speaking, the latter makes system 2 not really “meta”-systemic but only “bilateral” or “inter”-systemic. Accordingly, Leonard (2009a, p. 229) states that the 5 / 4 / 3 homeostat represents the metasystem of the 1 / 2 / 3 present activities: System 2 functions are numerous in organizations, they co-ordinate, inform and intermediate between any two system 1 units and keep system 3 informed about the “co-ordination state” of the system 1 level.

Examples of system 2 functions include time scheduler, productions or inventory planer, resource allocation units, treasurer (cash-pooling), quality or work safety agents, product or knowledge managers or corporate design regulation, purchasing, training, etc. System 2 compares to the sympathetic interaction of peripheral ganglia of the reflex arcs in the spinal cord to avoid ataxia (from αταξία ‘ataxia’, from Greek α- for no and ταξίς ‘taxis’ for order; ‘lack of order’, ‘insubordination’ (Gemoll and Vretska (2010, pp. 142;781), i.e. uncoordinated movements of the limbs.

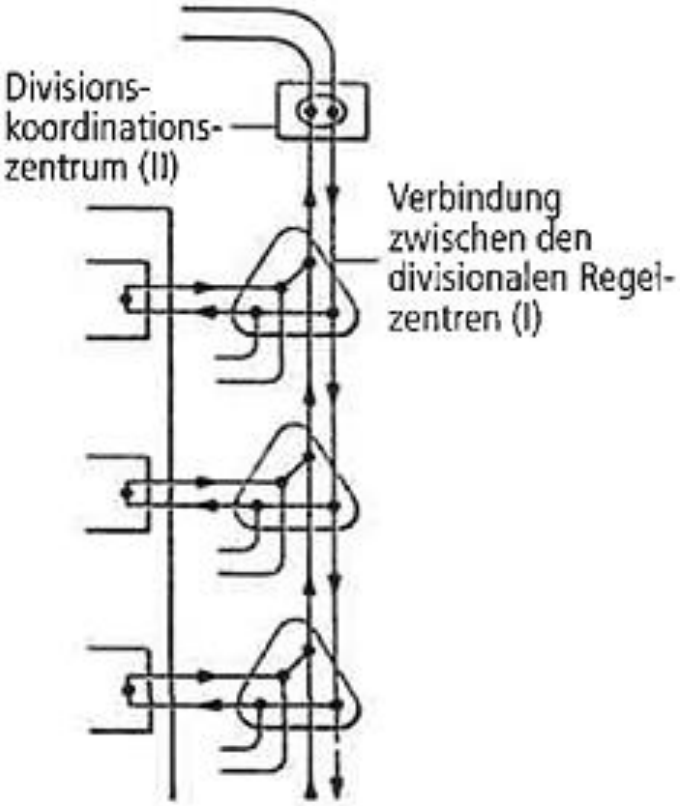

Figure 17 System 2 according to Malik (2008)

3.5.5.2.5 System 1

The totality of all operative areas and activities (system 1 units; divisions) is called system 1. It implements the purpose of the system, as set by system 5.

System 1 units are manifold interlinked networks ("anastomotic reticula") from Greek άναστομοσις (anastomosis) 'producing connection' and Latin reticulum 'network' according to Beer (1994a, p. 31), exhibiting a range of input- and output channels with the aim of achieving *ultrastability*, i.e. stability even vis-a-vis formerly unknown disturbances. To achieve this, a system 1 unit needs: a) An initial plan which sets the standard (preferred state), b) sensors to detect developments in real-time, c) a repertory of situational plans and behavioural options and d) motor channels to implement plans.

A division or system 1 unit consists of two main components and its communications channels: The division management ("Divisionsleitung") and

divisional control centre (“Divisions-Regelzentrum”, for both see Figure 19). As a part of the vertical command axis, the division (i.e. system 1 unit) management derives normative divisional plans from overarching policy and monitors adherence to it. To perform this task, the divisional control centre is at its disposal and reacts to negative deviations.

Examples of system 1 units of different organizations include profit centres, product groups, production sites, (online-)shops, regional sales people, merchants, branches, stores or consultant groups, who directly and, to a large extent, autonomously serve a specific market or demand. The main characteristic of system 1 is its principal ability to independently exist as a separate entity. To ensure this kind of autonomy, such, in principle, independent entities have to be viable systems themselves, with all necessary structures and functions (1 to 5) pertaining to them. As a rule, viable systems contain viable systems and are contained in viable systems. This means that a system 1 unit itself has again a system 5, 4, 3, 3*, 2 function and even one or several system 1 sub-units again possesses these functions. This key property of the VSM is represented in the VSM map as the recursive structure.

From a neurophysiological point of view, system 1 corresponds to the reflex arc which reacts on its own level without consulting the next higher level (frontal lobe).

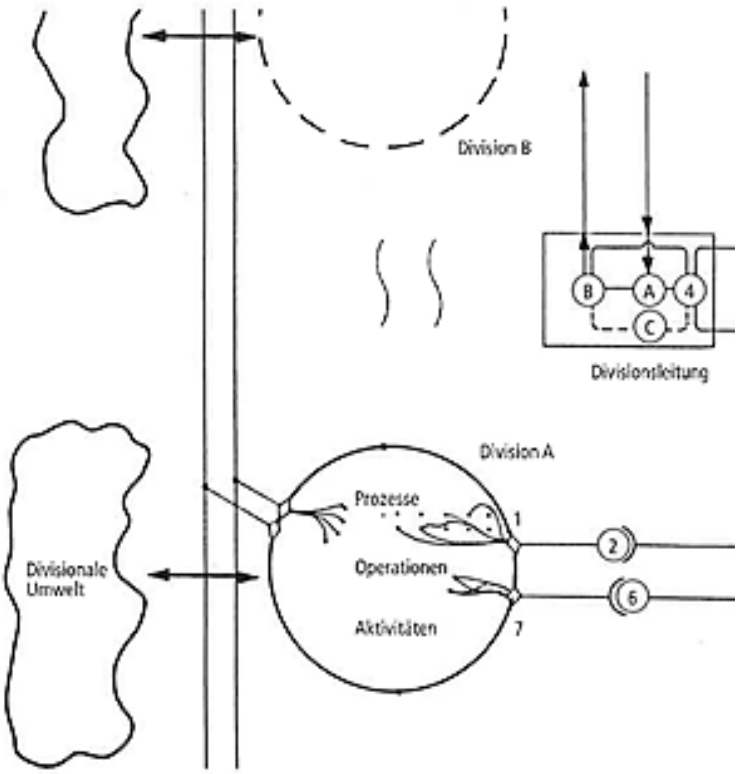

Figure 18 System 1 Unit according to Malik (2008)

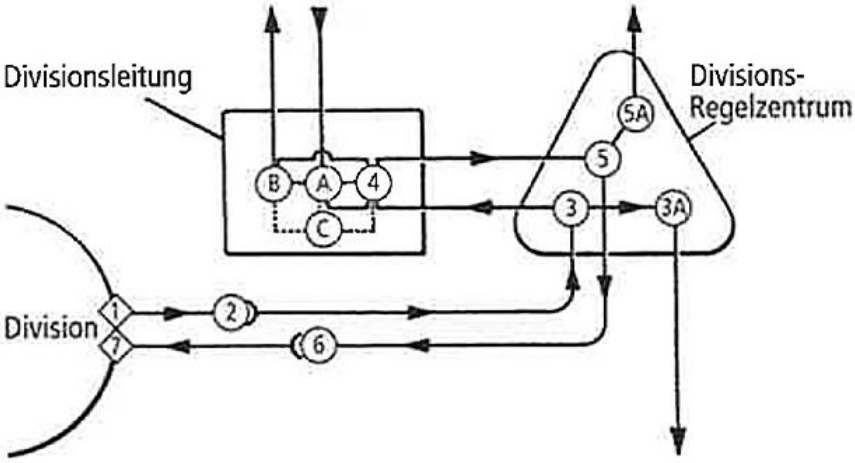

Figure 19 System 1 Unit with System 2 Interface acc. to Malik (2008)

A system 1 unit (see Figure 18; “Division A”, with processes, operations and activities) is in direct exchange (information, energy, matter) with its

divisional environment (“Divisionale Umwelt”) or market. It is exposed to outside stimuli, perceived as either perturbations or opportunities, which requires permanent adaptation and hence requisite variety on the divisional level. In the vertical dimension, the divisional management (“Divisionsleitung”) of a system 1 unit is connected via the central axis with system 3, on the horizontal with system 2 (right) as well as the divisional environment (not shown).

Depending on the structural model of the overall system, a system 1 unit is in no contact, limited contact or intense contact with other system 1 units (indicated by the two vertical waived lines). Think of a production and a sales unit (intense contact) or of divisions of a highly diversified industrial corporation (no contact). This illustrates that the environment (amoeboid structure in the model) is only a symbolic representation because other system 1 units could also be seen as part of the environment rather than as a part of the system in focus.

Figure 19 illustrates the main functional components of a system 1 unit or division, including:

Division management (‘Divisionsleitung’): A information input, B information output, C normative planning, 4 corrective actions trigger.

Divisional control centre (‘Divisions-Regelzentrum’): 3 monitoring, 3A connection to further divisions, 5 planning repertory, 5A connection to division co-ordination centre DKZ.

Information channels: 1 data collection and transducer (will be explained in 3.5.5.2.6), 2 input synapsis (data packets), 6 output synapsis (co-ordination of adaptive activities), 7 transducer and implementation.

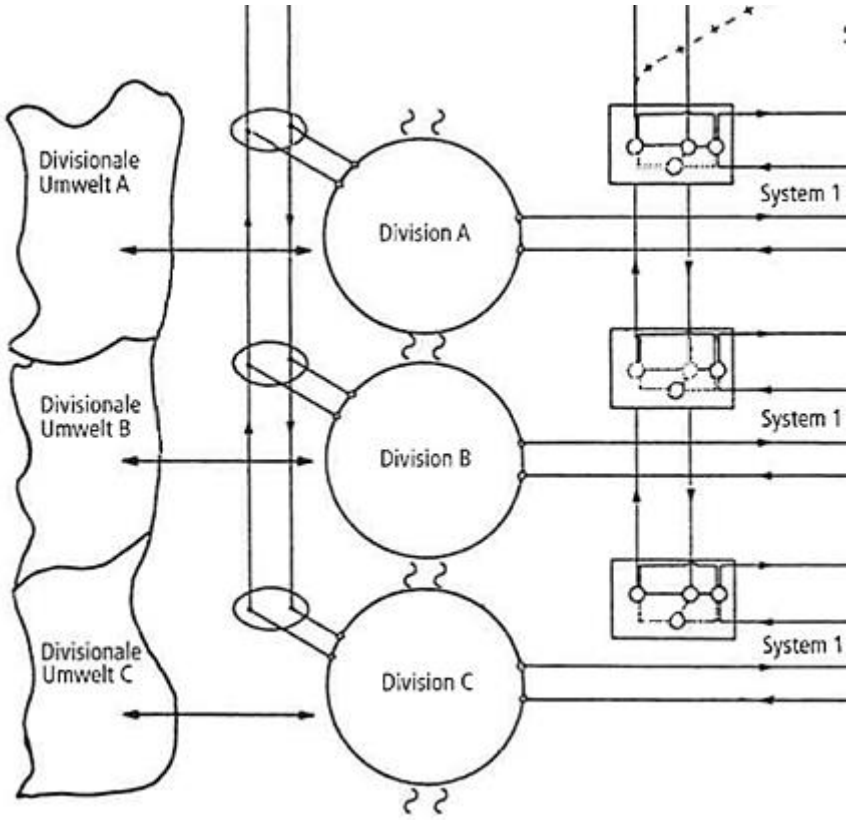

Figure 20 System 1 with its divisions according to Malik (2008)

3.5.5.2.6 Comprehensive Example Cybernetic Structure

The VSM should by no means be interpreted in such a way that the system functions, as defined by the model, be implemented by gigantic individual S1 – S5 departments, as Malik (2008, p. 88) underlines. He adds (ibidem): "*It is rather a task* […] *to examine, which activities of daily practice, implicitly or explicitly, fulfil functions of the VSM.*"

Time and again, Beer (passim) emphasizes that the VSM has nothing to do with an organizational chart, which he fiercely criticizes (see Beer (1994b, p. 116). He states that such charts would proliferate variety (ibidem) and be a "*machine for apportioning blame*" (ibidem, p. 216). Nonetheless, for the sake of easier understanding of the VSM, what follows is a graph showing explicit relations between an organizational chart and the respective VSM of an organization. The graph is a "terrible simplificateur" because it far too freely assumes one-to-one relationships, even between VSM functions and hierarchical structures. Still, the graph can help crosslink information about unfamiliar VSM concepts with existing knowledge about organizations.

The graph – which has been translated by the author – is owed to Malik (2008, p. 89). Malik (ibidem, p. 88) emphasizes that the illustration only helps identifying the viable structures of an existing organization and would by no means imply a normative spatial rearrangement of the respective entities.

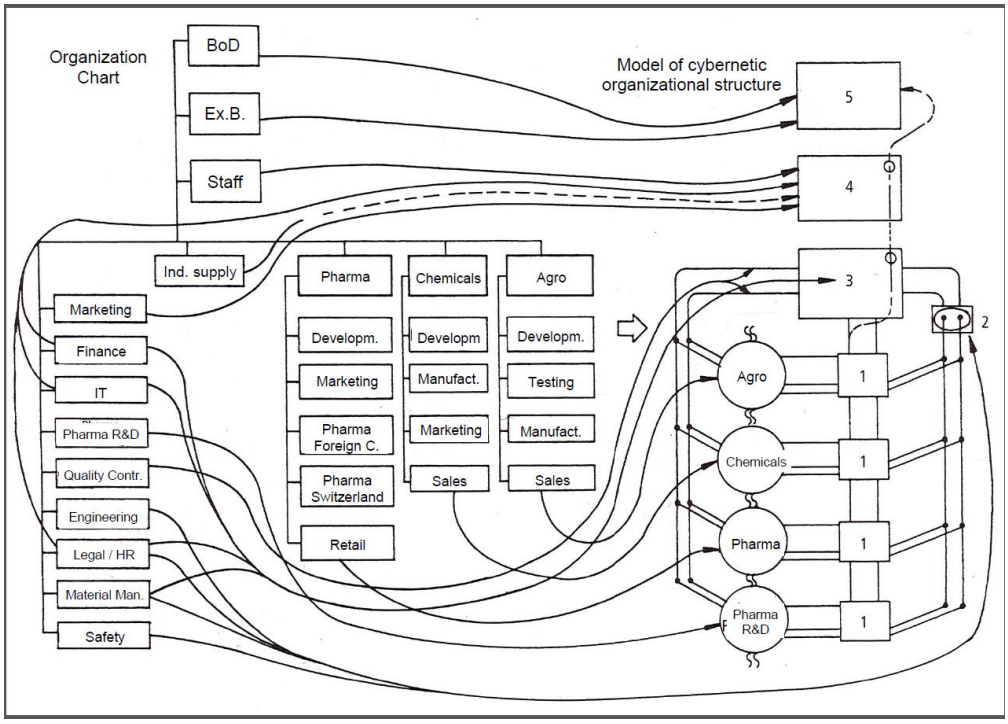

Figure 21 Relation Organization Chart - VSM (Malik 2008, translated)

Comments on Figure 21:

On the left, a classic organizational chart of a corporation is given. On the right the same corporation is depicted as a VSM. Reference lines connect the respective functions and structures.

Note that the organizational chart shows redundancies, for example, with central marketing (far left) considered a system 4 (i.e. planning function) and local marketing (middle) linked to system 1 units, the latter presumably more involved with market implementation and branch specific marketing issues.

The organizational chart lists Pharma R&D (far left) as a supporting entity which, from the perspective of the VSM, is an independent system 1

unit. The consideration of this entity as a viable system means that it is able to maintain a separate existence and (could) be a self-sustaining business.

Also of interest may be the convergent lines from Finance, IT, Legal/HR and Material Management (far left) related with system 3, which is the operative management function. Rather atypical for an organizational chart is the lack of a CEO or MD, who in the VSM, would act as a system 3 exponent, presumably this function is included in the executive board.

Finally, engineering and legal/HR, material management and safety units (or functions) are connected to system 2 which co-ordinates all system 1 units regarding the respective disciplines.

3.5.5.2.7 Important VSM Principles

The VSM, besides structural invariants, relies on a set of important principles and notions, encompassing: recursiveness, requisite variety, autonomy, communication channel capacity and viability. The recursiveness principle (3.5.5.2) and requisite variety (1.4) have already been introduced; the other concepts, as follows were based on Malik (2008) and Beer (1994a) and other VSM or management experts (see citation).

Autonomy Principle

In the understanding of Beer (1994a, p. 103) autonomy (Greek αύτόνομος 'auto-nomos' living by one's own laws) means being "*responsible for its own regulation*", which is quite close to the literal meaning of self-legislation. Beer emphasizes the importance of large areas of organizations being autonomous; otherwise the supervising senior management level would be overwhelmed quickly by taking a plethora of lower level decisions, often without having appropriate information available (problem of micromanagement).

In the context of autonomy, exhibiting requisite variety means that a system 1 unit is able to cope with the vast majority of incoming and self-generated complexity *horizontally*, i.e. on its own organizational or hierarchical level, without consulting the superior metasystem. Only in the event of

extraordinary occurrences, when local means are ineffective, is the next higher level of recursion addressed for support. Conversely, if system 3 identifies an incidence in a system 1 unit posing a threat to the whole organization and, at the same time, sees that the unit will not cope with that task, system 3 will interfere with the autonomy of the system 1 unit in order to protect the overall system.

Neither the body of an animal (rational animals included) nor an organization consciously controls its entirety, but operates with autonomic control sub-units; examples include reflex-arcs or project managers. Pickering (2010, p. 246) goes one step further when he points to the fact that system 2 (sympathetic system) acts on the level of system 1 units, largely without involving system 3 capacities. This approach too allows the system to remain internally stable by taking decisions decentralized at locations where both are available, namely, the information base, the system 3 targets as well as the guiding objectives and policies. The latter derives from overall objectives and policies that are omnipresent as a result of pilot controlling and strategically align the organization with system 5 information such as purpose, mission, etc.

Besides the quick and appropriate response argument in favour of autonomy, Brickley et al. (2009, p. 379) establish that, as a rule, the assembly and transfer of specific knowledge to a decision maker is costly. Above all, they stress the importance of "*idiosyncratic knowledge of particular circumstances*" (ibidem, p. 58), referring (in a lecture about the topic) to Hayek's notion of ephemeral knowledge of fluctuating variables tied to time and place. Imagine, for instance, the behaviour, facial expressions and gestures of 100 clients in as many simultaneous sales conversations with sales people of a firm. Their point is that such information cannot be transferred to a centralized decision maker as this would necessarily distort the quality of the decision (about the next step or argument in the discussion), let alone timing issues. As a result, it can be said that decentralized, autonomous decision making provides more quality for less when taking decisions with only local implications. For local decisions which affect the system as a whole, general guidelines (systems 2 or 5) must ensure overall compatibility of the decision

with the requirements of the total organization. This usually works well for day-to-day decisions in normal operation. All other cases require either an increased capacity with the decision maker or increased training and decisions rights with the customer interface, which, of course, again equals decentralized decision making.

Espejo and Reyes (2011, p. 96), from a systems viewing angle, point to the same fact that, with increasing degrees of regulatory capacity in autonomous sub-units, the residual complexity that has to be absorbed by higher levels of administration decreases, leaving increased capacity for, say, e.g. Strategic management.

It can be assumed that decentralized autonomy offers several benefits: Information channel capacity can be preserved, quality and speed of decisions increase, management attention can be allocated more efficiently, checks and balances are ensured and jobs at the sub-system level remain interesting and relevant.

Fischbacher-Smith (2014, p. 430) citing Perrow 1984 points to the fact, that the more interactively complex and the more tightly coupled organizational structures are, the more likely it is, that systems rapidly spiral out of control. Structuring systems according to the VSM in autonomous (viable) substructures reduces both complexity and coupling and as a consequence reduces the risk of a loss of control.

However, from a cybernetic perspective, the arguments in favour of decentralized autonomous decision making entities do not suffice to opt *unconditionally* for the autonomy principle. As mentioned earlier, the question about the *cohesion* of the overall system superimposes all other considerations. A decision that is cheap and good from a limited perspective, but threatens the existence of the overall system, is not acceptable. Therefore, autonomy in a viable system cannot be absolute, but as Schwaninger (2009) states, relative to the condition that cohesion is preserved as it stands in complementarity with control.

Communications capacity

An important basal insight from information science has relevance for two important VSM-aspects: variety engineering and the autonomy principle. In a viable system, communication channels convey information between functional units. These interconnections are a necessary condition for the constitution of a system out of its elements. However, according to Bremerman's speed limit for information processing systems, the information problem of central decision making in a decentralized system is, in principle, unsolvable, as Malik (2008, pp. 179–180) reports. The absolute Bremerman limit states that no physical system can process more information than mc^2/h bits/sec[21] which is equivalent to about $2x10^{47}$ bits/gram/sec. The simple insight that Malik draws from this fact and from the usual complexity situation in organizations is that even small and simple [organizational, note of the author] systems have a potential variety far above Bremerman's limit of information processing. In viable systems, horizontal (i.e. incoming and outgoing) as well as vertical (internal processing) variety equalize.

The above statement of Espejo and Reyes about residual complexity (variety) implies that the balancing of variety must occur as close as possible to the source of variety, otherwise large amounts of residual variety have to be communicated – i.e. coded, transferred (transduced, see next paragraphs), decoded, dealt with, re-coded, re-transferred (re-transduced), re-decoded and, finally, applied to deal with it – producing vast perhaps even unmanageable information flows and tying up management attention, which is in turn associated with both cost and risk.

For the majority of relations, organizations are, therefore, well-advised to let units regulate themselves locally using the ephemeral knowledge of time and place and considering the local circumstances. Given decentralized systems capable of acting, the information channels connecting them require

[21] (where mc^2 is known from Einstein's mass-energy equivalence equation and h is the Planck constant),

reserve information transfer capacity to ensure the co-ordinated and timely functioning of the system.

In simple terms, Beer (1994b, p. 99) stipulates – as the second principle of organization – that the information channels connecting the VSM functions must have more data *transfer* capacity [bandwidth, note of the author] than they can *generate* per unit of time – i.e. the channel itself must exhibit requisite variety to cope with the task of transmitting a certain amount of data within a time unit.

Besides quantitative issues, quality issues are relevant with information channels. Accordingly, as the third principle, Beer (ibidem, p. 101) states that information crossing a [sub-system] boundary undergoes *transduction*, i.e. translation while transferred across because the language of each sub-system is unique. Therefore, the variety of the transducer too, must exhibit at least the requisite variety of the channel.

Examples of transducers include input formats for customer's orders, which enable the order processing system to handle the order. Despite high-bandwidth online channels, without enough capacity in the transducers, bottlenecks will inhibit communication. Imagine a transducer situation with purchasing department's internal article numbers and that these have to be converted into the supplier's external article numbers for the order to be processed. Erroneous or slow transduction would lead to delays in delivery, despite fast communication connections.

It becomes clear from the description above that, without efficient information channels, a complex system not only fails to serve its purpose, but actually runs the risk of ceasing to be a system at all.

Viability

From a cybernetic point of view, viability (see also the glossary entry for viability) stands for more than just for the ability to survive. Survival is only a limiting state of a viable system. Viability is a systems *trait* rather than a specific resource configuration. Configurations may change while viability remains – or vice versa. Viable systems are able to *maintain* a separate existence; this does infer anything about the prosperity level at which a system exists. However, according to Schwaninger and Grösser (2010, p. 317), if an organization is oriented towards the viability criteria of the VSM, as opposed to profit maximization, it will keep its value potential and achieve moderate but continuous profits. Interestingly, when maximizing profits, the authors (ibidem) find that "*[…] emergence of a crisis is compulsory […]*", because maximizing "*[…] one* [single, note of the author] *variable in a complex system, you inevitably trigger bottlenecks and unstable or chaotic behaviour […].*"

Systems, in cybernetics terms, maintain their existence by keeping the information, energy and matter relation between the environment and itself balanced by means of homeostats, as explained earlier. In the context of organizations, this means that such entities need to constantly maintain an exchange relationship with their environment. In doing so, they trade – similar to national economies – required tangible and non-tangible resources for their market services. Their comparative cost advantage (i.e. the fact that they produce a good cheaper than the customer could) is their main raison d'être; this principle of lower opportunity cost applies to upstream (suppliers) and downstream (customers) in the entire supply chain – of course, under challenging conditions caused by competition.

Closed systems, however, cannot be viable as they inevitably approach entropy (due to both a lack of resources and the inability to dispose of "metabolic" products) and long before, they lose purpose, cohesion and identity.

Furthermore, viable systems are not immortal; if physiological circumstances change too fast or too extensively[22] even a (formerly) viable system may lack the time to adapt quickly enough. However, such a situation may still question the quality of its system 4 functions (environmental properties and dynamics). Hence it is possible that a supposedly "viable" system was not viable after all.

3.5.6 Revisiting the Definition of Organizational Crisis

A renewed OC-definition can be proposed while synthesizing the contents of chapter two's literature review on Organizational Crisis and the theory above in chapter 3 about the VSM and without prejudging the outcome of the study.

OC is a loss of homeostatic balance of vital variables in an organizational system due to inoperable control processes, which allows vital variables to deviate far from normal and, eventually, to go out of control; this accompanied by an increasing probability of dissolution of the entire system.

In brief: OC is a self-reinforcing, ultimately fatal, lack of response.

According to this proposed definition, OC is a failure of the system *itself*, not of the underlying business model or of the authority's mission. The latter is "only" collaterally damaged by the aftermath of the system failure or – in case of an a priori impossible business model or authority's mission – was falsely accepted due to a control failure at the outset i.e. the non-detection of a planning error.

[22] Of relevance here is the change-per-unit-of-time ratio of the environment compared to the adaptation-per-unit-of-time ratio of the system; i.e. requisite variety is at the same time a question of quality (what?), of quantity (how much?) and of time (when, in what period of time?).

4 RESEARCH DESIGN

4.1 Chapter Introduction

As pointed out earlier, this dissertation follows a quantitative approach of theory-led deductive reasoning. By testing the proposed hypotheses based on a broad empirical basis, the aim is to achieve generalizable results on the aetiology and predictability of OC based on Beer's VSM.

This chapter firstly revisits the research question and the hypotheses that will be tested in the next chapter and discusses, secondly, the research model. Afterwards, it is described how the VSM has been operationalized into the measurement tool in the form of a questionnaire in order to conduct the quantitative survey. Data collection and data analysis (i.e. the statistical method) used for this study are then discussed followed by a short account on the group of respondents.

4.2 Revisiting Research Question and Hypotheses

After the discussion of the theoretical approach and the review of the OC literature, it is important to check the suitability and logic of the research question and the hypotheses of this project and, if necessary, refine it before the next steps in the research process.

The research question was formulated as follows:

"*To what degree do the necessary and sufficient conditions for organizational viability as defined by Beer's Viable System Model predict Organizational Crises?*"

Although the literature review revealed a knowledge gap in the area of OC aetiology rather than in the understanding of the OC process itself, the research question remains correctly posed. It is the aim of this work to *predict*

OC using the VSM *because* a lack of system viability is an indicator for the aetiology of an OC, though in practice such a transition will be diffuse with altering phases or aspects of viability and non-viability.

The hypotheses were formulated as follows:

H_0: There is no significant predictive relationship between system viability and crisis occurrence.

H_1: There is a significant predictive relationship between system viability and crisis occurrence.

Here again, although literature review showed a knowledge gap about OC aetiology (causation), it is correct to hypothesize a predictive relationship between system viability and OC occurrence because non-viability is the (hypothesized) cause of OC or, in short, non-viability is assumed to be the *cause* of OC.

The term “system viability” was introduced by the author of this work as a conceptualization of, or a construct for, the degree to which an organization fulfils the VSM-requirements. Stafford Beer neither expressed system viability as one single variable nor did he see viability as a continuum. In fact, he noted that if only one aspect of the VSM is not fulfilled by an organization, that organization is no longer viable. This rigid definition is appropriate for theoretical reasoning; in social research, however, such absolute limits are neither defined nor effectively measurable.

As a conclusion, following the theoretical discussion and the literature review, the research question and the hypotheses are valid and can form the basis for the following steps in the research process.

4.3 Research Model

In this section, the research approach adopted in this dissertation will be explained and reasons for choosing the approach will be given.

4.3.1 Qualitative versus Quantitative Methods

A seemingly great divide exists between proponents of either qualitative or quantitative research, when observing the respective literature Haq (2015). Scientific research has a long tradition in natural sciences, where quantifying research findings is not only common and in the vast majority of cases feasible but is also virtually a prerequisite for their acceptance in the respective scientific community. This tradition has been behind the use of the term “scientific” for centuries and, still today, science is associated with exactness, measurability and significance which are, without exception, terms from the realm of quantitative research.

Qualitative research, on the contrary, emerged with the advent of social sciences, including disciplines which deal with phenomena of human individuals or groups. In social science behaviour, language or values are the object of research rather than energy, matter, space and time as is the case with its “natural” counterpart. Social research enlarged the range of objects under observation and meant that the available scientific methodology needed extension as the new objects of research did not lend themselves to natural science research methodology. Instead, new approaches had to be developed for both quantifiable (e.g. surveys) and non-quantifiable phenomena, such as interpretations, communications or thought processes (e.g. grounded theory).

Although qualitative research methods have gained much acceptance in recent years and became irreplaceable in many fields of research, the aftertaste of unscientific methods still clings to them. This is not only due to the problem of quantification but also to epistemological differences, the discussion of which, however, would go beyond the scope of this dissertation. While, in a sense, the allegation of being unscientific pertains to all social

science disciplines, when assessed from a purely “hard” natural sciences point of view, it particularly applies to fields of research where quantification is not possible or even undesired. The main reasons for this are twofold. Firstly, research findings generated by qualitative methods follow an inductive approach which, a priori, excludes results from being generalizable and thus is of limited scope. Secondly, qualitative findings often lack a measure of reliability. Other than with numeric data which can be analysed mathematically, qualitative findings are often coded in prose which can be confirmed by third parties only with substantial effort, if at all. The fact that qualitative researchers would disagree with most of the above reasoning points to the fact that the divide between the two methodological approaches mentioned at the beginning still today is far from being bridged, although the perfect complementarity of the two approaches seems obvious to the author as will be seen in chapter 4.4, when the development of the measuring instrument used for this work will be discussed.

4.3.2 Rationale for Adopting a Quantitative Approach

“OC research is still in its infancy” as Seifert (2006, p. 87) states in her comprehensive literature based qualitative method dissertation on the genesis of organizational crisis. Unlike Seifert – who took the first steps into theory development (ibidem, p. 341) on the causes of OC – the present dissertation draws on existing theory (the Viable System Model or VSM) and applies it to the problem of the aetiology of OC.

Many research projects about the causes of OC both qualitative and quantitative have been performed already; however, a causal quantitative analysis of OC based on the VSM, to the knowledge of the author, has not been done before. Indeed, only three quantitative studies (Frost (2005), Crisan Tran (2006), Sabir (2014)) have been conducted so far using the VSM as a theoretical basis, despite its strong claim to define the necessary and sufficient conditions for the viability of organizations.

This strong claim, in combination with the rigor of quantitative analysis and the potential generalizability of the results for a wider group of users, was

the reason for choosing a quantitative approach. However, the operationalization of the many non-quantitative characteristics of the viable system model into the survey questionnaire is strongly influenced by qualitative research methods, such as text analysis and the situation vignette technique.

4.3.3 Conceptual Model

To answer the research question of whether the viability conditions of the Viable System Model are in fact predictors of OC, this dissertation follows a quantitative approach of theory-led deductive reasoning (see the Conceptual Model in Figure 22). The proposed hypotheses will be tested statistically, using a structural equation modelling approach in order to conduct causal analysis on the grounds of OC. Independent variables are the functional characteristics as defined by the Viable System Model of the 135 organizations in the sample. Dependent variables are the ones which together define the organizational state of these organizations based on the characteristics of OC.

The data base will be generated by a survey consisting of a self-developed questionnaire among 135 crisis and non-crisis organizations. The relevant predictor and criterion variables will be assessed by knowledgeable and unbiased[23] third party assessors (called experts, due to their in-depth knowledge about these organizations).

Whether and to what degree there is a significant relationship between system viability and the occurrence of OC will be answered statistically. Following this, the question of whether generalizable results on the aetiology and predictability of OC can be derived from the results will be examined.

[23] as compared to managers or owners of the respective organizations.

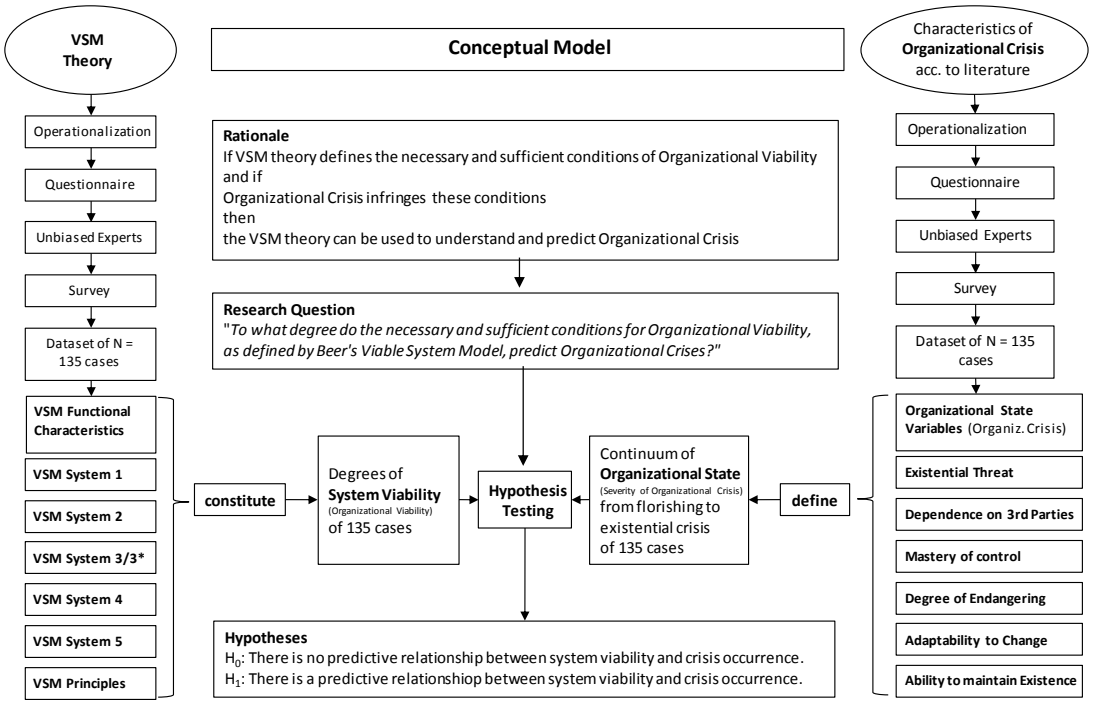

Figure 22 Conceptual Model

4.3.4 Quantitative Research Process

To answer the research question – the degree to which the viability conditions of the VSM are in fact predictors for organizational crises – the following research process will be followed.

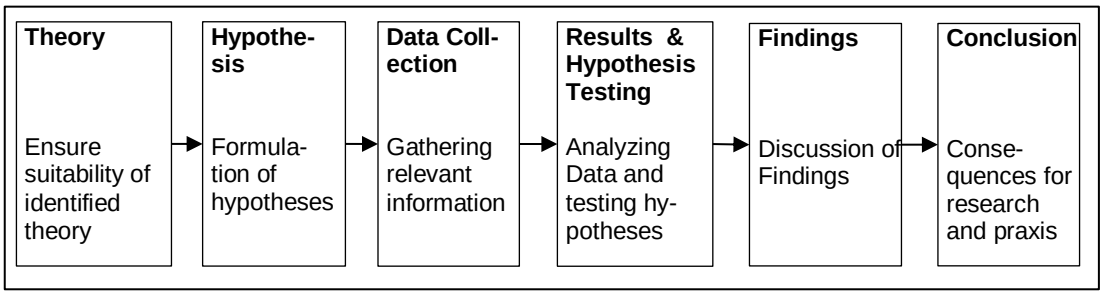

Figure 23 Research Process

The suitability of the theory has already been pointed out and the hypotheses have been proposed and revised. The following steps of the above research process are explained in the following chapters.

4.4 Measuring Instrument

4.4.1 Introduction

Empirical (from Greek εμπείρία; empeiria, “experience”, from εή- “in” and πέίρα “trial, experiment”) research is basically a simulation of reality, Popper and Keuth (2005, p. 9) use the term “experiment”, under controlled circumstances limited in size (sample) and scope (focus of attention) to verify whether or not a theory-led hypothesis has to be falsified. Popper demands “*It must be possible for an empirical scientific system to be refuted by experience*” ibidem p. 17 [third part translation, note of the author]. This process of falsifying is done by comparing theoretically based predictions with observed facts.

The term empirical research is mostly used to designate quantitative research in the sense that systematically observed characteristics of a research subject are expressed in numbers (“data”) and analysed using statistical methods. While data *analysis* for the most part is a quantitative process, primary data *collection* in social science to large parts is a qualitative undertaking because, in social sciences, theories or theoretical concepts – unlike in the natural sciences – are seldom formalized as ready to use mathematical axioms. Rather, as Diekmann (2010) concludes, they are available in literary form, sometimes as concrete statements.

Accordingly, in order to employ theories for social research they have to be interpreted, structured regarding the research question and coded into questions using a language that can be understood by the data source i.e. the respondents. At the same time, the coded content has to correspond to the theoretical intent – so that the respondent’s answer coincides with the original theoretical content.

This process of making theoretical concepts measureable (i.e. “operationalization”) had to be performed for this study because the existing measuring instruments on the basis of the VSM did not meet the requirements of the present project.

Crisan Tran (2006) has developed a generally usable measuring instrument for the viability of start-up firms on the basis of the VSM. With more than 110 data points the measuring instrument turned out too large for the targeted respondent group of bankers, fiduciaries and management consultants of this project (the selection of this respondent group is substantiated in 4.7). Early break offs, simplifying heuristics or response bias would have been a consequence of using such a large questionnaire as reactions of the pilot study respondents implied. Above all, the wording and personal address of Tran's questionnaire had to be rewritten, with the consequence that the tool had to be re-tested and re-validated.

Frost (2005) tested the viability of internet communities of practice with the VSM. His measuring tool was completely focussed on such communities and was not usable for the present purpose.

Sabir (2014) used the VSM systems 1 to 5 to operationalize twenty different functional work-events for which the respondents had to indicate their emotional experiences. With it, Sabir measured the effects of work on workforce emotion. Sabir's VSM operationalization was not used because it addresses the individual person (lowest possible recursion level in an organizational context), is targeted at the inner, emotional state of the respondent and, in any event, Sabir's thesis was published at a late stage of this research project.

Hales, Hough, Hoverstadt, Mettam, and Searles (2010) developed the Organisational Maturity Model OMM, which is a free-to-use questionnaire that can be downloaded from the SCiO [24] website (http://www.scio.org.uk/organisational-maturity-model). The tool is based on the VSM and is designed to "[…] *show the structural integrity of your organisation from one perspective*" (p. 4). Two perspectives are available: "Director", which assumes a top down view and "Manager" with a 360 degree view (up, down, to the sides). The OMM tool positions organizations with regard to

[24] SCiO stands for "Systems and Cybernetics in Organisation"

the six VSM “aspects” (p. 5), based on the score of the questionnaire on one of four maturity levels.

The OMM tool is an operationalization of the VSM but could not be used without alterations as the basis of the present study due to language, codification and methodical reasons. The language used for the survey during this research was German; a translation of the questionnaire had to be re-tested and re-validated. Codification of the VSM characteristics i.e. the translation of the concepts into language only corresponds in part to the experience of the target groups of the present study and, accordingly, had to be rephrased, re-tested and re-validated, together with the examples given. Finally, the structure of the questionnaire uses four successive questions per VSM function: 1. capacity, 2. connectivity, 3. balance and 4. consciousness. If one question (e.g. no. 2) is answered with a score of 1 or 2 the remaining (questions 3. and 4.) has to be set at score 1 due to the *consecutive* character of the questions, independent of the respondent’s results. This structure is designed for public use and self-assessment but it is less suitable for research purposes.

However, besides the literature analysis, the contents of these three tools have been taken into account when developing the questionnaire. For example, the idea of a consecutive form of the questions used by the OMM is well-founded, although implemented in a rather complex manner. In fact, in order to check the effectiveness of a certain function, first of all, the *availability* of that function has to be established; only afterwards does it make sense to ask for the *quality* with which this function is implemented. The design of the research questionnaire attaches importance to this insight. The following example, taken from the original questionnaire which was used to conduct the survey of this research project, may illustrate this principle. For methodical reasons (see 4.4.4.5), *idealized situations* rather than questions were used to test conformity of the real situations, which were encountered with the assessed organizations, with the idealized availability of the VSM functions.

Table 7 Idealized Situation System 1

1 Autonomous Operational Service Provision Units

In the organization, there are one or several operational units (hereinafter: service units SUs) **that…**	
1.1	... have **sole** (i.e. exclusive) **responsibility for logically definable market areas** (e.g. by customers or products or geographical areas, etc.). If there is only one market area, the **interface to the market is clearly defined** (e.g. sales *or* production *or* project management)**.**
1.2	...are **competent, able** and **flexible** to **serve their market areas comprehensively** (in conjunction with third parties, where necessary).

The above mentioned consecutive design is demonstrated in the situation vignette example in Table 7: The top section defines the *subject* of the function (*autonomous operational service provision units*). In the introduction section the *availability* of the function is assessed (*there are one or several…*). Subsequently in section 1.1, the *quality* of this function is covered (*sole responsibility for…*), followed by an additional *qualitative* section (*competent, able, and flexible to…*).

4.4.2 Operationalizing the VSM Characteristics

As said earlier, Stafford Beer, the author and developer of the Viable System Model VSM, was in many respects a versatile and original person as was his writing. When it comes to extracting theory from his texts, this can be considered a demanding task even for well-read native speakers, although a worthwhile intriguing piece of business management literature. Due to this partial inaccessibility and, in order to obtain third party perspectives as well as interpretations from other VSM experts, the author decided to consider a multitude of sources to operationalize the Viable System Model.

With the intent of extracting the theoretical content of the VSM and operationalizing it for the survey, the author followed an iterative approach of reading, deriving and structuring the VSM characteristics. Starting with introductory literature and journal articles on Beer's work, a catalogue of VSM characteristics and principles was created. To this end, older preliminary works were also evaluated. For example *Cybernetics and Management* by Beer (1967), where Beer gives a straightforward example of learning and the value of making mistakes from a cybernetic point of view, as well as an early

version of the VSM metasystem under the misleading designation of a “cybernetic machine”.

The content and structure of the VSM characteristics and principles catalogue have then been completed and expanded with every additional piece of literature on the VSM or on related literature. This sub-process bears similarities to text analysis approaches in qualitative social research.

Literature analysis has been performed with a reference and knowledge management software called citavi. It allowed every reference to be assigned to at least one of the catalogue criteria and a VSM-characteristics information collection to be compiled.

In order to enhance material closure and coherence of the VSM characteristics catalogue, one piece of literature was considered with special attention. Malik (2008), a student of Beer and a former University of St. Gallen scholar, wrote his habilitation[25] treatise on Beer’s VSM. On the basis of his structured and detailed analysis of the VSM, the catalogue on the VSM characteristics obtained a coherent and comprehensive golden thread.

Before this process, in order to double-check the fundamental feasibility of a questionnaire based VSM-analysis, the author contacted two VSM experts: first, Patrick Hoverstadt a VSM expert, VSM author and chair of SCiO (www.scio.org.uk), a UK-based not for profit organization of system practitioners, offering, among other things, the OMM (see 4.4.1) based on the VSM; second, Dr. Martin Pfiffner (not related to the author), a business partner of Malik and leading VSM expert and practitioner. Both experts confirmed the fundamental feasibility of the endeavour. A full version (later on further revised) of the questionnaire was sent to Dr. Martin Pfiffner for feedback; besides minor suggestions for adaptation the expert confirmed the (in terms of the VSM) material completeness of the tool. Both experts pointed to the fact that questionnaires necessarily restrict the (requisite) variety of a VSM analy-

[25] The habilitation qualifies the holder for a full professorship and to independently supervise doctoral candidates. Postdoctoral thesis.

sis. This reservation was later considered in the further development of the questionnaire and the questioning technique.

4.4.3 Covering the VSM Characteristics

At first glance, the VSM, with its six systems and four principles, seems to be straightforward and clear cut to turn it into a brief questionnaire. However, if one recalls the models universal claim, which defines the necessary and sufficient conditions for viability of any organism, as well as the high level of abstraction on which the VSM is defined, it becomes clear that there must be more to it than just asking ten questions. In addition, the cybernetic concepts of the VSM are coded in a technical language unfamiliar to most or all respondents. Accordingly all VSM-concepts have to be translated into plain language that can be understood by all respondents.

As illustrated, each component (systems 1 to 5) of a viable system is again a collection of subsystems with control elements, homeostats and feedback loops exhibiting several interconnections with the rest of the system in a specific way. As a recursive model *("any viable system contains, and is contained in, a viable system*" Beer (1994b, p. 308) the VSM-structure is repeated "above" and "below", i.e. one or several level(s) of recursion higher or lower at a time of the respective system in focus.

As has been pointed out above, the VSM exhibits six control functions (systems 1 to 5 with 3* in between) and additionally requires the observation of four principles (autonomy, requisite variety, recursiveness as well as information transmission capacity and connectivity).

The object of measurement is then system viability, a construct established for this dissertation, to designate and measure the degree to which an organization fulfils the VSM-requirements.

It should be noted again that mere information gathering about the *presence* of these ten constituents of the VSM does not suffice. In addition, it is clear that the *quality* of these subsystems as well as their *degree of utilization* must play an equally important role (concretisations). Furthermore, since

the VSM is a holistic model looking at organizations as integrated systems, the *interconnectedness* of the control functions is essential when assessing organizations using the VSM.

This posed the question of how a multitude of theoretical concepts encoded in a difficult to understand language can be operationalized so that people not familiar with the VSM can understand and answer it in a meaningful way and within a reasonable time frame.

4.4.4 Data Collection Method

From the point of view of research economy and taking into account potential difficulties of respondents, it was not feasible to construct a questionnaire with more than one hundred questions (ten systems/principles x three to four characteristics x four concretisations, still without any redundancy in information, the necessary context as well as questions about crisis and control variables). This argument of proliferating data volume is also supported statistically because such a large number of items at the outset of the research project had demanded for a prohibitive sample size of N >1600. On the other hand, an excessive eradication of information would infringe the completeness of the VSM characteristics in the questionnaire, as the VSM experts had warned beforehand.

The question arose as to how a large amount of information about control functions of organizations can be gathered without placing an excessive burden on the respondents, thus avoiding early break-offs of surveys or simplifying heuristics, respectively, and yet without inflating sample size. At the same time, infringing basic laws of questioning techniques, such as the one on asking multi-barrelled questions had to be avoided.

In conclusion, the task of collecting information about a multitude of criteria without asking a multitude of questions had to be solved. Investigations on research techniques to this effect and a friendly hint yielded two useful approaches. The first was the vignette-method, the second the business case method in education. What follows is a short description of these two

methods with a strong emphasis on the formulation of the respective survey questions or narratives as is the focus of the present considerations.

4.4.4.1 Vignette Method

The vignette-method (French *vignette*; ‘wine label’), also called factorial survey, was developed in 1951 by Peter H. Rossi in his dissertation on social stratification. The method provides respondents with short hypothetical object or situation descriptions or scenarios (vignettes) in prose about the research topic. A vignette contains several factors (or “dimensions”, such as age, gender, education, salary, profession, prestige, etc.) and their manifestations (or “levels”, such as age intervals, gender, etc.), each combination building a separate vignette. Respondents evaluate each vignette on a closed response scale or (occasionally) on an open magnitude scale. The evaluation of the scores allows the researcher to draw conclusions about the relative importance of the dimensions (e.g. above dimensions and levels on salary).

As Auspurg, Hinz, Liebig, and Sauer (2009) state, the way questions are formulated with the vignette method provides several advantages over the single item approach, such as context information around the dimensions, closer correspondence with real situations, closer control over assumptions and circumstances of both, respondent and situation. Formulating vignette-type questions, respondent-oriented language can be used to further increase response validity. Auspurg et al. (2009) also name disadvantages of the method such as cognitive overload and, as a consequence, the use of simplifying heuristics (consideration of only a few central characteristics) or respondent assumptions of unknown characteristics. However, the authors in their survey did not observe cognitive overload even when using twelve dimensions plus control variables per vignette. Together with the options of syntax and semantics (i.e. by carefully building meaningful sentences) the formulation of understandable vignettes is possible, even with a large amount of information in them.

This suggests that the formulation of vignette-type situational questions provides interesting insights when it comes to asking respondents about complex control functions and situations.

4.4.4.2 Case Method

The second approach that provides helpful insights toward data collection about multi-attribute situations is the business case method used in business education to provide students with realistic business situations to apply their business knowledge.

The case method is said to have been developed by Harvard Law School around the 1870s and was applied to business situations in the early 20th century. Because this method is a very well-known teaching method it should suffice to just recall here the major parts of a business case. The following information on the case method is owed to Siddiqui (2013).

A case needs a concise title and an introduction from which the situation and the context can be captured quickly, with Siddiqui using the term “vignette”. Background information about company and industry (i.e. circumstances) should then be given. Following this, issues and challenges shall be named with enough information for the reader to analyse the case. A conclusion (or question) should draw the readers’ attention back to the central problem and trigger an evaluation or a decision.

Compared to the vignette method above, the case method emphasises the narrative to create a context around the core variables of a case and allow the reader to empathize with the case and learn about the constructs to be assessed.

Both methods provide the reader with a large amount of information which has to be, at least partly, memorized and recalled for the ultimate decision or statement.

4.4.4.3 Multi-Barrelled Questions

One central rule when developing a questionnaire concerns multi-barrelled or multi-stimulus questions. Such questions ask about more than one issue at the same time and answers to such questions are generally considered indifferent or incomplete with regard to the content of the question. Vignettes (of the factorial survey method) are not multi-barrelled because each possible combination of levels is covered by a number of separate questions and respondents evaluate each vignette in its entirety, i.e. as one combination of facts. Case studies, on the other hand, only provide the detailed background to the actual questions and can, therefore, not be considered multi-barrelled.

4.4.4.4 Observational Aspects and Conclusion

Besides the research of the author on appropriate proven data collection methods, self-observation contributed to finding the appropriate measurement method. A building was viewed from the outside and the observer asked himself whether or not the building appealed to him. An answer to that question was possible, although this in fact could have been considered a multi-barrelled question about the windows, the façade, the location of the property, the colour or the proportions of the building. Instead, the aesthetic judgement concerned the building as an entity.

Just like a building, a control function of an organization is composed of a variety of characteristics but it is amenable to an assessment as a whole. This principle of integral perception has close parallels with the notion of recursiveness in the VSM, where one recursiveness level (e.g. the firm) contains and integrates all lower levels (e.g. its departments). Consequently, judgements are *always* integrals over abstractions, otherwise they would get lost in meaningless detail.

4.4.4.5 Situation Vignettes Method

Integrating the aforesaid, the data collection approach established for this dissertation provides abstracts of control functions by using both the

brevity and variety of vignettes and the situational approach of case studies. Situation vignettes provide short idealized situation descriptions about the issue in question (here: VSM-control functions) in the context of practical use or application, rather than describing a variety of constellations of dimensions or providing lengthy narratives.

The situation vignette approach has the above mentioned advantages of the vignette and case study method, such as context provision, close correspondence with real situations, control over assumptions and, at the same time, it facilitates the operationalization of the rather abstract concepts and language of the VSM.

The problem of multi-barrelled questions can be circumvented with situation vignettes although they include a multitude of aspects (a summary screening of the questionnaire yields 170 stimuli as well as 93 synonyms and examples). This is done by asking the respondent to what extent an idealized situation *as a whole* is fulfilled, deliberately renouncing information on single aspects. Consider again item battery 1 questions 1.1 and 1.2 – already familiar examples – taken from the translated version of the research questionnaire used for the survey of this dissertation. The full questionnaire (translation only) can be found in appendix 1.

Table 8 Example Item Battery 1 Questions 1.1. and 1.2

1	**Autonomous Operations Service Provision Units (SU)**
In the organization there are one or several operational units (hereinafter: service units SUs) **that…**	
1.1	…have **sole** (i.e. exclusive) **responsibility for logically definable market areas** (e.g. by customer or products of geographical areas, etc.). If there is only one market area, the **interface to the market is clearly defined** (e. g. sales *or* production *or* project management).
1.2	…are **competent**, **able** and **flexible to serve** their market areas **comprehensively** (in conjunction with third parties where necessary).

After the descriptive title, the situation vignette provides a short introduction, which is common to the following texts, and two statements describing idealized situations around a VSM control function (system 1). The text

provides synonyms and gives examples to support the respondent's evaluations process.

Situation 1.1 may seem multi-barrelled but it is not. It describes the situation (more precisely: possible constellations of ideal situations) of an exclusively responsible unit for a defined market. Precisions ("exclusive") and examples (e.g. "geographic" as a market definition criterion) for a better understanding of the text are provided additionally.

Situation 1.2, in fact, gives multiple stimuli ("competent", "able", "flexible", "comprehensively") which may or may not apply. However, to assess the concept in question, "unit autonomy" as a whole, it is immaterial exactly which individual aspect is missing or fulfilled only to a degree.

The respondent evaluates the control function holistically by comparing the idealized situation vignette (e.g. 1.1 or 1.2) to his or her picture of the reality of the assessed organization and accounts for the accord on an eight point Likert scale with a "don't know" response. More details and differentiations about these aspects only had to be clarified in the hypothetical case of in-depth further investigation about the autonomy of this unit.

In summary it can be stated, that the situation vignette method for this work provides the necessary data collection tool to meet the complexity of the VSM without getting lost in details or exuberant amounts of data.

4.5 Data Collection

4.5.1 Statistical Method

To *simultaneously* analyse multiple system characteristics (indicators; independent variables) that, according to Beer's theory, add up to several control functions (systems 1 to 5; exogenous constructs), which together ensure system viability (endogenous construct), which again brings about or precludes organizational crisis (dependent variable), a powerful and versatile analysis tool has to be employed. Complex analytic structures, such as the one just described, require sophisticated multivariate statistical analysis techniques.

4.5.1.1 General Considerations

Hair, Hult, Ringle, and Sarstedt (2014, p. 2) distinguish between first and second generation multivariate statistical techniques, where the term multivariate stands for a simultaneous analysis of several variables at the same time. First generation techniques include cluster analysis, factor analysis, multidimensional scaling, analysis of variance and regression analysis. Confirmatory factor analysis and structural equations modelling rank among second generation techniques. The generational distinction of Hair et. al. is based on the a priori knowledge about the relationship among the variables and the consideration of unobserved variables: First generation techniques assume no or only marginal a priori knowledge about the relationship among variables and *cannot include unobserved variables*. In contrast, second generation techniques such as Structural Equation Modeling (SEM) assume theory-led a priori relationships and allow unobserved constructs that are measured indirectly to be included.

SEM, as a confirmatory application, is especially useful in the present research context because the theoretical basis, the VSM, is highly abstract and manifold. A high abstraction level is advantageous when it comes to applying the theory to a broad range of cases and with a view to a generalization of the results, which apply to the present study. However, at the same

time, high abstraction places major demands on a stringent depiction and scrutiny of the causal chain from the observable indicators via the VSM sub-constructs, the constructs, to the crisis prevalence indicators.

By allowing consecutive multi-order constructs, SEM permits complex models – such as those shown in the following graph – to be analysed. If one, in contrast, imagines a multiple regression analysis with 18 independent VSM variables and 2 dependent system viability- and crisis-variables, it becomes clear that a first generation approach cannot meet the differentiation requirements of a VSM-based analysis.

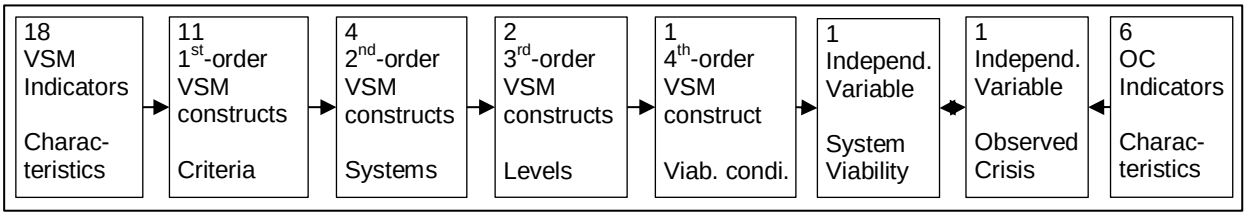

Figure 24 Basic Statistic Model

4.5.1.2 Structural Equation Modeling SEM

SEM is the multivariate analysis method applied for this study, more precisely called Partial Least Squares or PLS SEM. Strictly speaking, according to Kline (2011, p. 7), this term does not designate a single statistical technique but refers to a family of related procedures, for which it is important to understand that the term “related” refers to the fact that these procedures take place *simultaneously*. In addition, Weiber and Mühlhaus (2010, p. 17) emphasize the nature of SEM as a structure detection method for the assessment of a priori theoretically or logically formulated system of hypotheses.

Astrachan, Patel, and Wanzenried (2014, p. 116) point to the fact that SEM combines factor analysis and linear regression models to allow the researcher to statistically examine the relationships between latent i.e. unobserved constructs by measuring directly observable indicator variables. Underlining the ability of SEM to examine multi-level interdependences, they attach importance to the fact that formerly dependent variables (see Figure

25: Y_1 depending on $X_1 – X_3$) become independent for subsequent relationships (ibidem: Y_3) within the same analysis procedure.

Another important notion in connection with SEM is causal analysis, which has to be distinguished from mere covariance or correlation analysis. The latter measures only standardized commonalities to the extent of the development of numerical series, but provides no information about reason, source, direction, immediacy or timing of the relationship between the values. Causal analysis, however, demands, besides significant correlation for theoretically and / or logically sufficient reasons as to why a statistical dependence between variables shall be / can be *interpreted* (emphasis in original) as a causal relationship, as Weiber and Mühlhaus (2010, p. 9) point out. Consequently, they define the availability of a set of causal hypotheses derived from a valid theory (such as the VSM as pointed out above in the VSM section) as a prerequisite for a valid presumption of causality.

The process of conceptualization and operationalization of the (VSM-) theory into measureable variables and the development of the hypotheses is given in the next chapter on the measuring instrument (questionnaire).

4.5.1.3 Model description

Structural Equation Models (see Figure 25) in the first instance consist of two basic kinds of sub-models: the structural model and the measurement models. The following explanations are based on Hair et al. (2014, pp. 11–14).

The measurement (or outer) models show the relationships between the independent variables (rectangles, X_n) or indicators and the constructs (ovals, Y_n). Error terms (e_n) represent the unexplained variance of reflectively (arrow points from a construct to an indicator, i.e. the construct causes the indicator or the indicator *reflects* the construct influence respectively) measured indicators. In contrast, formatively (arrow points from an indicator to a construct, i.e. indicator causes the construct or the indicator *forms* the construct) measured indicators have no error term. (z_n) represents the error term

of endogenous latent variables (Y_3, Y_4), while exogenous latent variables (Y_1, Y_2) do not have error terms.

The structural (or inner) model shows the relationships (paths, arrows) between the constructs (or latent variables).

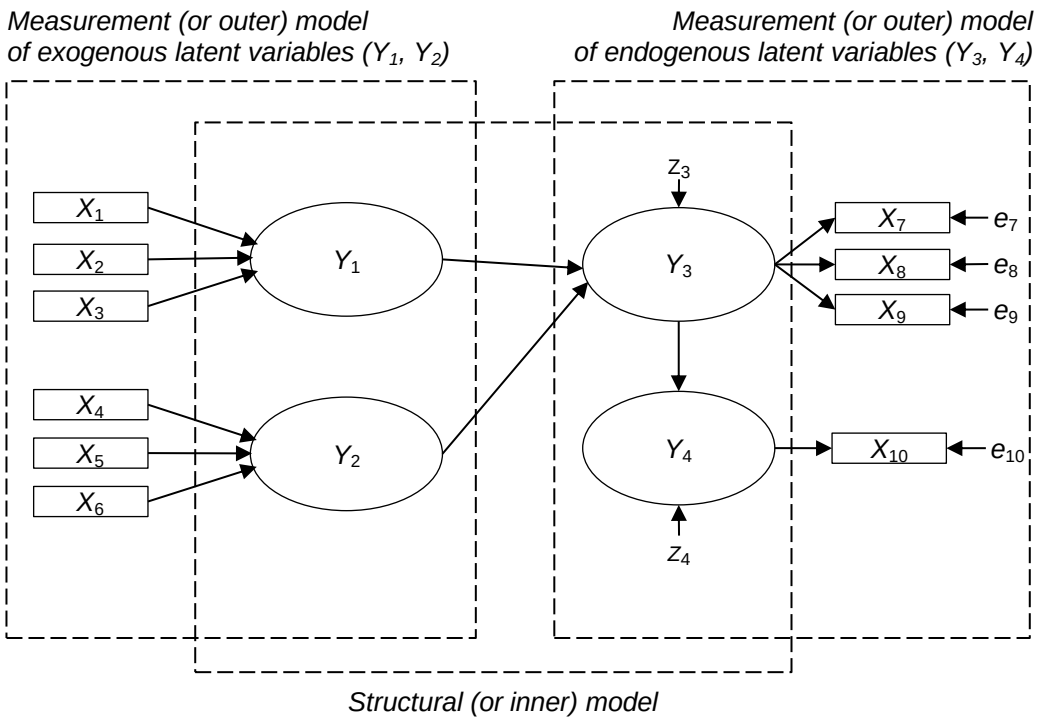

Figure 25 A Simple Path Model according to Hair (2014)

By convention, variables on the left side of the model are the independent, affecting ones, chronologically earlier observed, prognosticating the ones on the right side of the model, which are the dependent, affected, chronologically later observable variables. Latent variables may also serve as both the independent and dependent variable.

4.5.1.4 Statistical approaches to SEM

SEM has been developed two times: the first time by Herman Wald in 1974 (Partial Least Squares or PLS-SEM) and the second time by Karl G. Jöreskog in 1978 (Covariance Based or CB-SEM).

Hair et al. (2014) elaborates on the mathematical differences between PLS and CB-SEM as follows: *PLS-SEM maximizes the endogenous latent*

variables' [Y_3, Y_4 in Figure 25] *explained variance by estimating partial model relationships in an iterative sequence of OLS* [ordinary least squares; note of the author] *regressions. In contrast, CB-SEM estimates model parameters so that the discrepancy between the estimated and sample covariance matrices is minimized.*

Due to early availability of a statistical software tool for the CB-PLS application in the seventies and continuous improvement initiatives, this approach dominates the field. In contrast, PLS-SEM, which lacked such a platform, experienced much weaker distribution and application. In 1998 and 2005, with the availability of graphical interface technique and software tools such as SmartPLS, the attractiveness and user-comfort of PLS-SEM propelled the adoption rate in social science disciplines. This achievement coincided with the recent (2012) and on-going criticism of the approach (historical summary owed to Sarstedt, Ringle, and Hair (2014, p. 133).

Although it was clear to Wald and Jöreskog that the two approaches were complementary, the debate between the proponents of either approach continues to bring forth strange results, such as a denial of PLS being an SEM method at all or the usefulness of PLS when testing the significance of path coefficients. Perhaps the most discussed issue is sample size, where PLS has an advantage over CB.

A recent comparative analysis of CB- and PLS-SEM by Astrachan et al. (2014) concludes on the test results that the methods provide robust and similar results. Weiber and Mühlhaus (2010, p. 266) came to the same conclusion. Comparing the results of the application of the two approaches on the same case, they arrived at the same results, with minor numerical deviations.

The on-going meticulous technical debate among experts may contribute to the perfection of both approaches. Apart from such disputes, PLS-SEM is increasingly used in empirical studies. Ringle, Sarstedt, and Straub (2012) analysed the journal *MIS Quarterly* for the use of PLS-SEM between

1992 and 2011 and found a significantly increasing number of PLS-SEM applications per year.

4.5.1.5 Method Evaluation

From the point of view of this dissertation, however, it is the duty of the author to comprehensibly choose the appropriate method based on available knowledge. The following table lists important characteristics of both PLS-SEM and CB-SEM, which allow the suitable technique to be evaluated based on the research project requirements. The table is a compilation of findings from Astrachan et al. (2014, p. 126), Sarstedt et al. (2014, p. 134) and Weiber and Mühlhaus (2010, p. 253).

The requirements of the present study are reflected by a cross (x) in the column besides each method characteristic.

Table 9 Comparison of PLS-SEM and CB-SEM

Criterion	PLS-SEM		CB-SEM	
Objective	Prediction oriented	x	Parameter oriented	-
Approach	Variance based	-	Covariance based	-
Assumption	Predictor specification (nonparametric)	-	Typically multivariate normal distribution and independent observations	-
Distribution requirements	None	x	Normal distribution required	-
Parameter estimates	Consistent as indicators and sample size increase (i.e. consistency at large)	-	Consistent	x
Latent variable scores	Explicitly estimated	-	Indeterminate	-
Epistemic relationship between a latent variable an its measure	Can be modelled in either formative or reflective mode	x	Typically only with reflective indicators	-
Implications	Optimal for prediction accuracy	x	Optimal for parameter accuracy	-
Model complexity	Large complexity (e.g. 100 constructs and 1000 indicators)	x	Small to moderate complexity (e.g. less than 100 indicators)	x
Sample Size	Power analysis based on the portion of the model with the largest number of predictors. Recommendations for the minimum number of observations range from 30 to 100 cases.	x	Ideally based on power analysis of specific model. Recommendations for the minimum number of observations generally range from 200 to 800.	-
Later stage theory testing	Less useful	-	Useful when “real” theory testing.	-
Early stage theory testing	Useful when measuring and constructs are novel	x	Less useful	-
Goodness of Fit criterion	None	-	Available	x

Considerations in the order of the above criteria (with an “x”):

The objective of this study is to identify crisis predictors based on viability criteria independently from the statistical approach in use.

Data is not normally distributed as the item scores necessarily show a tendency to one side between the two data groups “crisis” and “non-crisis”. This will be discussed in the findings chapter. Therefore, the method should not require normal distribution.

The minimum sample size is available; therefore, the “consistency at large” characteristic of PLS-SEM is acceptable.

The flexibility to use both reflective as well as formative measured constructs is an advantage and reduces risk.

The prediction of crisis occurrence (dependent variable) based on VSM conditions (independent variable) is the main aim of the study.

The model is complex (first, second, third and fourth order constructs) but it is within the limits of complexity of both CB and PLS methods.

The sample size is 135 and meets the requirements of PLS-SEM but would not meet the standards of CB-SEM.

VSM as a theory basis for empirical research is, to the knowledge of the author, novel. To date, only three researchers – Frost (2005), Crisan Tran (2006) and Sabir (2014) – have operationalized the VSM for a quantitative analysis. In contrast to this study, they did it for specific target groups (Frost for communities of practice; and Crisan Tran for start-up companies) or on the level of individuals to explore the influence of functional work-events (as operationalized by the VSM) on employee’s emotional experience (Sabir).

PLS-SEM still lacks a Goodness-of-Fit-Criterion but there are a number of single measures which compensate for it.

In summary of the considerations, it can be stated that PLS-SEM is the appropriate statistical approach for the present study.

4.6 Questionnaire Design

The questionnaire design chapter is based on VSM chapter 3.5, where the basic properties of the VSM have been explained already.

As the questionnaire for this project had to be constructed from scratch, this chapter contains a detailed description of the steps and considerations taken when developing the measuring instrument for the quantitative survey. The survey was conducted in the German language; the description, however, refers to a translation of the original questionnaire. The translated (non-validated) questionnaire is available in the appendix.

4.6.1 Requirements

This section contains the requirements which have to be met by the measuring instrument.

4.6.1.1 Guidance

Respondents fill in questionnaires when they have time and information available. As a rule, this happens without the direct support of the researcher. Consequently, a questionnaire must not only be self-explanatory but also guide the respondent through the questions step by step, ensuring completeness and accuracy of the data collected.

To achieve this, respondents in this project were given general information on the topic, the aim and the methodology of the project upfront when first been contacted by the author. This proved to be the right approach as it ensured an increased degree of interest in the research aim, which, in the end, was helpful in terms of the level of response, completeness and number of assessments.

Further, instructions on how to understand and fill in the survey were included in the questionnaire. Only one respondent used the possibility to enquire with the author while completing the form, which precluded any possible bias from asymmetric information.

4.6.1.2 Data Collection

Three types of data were collected:

Data about control variables with the aim of understanding the circumstances and characteristics of the assessed organization and the respondent, and to monitor compliance with the research design conditions.

Data about the cybernetic characteristics of the organization by contrasting the actual situation of an assessed organization with the ideal situation.

Data of the assessed organizations on risk-, survivability- and crisis-characteristics as well as statements about the behavioural repertoire of each institution.

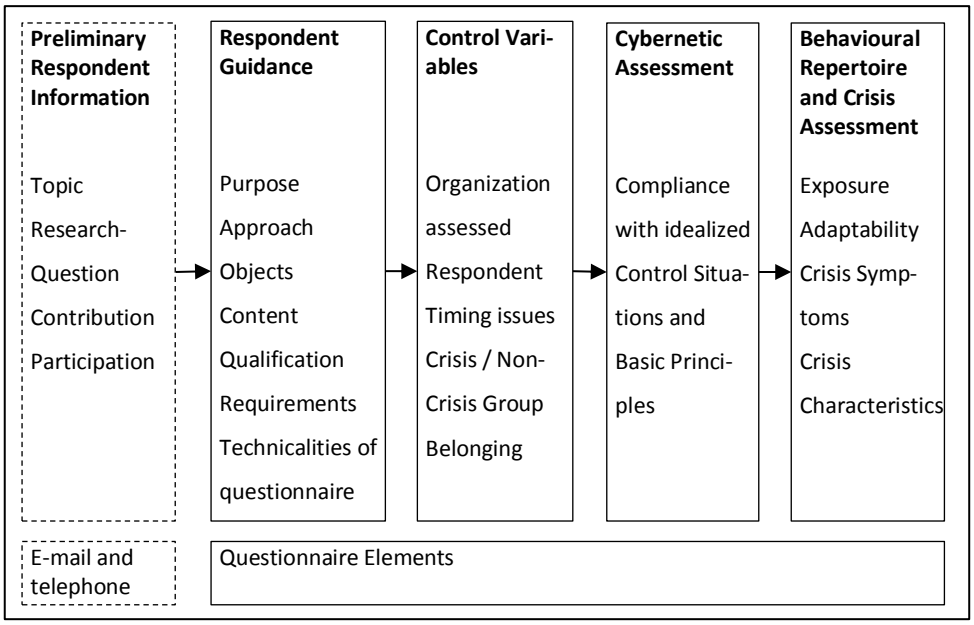

Figure 26 Information of Respondents and Data Collected

4.6.2 Components

4.6.2.1 Respondent Instructions

Most of the respondents were not familiar with the VSM, so the wording of the questions had to be approximated to the professional jargon of the respondents. For the same reason, the fundamental concepts, terms and

objects of the VSM perspective had to be briefly described, enabling the respondents to envision and assess the respective control situations (see section 1 to 3 of the questionnaire translation in the appendix).

Important definitions and explanations in connection with the differentiation of functions and functionaries, the assessed point in time and level of organization, and a familiarization with the particularities of the Likert-Scale have been added in section 4, which closed with the requirement of considering both informal and formal structures and characteristics.

4.6.2.2 Control Variables

To observe compliance with survey conditions, a set of control variables were defined.

Table 10 Control Variables (CV) Questionnaire

#	CV Organization	Value	#	CV Experts	Value
a	Organization identifier	-	i	Expert identifier	-
b	Age of organization	Min. 5 years	j	Assessment number	-
c	Number of employees	Min. 20 employees	k	Expert employer identifier	-
d	Sales or budget	-	l	Time requirement assessment	-
e	Environmental dynamic	Rather high / rather low	m	Knowledge about the case	Min. 5 out of 6
f	Management qualification	Rather high / rather low			
g	Industry / sector	Service / Prod. / GovNPO	#	**CV Survey**	**Value**
h	Bank rating standardized	1 “bad” to 100 “excellent”	n	Date of assessment	-
			o	Date of crisis break out date	-
#	**Crisis Category**	**Value**	p	Assessed point in time	Max. 4 years ago
-	Expert assessment	Did / not experience OC	q	Assessed organization level	Whole / part (unit)

Allowable minima and maxima with a limit of plus or minus 10 % have been defined for variables b, c, m and p.

4.6.3 Cybernetic Assessment

4.6.3.1 General

The following operationalization of VSM concepts has been based on a catalogue of VSM characteristics gathered in the course of the research project as well as on existing VSM questionnaires, as reported earlier.

Two main stages of development could be observed: firstly, the basic material development of the questionnaire without length restriction and secondly, the optimization stage.

The first version was examined in a pilot survey (n=24) by test respondents (formal as well as material issues) and a VSM expert (theoretical issues). The VSM expert, Dr. Martin Pfiffner (no relation with the author; see 4.4.2), apart from minor amendments, confirmed the fundamental compliance of the questionnaire with the concepts of the VSM. However, this confirmation took place along with a notice about the challenges involved in testing organizations on the basis of a comprehensive theory – such as the VSM – with a questionnaire. With it, he addressed the question of whether the questionnaire would exhibit the requisite variety to cope with the complexity of real world situations. The answer to that question, of course, lies within the VSM characteristics themselves: To the degree the questionnaire addresses the *invariants* of viability but not the innumerable irrelevant symptoms, it is able to distinguish the signal from the noise and, accordingly, exhibits requisite variety. To test for this and other aspects, the pilot surveys were performed.

Test respondents, besides VSM experts, provided valuable input on wording, understanding, logic and measurement issues but, above all, they complained about the length of the original questionnaire.

On the basis of these criticisms and a test survey, a factor analysis was performed to reduce the original number of 61 questions down to 34 to arrive at the second, optimized version.

A second pilot survey was conducted with the optimized version of the questionnaire. Interviews with all test respondents revealed further flaws. One important objection dealt with a measurement problem. Respondents who rated both crisis and non-crisis organizations integrated their assessment of both groups of organizations over the whole scale, as intended. Respondents, however, who rated only one group (either crisis or non-crisis) used the whole scale for their group of organizations. This implied two different centre points within the sample. This issue was dealt with by calibrating

the scale. This was done by designating the extreme points of the scale as either “flawed” (1) or “good” (8), thus clarifying that the scale encompassed the whole spectrum of cybernetic characteristics of organizations but not only the spectrum of one subgroup such as for instance crisis-organizations.

In total, twenty-four preliminary versions of the questionnaire have been tested and re-tested. Different kinds of feedback have been used as a source for the cumulative amelioration of the survey instrument. Test persons were asked to go through the questionnaire read the questions aloud and express their thoughts when reading the questions. This procedure revealed misunderstandings and terminological issues. Quite often, cybernetic jargon had to be replaced by normal business language terms.

Another form of feedback was used to test the scaling behaviour of the test respondents. Several respondents were asked to report their rating process, in order to investigate whether the respondents did in fact comply with the introductory instructions. This test has helped to (re-)formulate the instructions part and the guidelines in the questionnaire.

Finally, the design of the questionnaire was tested. It turned out, that the eight point scale of the instrument had to be optically separated from the “don’t know” option on the far right in order to avoid misjudgements, because some test respondents had considered the scale a nine-point scale.

4.6.3.2 Questionnaire Introduction

The main question in the questionnaire addresses the degree of correspondence between the generalized and idealized situation (vignette) and the reality of the assessed organization. To ensure correct filling out, a set of instructions to guide respondents about answering options and the usage of the scale is given in the introduction. In order to save space and keep fonts at a readable size, the eight point Likert scale – with a “don’t know” option to the right of the question field – is not shown in Table 11.

Table 11 Introduction Questionnaire

To what extent do you think that the following statements are applicable to the organizations assessed?
Please use the **assessment scales** to evaluate **whether and to what degree the situation descriptions are applicable**. Where you cannot make an assessment, please make assumptions based on what you consider to be suitable indicators and observations. Please use the "Don't know" column only when it is really impossible for you to make an assumption – in most cases however, an assumption is possible. **It is possible that your assessment in most areas to result in selections at either one or the other end of the scale.** Thank you for **unambiguous** assessments (ticks): ☒

4.6.3.3 Description of situations

Based on a comprehensive literature review of the characteristics of the generalized and idealized VSM situation, vignettes – as explained in 4.4.4.5 – are formulated instead of directly addressing each individual trait of the VSM. These situation vignettes are thought to be contrasted by the respondents with the actual situation of the assessed organization.

In the following section, the significant attributes of the VSM components are given and commented upon, to allow the reader to evaluate and compare the formulation of the situation vignette in the respective tables.

4.6.3.4 System 1

The core characteristics of system 1 units include direct market access, autonomy, availability of resources and knowledge as well as a designated market interface with clear responsibility and competence to act, i.e. a defined unit for market cultivation / sales. Availability of these resources, structures and functions allows an entity to act independently and to be, in principle, a viable system itself.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 12 Questionnaire System 1

1 Autonomous Operational Service Provision Units

In the organization, there are one or several operational units (hereinafter: service units SUs) **that…**	
1.1	... have **sole** (i.e. exclusive) **responsibility for logically definable market areas** (e.g. by customers or products or geographical areas, etc.). If there is only one market area, the **interface to the market is clearly defined** (e.g. sales *or* production *or* project management)**.**
1.2	...are **competent, able** and **flexible** to **serve their market areas comprehensively** (in conjunction with third parties, where necessary).

4.6.3.5 System 2

System 2 co-ordinates the activities and resource use of system 1 units to avoid friction and efficiency loss. It observes normal performance of systems 1 and reports major deviations to system 3.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 13 Questionnaire System 2

2 Coordination Inputs

To **prevent friction losses** and **inefficiencies** between SUs, **there are** effective **coordination functions** (for mutual approval, to determine responsibilities, boundaries, allocation, regulation, codes of behaviour, criteria for decision making, etc.), in relation to...	
2.1	...internal and external **activities of SUs** (e.g. sales areas, schedules, communication, methods, standards, policies, exchange of information, etc.).
2.2	...**resources** that are **jointly used** by the SUs, i.e. **shared resources** (e.g. reservations of systems, devices, spaces, funds, capacities, etc.).

2 Coordination Outputs

By **constant performance monitoring,** the **normal parameters** of the organization (actual and target control parameters, completion of tasks, quality, quantities, etc.) are …	
2.3	...**monitored** on an **on-going basis** and deviations were identified.
2.4	**Significant deviations** always **trigger regulatory measures** or, where necessary, **adjustments to the system**.

4.6.3.6 System 3

System 3 is the connecting system between the meta-system (5-4-3) and operations (1, 2). It implements the purpose of the overall system by resource allocation and goal setting with system 1. Information from system 2 on normal performance and from system 3* about exceptions and background information supplements the official vertical information channel and

allows system 3 to generate and maintain synergies, optimize operations and assure overall performance. As part of the 3-4 homeostat, it represents the inside-and-now perspective, which is interested in stable circumstances and smooth operation. System 3 informs system 4 about internal stability and makes amendment proposals regarding corporate policy. From system 4, it obtains information coming from system 5 (policy) and about external stability (environment). Based on its information sources, system 3 develops plans to streamline operations and intervenes in the interest of the overall system and system coherence with system 1 units if the development in a subsystem questions the viability of the overall system.

System 3* is the audit channel and the source of unbiased and "paradigm-free" information and information about overload or stress situations. Above all, system 3* is able to implement stabilizing measures which cannot be performed by either system 2 or system 3 via the vertical axis.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 14 Questionnaire System 3

3 Operational Management Streamlining

Operational management monitors and **optimises** the **performance** of the organization **as a whole** - including its own - by means of controlling measures, allocation of resources and changes to the parameters **with regard to**…	
3.1	…the **overall performance** (effectiveness, productivity, gains, support services, quality or the like) **constantly** or **frequently** and **systematically** (i.e. following appropriate rules).
3.2	...**opportunities, risks** and **synergies**; these are **always recognized**, **utilized** or respectively **dealt with appropriately.**

3 Operational Management Information

Operational Management (OM) gathers…	
3.3	…internal (i.e. concerning the organization itself) and external (concerning the market and environment) **information for management and decision-making** from a suitable **reporting system on an on-going basis**.
3.4	… repeatedly **information**, **independent from line management**, regarding the **state of the organization** (condition, load, stress, error potential) by means of surprise or random sporadic audits, surveys, direct conversations or analyses. **If necessary**, OM **triggers regulative measures** or **system adjustments**.

4.6.3.7 System 4

System 4 is responsible for the outside-and-then perspective and for the permanent suggestions of plans for the adaptation of the system to changing environmental circumstances, be they potentially beneficial or detrimental. It does so by using information on internal stability from system 3 and an internal representation (model) of the system as a whole to contrast internal facts with external circumstances and derive action alternatives. System 4 implements measures to exert influence on the system environment and, as the other part of the 3-4 homeostat, it struggles with system 3 for the right amount of internal change. This struggle is monitored by system 5 which places it in the overall perspective and takes final decisions, if necessary. System 4 is the intermediary between systems 3 and 5 and has an alarm filter in the algedonic (good/bad messages) loop to avoid overload in system 5.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 15 Questionnaire System 4

4 Environment analysis and planning for the future observation

The **organization's overall environment** (political, environmental, technological, social, legal, sectoral, market, etc.) is **constantly** or **frequently** …	
4.1	…monitored with regard to the **qualities** (properties) and **developments** that are **relevant or potentially relevant** to the organization.
4.2	This is done with an eye on the **current situation**, possible **scenarios** and **future developments** (future circumstances and dynamism).

4 Environment analysis and planning for the future courses of action

Those tasked with **Environment analysis and planning for the future** (e.g. observation of distribution and procurement markets, R&D, organizational development, trend analysis, monitoring of technology and regulation, market research, customer panels, financial market, media and sectoral research)…	
4.3	...**combine information from the environment**, from **their organization** and from **corporate policy** (self-image, target state, parameters, freedom of action), recognize **opportunities and risks** and from these **develop timely scenarios** and **courses of action** (plans).
4.4	...frequently **initiate** necessary - if need be - **controversial adjustment discussions** with the exponents of **Operational Management** and of the **Normative Management**, with it **contributing to the** further **development** of the **organization**.

4.6.3.8 System 5

System 5 is the closure system of a viable system, so to speak the beginning and the end of the control process. On the one hand, it defines and disseminates the intended purpose of the system, formulates the overall objectives, values and develops and maintains the identity of the system. In the sense of a pilot control, it declares the preferred state of the system to align endeavours. As the last instance of a particular level of recursion, it provides closure in the sense that system 5 is able to absorb residual variety (complexity coming from the lower levels) and take final decisions. However, it is isolated insofar as the algedonic loop and system 4, via the central axis, provide the necessary information. System 5, on the basis of this information, influences the system via the central axis and the 3-4 homeostat.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 16 Questionnaire System 5

5 Purpose, Identity and Normative Management

Normative Management ensures…	
5.1	…availability of binding **guidelines** and a **target state definition,** both **informing** the **organization** as a whole (pilot control, identity)
5.2	…that those in charge of **Environment analysis and planning for the future** and **Operational Management** co-operate in a way that yields the **best possible development** of the organization.
5.3	**Normative Management** is **willing and able, when necessary, to take final decisions** (closure of the decision making process) or **decisions that would fundamentally change** the system (change of basic mission and self-conception).

4.6.3.9 Principle of Recursion

According to the principle of recursion viable systems contain viable systems and are contained in viable systems. This principle allows complex structures to be coherently modelled or analysed using the VSM. Although only a structural rule, together with the autonomy principle, it is able to ensure or explain the capacity of systems to stay effective and manageable at the same time, in spite of increasingly complex structures.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 17 Questionnaire Principle Recursion

P	Principles Recursion
P.1	SU's **overarching units** (e.g. company, division, holding company) are **themselves able to act as independent organizations** at their level **with all necessary functions** which can fulfil their remit independently.
P.2	SU's **subordinate units** (e.g. department, area, group) are themselves **able to act independently** at their level **with all necessary functions** and can fulfil their remit independently.

4.6.3.10 Principle of Requisite Variety

Ashby's well-known law of requisite variety states that only variety (i.e. complexity) destroys variety. This means that in order to control a system, the controller must be able to cope with (or have) at least as much complexity as the system is able to exhibit. However, this does not imply that, for example, a user of a computer must be able to assume as many states as his computer. But it does mean that he/she compensates for the variety gradient between him/her and the machine by using variety amplifiers and attenuators (software, interfaces). In business terms, this means balancing variety between the organization and the environment (for example, by using product lines or terms and conditions), between the customer and the salesman (using knowledge and sales techniques), the project and the project-manager (using planning or technology), etc.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 18 Questionnaire Principle Requisite Variety

P	Principles Repertoire
The **ability to react** (i.e. the capability to react in a timely, appropriate and formally correct manner), **scope of action** (the set of suitable behaviours) and the **range of offerings** (available solutions to a problem) of the organization or the management **are always sufficient** to...	
P.3	...**master expected** internal (organization) or external (environment, customer, competitor, stakeholder) **issues** or **challenges,** if need be with the aid of **third party services**.
P.4	...**master** even **unexpected** internal or external **issues** or **challenges**, if need be with the aid of **third party services.**

4.6.3.11 Principle of Information Flow

In order to survive, systems must adapt to their environment. Adaptation implies perception and control. Control implies a vector (to give adaptive action a direction). A vector is a piece of information. So a necessary condition for the control of a system is a flow of (meaningful) information at least at the frequency of necessary adaptations. Even when the controller sits near the "adaptor", the controller itself needs information in order to perform a meaningful job. In viable systems, it has to be guaranteed that a stream of information be transmitted to the places where control has to be exerted.

In business terms, this simply implies that no task can be fulfilled unless reliable and efficient communication channels are provided.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 19 Questionnaire Principle Information Flow

P	Principles Communication
P.5	All units of the organization are **networked at all times by efficient** (sufficient capacity) **communications channels** or **processes** or intermediaries ("official channels", willingness to interact, telecoms). These channels are **neutral**; **i.e. communication**, **contents** and **co-operation are neither disrupted nor distorted** by the transmission process over these channels.

4.6.3.12 Viability

In this research project, viability serves as the antithesis of organizational crisis: the absence of one implies the presence of the other. Organizational crisis has to be operationalized in order to test its statistical relationship with system viability. On the one hand, this is done ex negativo i.e. by assessing the opposite of organizational crisis, which is viability in the (general language) meaning of ability to survive sustainably.

On the other hand, a positive definition is used to operationalize organizational crisis, which implies asking respondents directly about crisis indications (see next section).

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 20 Questionnaire Viability

The organization assessed…	
V.1	…- at *the assessed point in time* - in terms of its **degree of vulnerability** (i.e. risk level) can be accurately **characterized as**…

The answering field for V.1 is a semantic differential scale starting from 1 “perishing” to 7 “thriving” (see the questionnaire in the appendix).

V.2	……- at *the assessed point in time* - is **in a position to adapt** to even **rapidly occurring** and/or **very changeable circumstances.**
V.3	...is…- at *the assessed point in time* - fundamentally in a position to **maintain its existence** for an **unlimited period of time.**

4.6.3.13 Crisis Independence

The most frequent definition of organizational crisis refers to an existential threat, which is exerted on the organization as a whole. Also a very frequent crisis characteristic is the notion of uncertainty of cause, (imminent) effect and means of resolution. Besides that, the concept of self-preservation is often used to assess viability “by its own means”, meaning that viability is not compatible with survival at the cost of others. Finally, the ultimate indicator for crisis is the (involuntary) demise of an entity.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 21 Questionnaire Crisis Independence

There were or are…	
K.1	...**periods** where the organization’s **existence** was/is **under threat** and the **outcome** was/is **in doubt** (≥ 50% collapse : ≤ 50% survival).
K.2	...situations or developments that the organization **would not have survived without external help** (of third parties).
K.3	Did the organization **cease to exist as an independent unit**?

4.6.3.14 Crisis Capability

Besides the ontological perspective, organizational crisis can be diagnosed on the basis of an organization's capabilities. Inability to fulfil the fundamental duties, such as their core mission or their financial obligations, are clear indications for critical circumstances which, unless counteracted, inevitably lead to an existential threat and demise. The latter occurs when a massive overload situation (basically a lack of requisite variety) causes a loss of control. This may happen when, for example, perturbations combine and / or their frequency is higher than the relaxing time of the system. In such cases, building-up effects may quickly render an organization uncontrollable.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 22 Questionnaire Crisis Capability

K	**Crisis Capability**
There were or are situations or periods where, for an uncomfortably long period, the organization was/is…	
K.4	…**unable to fulfil** its **core mandate** (purpose).
K.5	…**unable to meet** its **financial obligations.**
K.6	There were/are **periods** where the **demands** faced by the organization **massively exceed(ed)** its **capabilities**, resulting in it **spinning out of control** or **the leadership** of the organization **losing control.**

4.6.3.15 Crisis Type

The nature of crisis development allows conclusions about the type of crisis. Sudden crises may in fact be slowly developing crises which were only triggered suddenly, but not caused suddenly, as with accidents, disasters or force majeure. The question acts basically as a filter for crisis types.

These attributes and circumstances have been translated into a generalized and idealized situation vignette, the content of which can be compared to the reality of the assessed organization.

Table 23 Questionnaire Crisis Type

K	Crisis Type
In the case of a Crisis Organization (otherwise leave the fields empty): **The crisis…**	
K.7	…situation **develops/developed slowly, continuously, insidiously**.
K.8	…situation was **triggered** (**not** caused) by a **particular key event**.
K.9	**What** was this **key event?** (Please insert descriptive key word(s)).

4.6.4 Crisis Occurrence Indicator

The ultimate comparison in the statistical analysis of this work to answer the research question is the one between the constructs system viability and crisis occurrence. This ultimate regression analysis (done simultaneously in SmartPLS) occurs between the composite indicator for viability, which consists of all lower level VSM components, and the one for crisis occurrence which is composed of the above crisis indicators (see 4.6.3.12 - 4.6.3.15).

In the progress of the analysis, it turned out that some indicators do not add value to the analysis, so ultimately a reduced set of indicators was used to calculate the final results. In the case of the crisis indicator, the inverse value of viability indicators, V.1 – V.3, were used, as well as the values of crisis indicators, K.1, K.2 and K.6. For every latent construct – such as for example crisis occurrence – SmartPLS calculates its own indicator values out of its constituting indicators (V.1 – K.6), with it creating a new data set which then can be used for further statistical analysis.

For an overview of all indicators and their interrelationship, see Figure 39, and for the explanation of the used abbreviations, see Table 27.

4.7 Respondents

4.7.1 Management Teams

Key-informant-bias is a recurrent topic in management research and is of relevance for this thesis. It addresses reliability issues with survey data collected from executive level respondents. Hurrle and Kieser (2005, p. 584) state that it is necessary to observe precaution when applying key informant

interviews. Besides the difficulties of this respondent group to understand the strange abstractness of academic concepts, it is (ibidem) p. 589 their personal involvement, their motives as well as self-serving bias which can distort the reliability of their statements.

Organizational crisis (OC) in this dissertation is defined as an involuntary and dangerous state of an organization, in which its existence is threatened. Not surprisingly, management teams and executives, which are primarily – and personally – responsible for OC often deny the presence of OC as long as they can, and this denial is followed by anger, depression and eventual acceptance, as Mitroff, Shrivastava, and Udwadia (1987, p. 291) highlight.

Non-avoidance of OC as well as failure to stop OC escalation is experienced by stakeholders and management teams and provides strong and embarrassing evidence suggesting that an organization is unable to manage its affairs. This fact makes management teams of OC organizations heavily biased, not only during the event but also years after, even if the organization survived the OC. Any collection of data with such management teams on the grounds and circumstances of OC would also be biased. In addition, it is very often the case that, during or after an OC, new management teams were installed. In their construction of the past, it is difficult to distinguish results of objective analysis from information which stems from the “plausible narrative”, which is necessary to close ranks (stakeholders) and collect the troops (employees) to overcome OC during crisis management: With time, the colour of their communication has dyed their factual knowledge. This makes data collection with such personally involved respondents about the state of the organization before the event unsafe or in some cases even futile.

In the pilot surveys, when respondents had to assess the control functions of a crisis organization, it could also be observed, that personally involved respondents tend to brighten the assessment.

A good example concerns the respondent who assessed an organization that had experienced a heavy OC. His scores were rather low with sys-

tems 1 to 3 but high with 4 and especially with system 5. This was surprising, as other respondents rating the same firm came to a different conclusion for systems 4 and 5. It turned out that the respondent in question was a board member (system 5 in interaction with 4) of this firm and thus had to rate his/her own work with this organization. Personal bias had distorted the results.

The implications of personal bias were in stark conflict with the fact that management teams are very knowledgeable about characteristics of crisis organizations. But even when management teams may have the best informational prerequisites to assess crisis organizations, the probability of a biased assessment and the effect of such bias on the results of the study are both large and at the same time uncontrollable. This circumstance disqualifies personally involved management teams as data sources for this study.

4.7.2 Independent Third Parties

The fact that management teams did not qualify as respondents for this study meant that equally or comparably apt candidates with good knowledge about the organisation for an evaluation of the control functions were needed. Regular employees have insights into organizational detail that are comparable to, or even deeper than, what members of management have. However, often employees are knowledgeable only in a limited area of an organization instead of the organization as a whole. Moreover, the probability of being biased is as large with employees as it is with managers. This means that individual employees did not qualify as sufficiently reliable data sources either, whereas groups of employees could not be asked.

This is not to say that managers and employees are unreliable per se, but as OC is the ultimate and worst problem an organization can experience, denial is a natural and understandable behaviour, albeit completely unhelpful.

After managers and employees, bankers, fiduciaries and management consultants have the most expert knowledge about the organization. They interact frequently with management teams and chief employees, are well-

informed, educated and independent of the organization (especially in case of such an anonymous survey). This group of experts, in general, has a professional and critical attitude towards customer-organizations, is used to assess structures and (control) functions, is accessible for data collection and available in sufficiently large number to cover a sufficiently large number of both crisis and non-crisis cases. However, the opportunity costs of time of this group of experts are very high and their availability is usually very limited.

4.7.2.1 Bankers as Respondents

Commercial bankers are the typical interface between the organization and the bank during normal operation of the organization. Often they accompany specific organization for many years. They have to be knowledgeable about the organization well beyond financial figures. To accomplish this, interviews take place with the CEO and the CFO often together with the bank's credit officer (see below). Intermediate and annual reports, special occurrences or issues are discussed and the site is visited. Decision making power for new credits or changes in contractual terms is strictly divided between the customer advisor of the bank and the credit officer (checks and balances). The customer advisor of the bank has to convince the credit officer of the proper circumstances and the advantageousness of a proposed deal. This ensures high familiarity with the organization and the circumstances of the credit transaction. A comprehensive qualitative (markets, management, people, business model, target group situation) and quantitative (financials, key figures and performance indicators) credit rating assessment scheme (different from bank to bank) is performed for new business or new credits given to existing businesses.

Recovery and special financing bankers are a second group of bankers which assessed crisis and non-crisis organizations. This group of bankers is deeply knowledgeable about the assessed organizations because the financial position (i.e. credits outstanding) of the banks is at substantial risk and, apart from the often weak collateral, only an in-depth knowledge about the organization, it's assets, the management and mastery of the business process allows the interests of the bank to be protected. Recovery

bankers and special financing bankers are very close to an organization, its management and its markets in order to recognize risks and opportunities at an early stage. The downside of this expert group lies in its availability. They run several high risk cases at the same time, each requiring high attention and prudent steering impulses. Interventions or even only statements of these experts have to consider both the interests of the company and the one of the bank at the same time without running the risk of factual organ liability on the part of the bank or the irritation of vital business partners. Accordingly, these experts invest large amounts of personal time in the management and settlement of such financial positions and are not keen to fill in questionnaires or give interviews - unless they anticipate a tangible contribution to their field.

4.7.2.2 Consultants as Respondents

Consultants are the second large group of assessors of the 135 crisis and non-crisis cases. They are, for instance, called in to help businesses achieve a turnaround in OC cases, which often takes years to achieve, or appointed to support and accompany the further development (new business, new markets, new systems, new processes, etc.) of successful organizations. This group of experts, not seldom has an even better understanding of the organization than the executives of these firms have.

Consultants, however, also have high opportunity costs of time; their activities for organizations often oscillate between short but intense phases of support (e.g. during financing talks with banks or negotiations with business partners) and rather extensive accompanying of a client's normal activities. Compared to recovery bankers, business consultants are a somewhat easier to access for research data collection but they are still a group of very busy professionals, who carefully use their limited time resources.

4.7.2.3 Implications of Using Bankers and Consultants as Respondents

How can busy bankers and consultants be convinced to invest one entire working week in filling in 135 questionnaires about the cybernetic characteristics of organizations? To get access to the rich generic as well as entity-

specific organizational knowledge and experience of these two expert groups and harness this knowledge for research purposes, it was necessary to spark their interest and demonstrate the practical benefit of such an endeavour. This was done by relating the research question (in short: understanding and predicting viability and OC) with their work (avoiding or settling OC and ensuring or restoring viability). It turned out that – despite being very sophisticated in many respects – most ranking systems of the banks have little sensitivity for holistic / systemic characteristics of organizations. The prospects of a viability or OC "sensor" intrigued many bankers.

To accomplish this information task, dozens of talks and meetings took place, presentations given and mail-outs performed to brief bankers, consultants and their superiors, research departments and legal services. The major part of commercial banks (not branches, headquarters only) in the German speaking part of Switzerland were contacted; 22 highly skilled respondents of 13 banks, 2 consultancies and 1 fiduciary eventually took part in the survey.

Summing up, the questionnaire of this study was developed with utmost diligence. The survey was conducted with great care. The knowledge, competence and experience of the respondents was very large. Together with the largest sample size to date for such a quantitative study on systems viability and OC, the data set of this study is scientifically both valuable and unique.

With a view to the statements above, two questions arise: firstly, whether an assessment of the control structures of organizations made by bankers or consultants would distort the validity of the sample; and secondly, whether the aforesaid way of "acquiring" respondents would yield a valid sample.

It could be argued that an intense interaction between organizations and consultants or bankers is already sufficient to suggest pathological characteristics with these organizations and, therefore, a biased sample. This concern can be dismissed, because, firstly, consultants and bankers have both kind of customers, i.e. successful or "healthy" ones as well as unsuc-

cessful or “ailing” ones. Secondly, the sample of this study is not representative in terms of the structure of the population of organization, but rather consists of two distinct groups, namely, crisis and non-crisis organisations. Fourthly, control variables about the organizations in the sample allow an assessment of their kind; it turned out that the sample is very diverse (see 5.3.3).

To make sure the case-specific knowledge of consultant, banker and fiduciary respondents is sufficiently high to evaluate the organization, a control variable was introduced, according to which a respondent had to reach at least 5 out of 6 points with regard to knowledge about the case. The 6 point scale is very familiar in Switzerland; it corresponds to the grading system in schools and universities. The highest (and rarely achieved) grade of 6 means “very good”, whereas a grade of 5 stands for “good”; the average in the sample was 5.36, which corresponds to a high standard.

The chosen approach for respondent identification was neither purely random sampling nor convenience sampling (see 7.3.3.) However, a large proportion of the population of banks in the German speaking part of Switzerland within the control variable restrictions had the chance to be part of the sample, providing a very good approximation of the real situation in the population.

4.7.3 Assessments by the Respondents

4.7.3.1 Information Sources

The following figure summarizes the process as to how and from which sources the data about the organizations in the sample was gathered, which was later on used for quantitative statistics. It shows how VSM knowledge and knowledge about the assessed organizations was combined by means of the questionnaire:

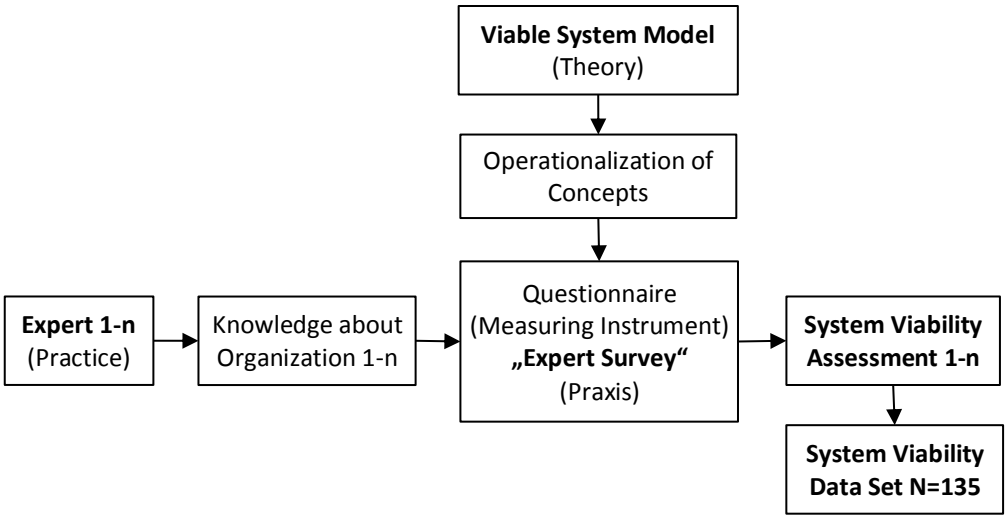

Figure 27 Information Sourcing Process

In the so called “Expert Survey”[26] conducted for this study, several respondents from different origins brought in their knowledge about organizations. Experts are considered experts, firstly, because they are highly knowledgeable about the organization they assess, secondly, because they are neutral, i. e. have no interest in glossing over or blackening the assessment and, thirdly, because they are largely unbiased, since they have no stake in the organizations. The experts were not knowledgeable about the Viable System Model and thus they did not (consciously) perform a cybernetic analysis (in fact only two of twenty-two experts have mentioned that they knew

[26] The designation “Expert Survey”– besides the fact that respondents are legitimate experts for the assessed organizations - was in part chosen for respondent-acquisition reasons. Respondents prefer to give expert statements rather than just doing surveys – which increases the response rate.

the model before the survey). What they actually did was reproduce their knowledge about organizations they knew thoroughly answered questions about functional traits based on cybernetic principles.

The assessments thus combine knowledge from different sources to gather the data needed for the statistical analysis: firstly, knowledge of the individual expert about the organization and, secondly, knowledge from VSM theory encoded in the questionnaire to structure the information about the organization. The latter has been translated into a language that can be understood by the respondents. This allowed a cybernetic assessment to be performed without cybernetic language and without respondents familiar with cybernetics. The result is a data set about the system viability of a sample of organizations.

4.7.3.2 Expert Assessments and Confirmation Bias

Respondents were informed by the author about the dissertation project, in general, and also about the research question. With regard to the survey, respondents were asked to read and follow the introductory instructions and guidelines exactly. They were then asked to select organizations "*which did clearly undergo an existential organizational crisis*" (group 1) or "*which did clearly not undergo an existential organizational crisis*" (group 2) from their portfolio of cases, as formulated in the questionnaire on page two (see appendix).

Does this selection produce a confirmation bias i. e. the tendency to recall and interpret information which confirms preconceptions when assessing the organizations using the questionnaire?

The arguments speak against this view or suggest even the opposite:

- The experts (bankers, consultants, fiduciaries) declared their professional interest in the results of the study. A valid viability measurement and OC prediction tool would add value for these professions. Accordingly, they engaged in an evaluation as objectively as possible.

- Outlier data with inverse score / outcome relationships (high system viability scores with OC and vice-versa) could be observed (see 5.4.6 and Figure 37) and have been kept within the data set.
- Professional bankers and consultants are used to critically assess organizations; bias in their assessment causes expensive mis-judgements and would quickly distort an expert's credibility.
- The data shows a differentiated scoring picture with each individual organization. Item batteries concerning one function of an organization show low scores, whereas others of the same organization indicate high scores. Accordingly, a stereotype assessment is unlikely.
- The score distribution with crisis cases shows two peaks, one with favourable scores and one with unfavourable scores (see 5.4.1 and Figure 33), which indicates differentiated instead of monotonous assessments.
- The initial classification of the respondents in OC or non-OC was only a first indicator and was not used later in the analysis. The actual OC score was based on nine variables raised in the questionnaire (sections V and C of the questionnaire in the appendix).

In summary, it can be argued that confirmation bias is unlikely.

The respondents assessed a variety of organizations encompassing very large as well as mid-sized entities. To ensure a constant focus in the assessments, respondents had to declare whether they assessed whole organizations, such as entire companies or administrative bodies (n = 126), or sub-entities (n = 9) of such organizations and name these entities. The guidelines were very explicit about this focus; respondents were requested to maintain the chosen focus throughout the assessment. In so doing, the coherence of the analysis and the resulting data could be ensured. Coherence in the above sense means, that all elements of the assessment clearly relate to the same pre-specified system in focus, with it ensuring the closed nature of the analysis.

5 RESULTS

5.1 Chapter Introduction

This chapter reports the results of the quantitative survey. Starting with the nature and quality of the data gathered, demographical details of the sample and information on important control variables are provided. The section “Bivariate Statistics” offers basic figures on the observed item scores and a preview of the relationship between the two main variables system viability and crisis occurrence. In the subsequent section “Multivariate Statistics” the structural equation model is described in detail followed by a description of the resulting path model. The chapter closes with the evaluation of the statistical model and the testing of the hypotheses of the study.

5.2 Data

Data collection for this research project was conducted between December 2014 (preparation) and April 2015. Respondents were addressed personally or by electronic mail and telephone by the author. They were asked to assess one or several organizations using the questionnaire (see 4.5). Questionnaires were titled expert consultation with reference to the expertise of the respondents regarding the assessed organizations. The survey was conducted in the German language. One group of respondents (16 persons) was chosen based on an internet research process to identify recovery or special financing officers and commercial bankers of Swiss banks. Another group (5 persons) was directly and personally addressed among (ex-) consultants of the author’s employing firm. A (1) fiduciary was addressed during a co-operation opportunity.

The incoming raw data has been entered into an excel spread sheet, double checked and reviewed for plausibility, and validated for use in the statistical analysis. All data was valid and usable.

5.2.1 Missing Values

The sample (n = 135) has 35 independent variables and, accordingly, 4725 data points. A total of 35 values were missing in 20 cases (0.74%). Hair et al. (2014, p. 51) recommend mean value replacement of missing data when less than 5 % of the data is missing per indicator. In the sample, the only variable that surpassed this threshold with 5.9 % (8 values) was P.1 UpRec (recursion upwards). All other variables showed less than 5 % missing data, the largest exhibiting 2.2% (3 values) and 1.5 % (2 values), respectively.

All missing data was replaced using an imputation approach on the basis of four mean values; the case mean, the variable mean, the item battery mean and the respondent mean. Every missing value was assessed individually and replaced by the most appropriate value. Because the measurement model in this study is reflective (see Figure 34) and each item battery is a collection of thematically related indicators, the item battery mean was prioritized followed by the case mean. This approach best considered the situational circumstances of the case without decreasing the variability in the data too much by using a variable mean only. Variable P.1 later on was removed for reasons to be described later in this text.

5.3 Data Analysis

5.3.1 General

Respondents (see 4.7.2) – called “experts”, in part, due to their sound knowledge about the cases (the organizations under assessment) – were asked to evaluate crisis or non-crisis cases (or both), depending on their personal portfolio of cases. As reported earlier, the resulting collection of cases yielded a data sample of n = 135; each of the 135 cases corresponding to one expert assessment, including 53 data points, where for each of which 18 were control and 35 independent variables.

The 135 cases were assessed by 22 respondents from 16 organizations (13 banks, 2 consultancies, 1 fiduciary) of the German speaking part of Switzerland, assessing an average of 6.1 cases per assessor. Fifteen assessors are either from recovery or commercial banking (68.2 %, blue columns in the following graph), six from business consulting (27.3%, red) and one from a fiduciary company (4.5%, green).

Assessor o (see Figure 28) is a partner of a consultancy with a pronounced specialization in business consulting; according to this intense focus and high volume of his professional activities this respondent was able to provide twenty-three assessments. Assessor l is a senior banker of a very large Swiss bank in the area of special finance (distressed capital, recovery and workout). These special finance units have to be extremely close to the customer in order to manage their financial positions successfully. This involves intense communication exchange, site visits and a profound insight into the organization. This respondent too has a large portfolio of cases and accordingly was able to contribute nineteen cases with which he is very familiar. Assessor f is a senior project manager with a consultancy whose portfolio consists of restructuring mandates, merger & acquisition cases and business analysis; as a management coach and turnaround manager, this respondent can draw on a large collection of cases and hence contributed thirteen cases of which he has an in-depth knowledge. The remaining assessors contributed between one and ten cases each. Most of these assessors are either from regular corporate or recovery banking. Due to the increased level of knowledge which was asked in this study to perform an assessment, the majority of these respondents provided only some assessments each.

The average time that assessors took to fill in a questionnaire was 15.7 minutes with a minimum of 5 and a maximum of 40 minutes. The average knowledge of the experts about the assessed organization on a scale from 1 to 6 was 5.36 as reported earlier; a minimum of 5 out of 6 was mandatory to qualify for a valid assessment of an organization.

All 135 assessments took place between January 2015 and April 2015 in the German speaking part of Switzerland. To minimize memory and hind-

sight bias, the maximum elapsed time since the assessed organization showed the indicated characteristics was limited to 4 years. The actual average was 2.29 years with a minimum of zero years (time of assessment equals assessed point in time) and a maximum of 4.5 years (in a flexible interpretation of the allowed deviation of +/- 10 %).

The point in time at which the assessed organizations exhibited the indicated characteristics had necessarily to be in the year *before* the organizational crisis broke out or earlier. For non-crisis organizations, there was no such limit, i.e. such firms may still show the respective characteristics.

The graph below indicates the number of cases (y-axis) each assessor (indicated by the lower case letters “a” to “v” on the x-axis) provided.

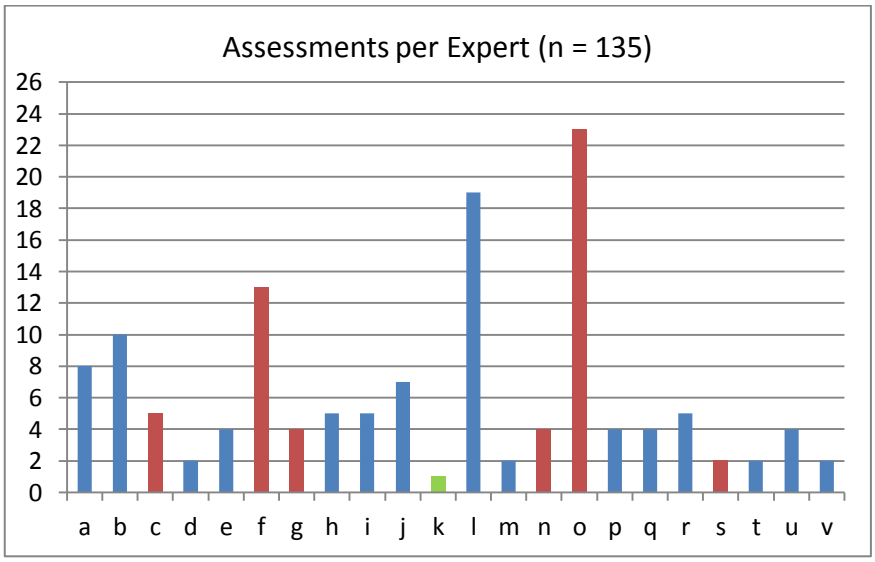

Figure 28 Assessments per Expert

Above graph: Assessors c, f, g, n, o and s business consultants; k fiduciary; remaining recovery or commercial bankers.

5.3.2 Sample Size

With 135 cases, the initial conservative sample size requirement was exceeded. It had been based on the need for analysis of two groups and six VSM-systems, totalling 120 (2 x 6 x 10). The actual sample size requirements of the final model with only one group according to the rule of thumb

(10 times the largest number of structural paths directed at a particular construct in the structural model; Hair et al. (2014, p. 20) amounted to a minimum of only 30 cases.

The more differentiated rule of thumb (ibidem) is also met: all outer loadings of the indicators are above 0.7, with a minimum of 0.778 and a maximum of 0.961. Thus, both rules suggest sufficient statistical power for the analysis.

5.3.3 Demographic Details

5.3.3.1 Crisis and Non-crisis Cases

The respondents assessed 74 crisis (54.8 %) and 61 non-crisis organizations (45.2 %), adding up to the total of 135 cases. The respective preliminary categorization was done by the respondents themselves. For the statistical analysis, the severity and extent of crisis were considered by additional more differentiated crisis and viability indicators. It turned out that the original respondent's categorization strongly correlates (r = 0.8567) with the final crisis construct.

5.3.3.2 Age and Size of Assessed Organizations

Corresponding to the research goal of a general and universal statement about the relationship between the viability of organizations and the occurrence of crises, the 135 cases or organizations represent a broad spectrum of organizational age and size. For all requirements, a deviation of +/- 10 % was allowed.

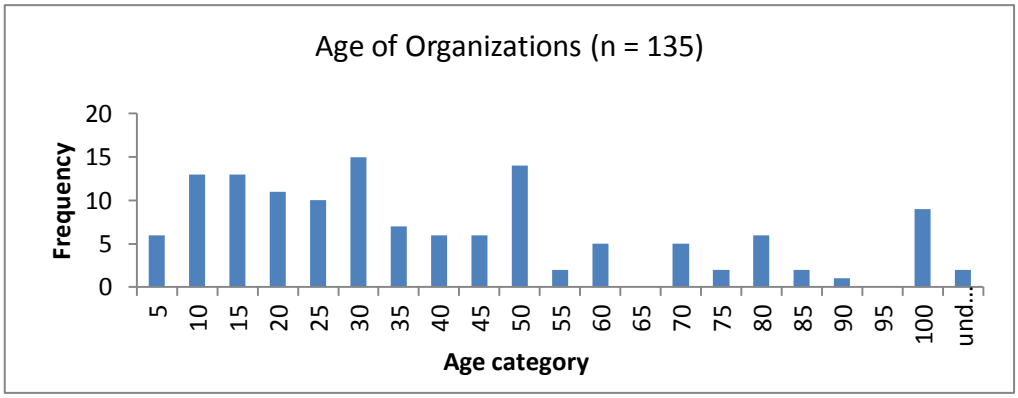

Figure 29 Age of Assessed Organizations

A minimum organization age of five years was required to ensure established consolidated and differentiated organizational structures (the mean organization age in the sample was 39.8 years, median 30 years, minimum 5, maximum 150 years). The term “und größer” in the graph means “and above”.

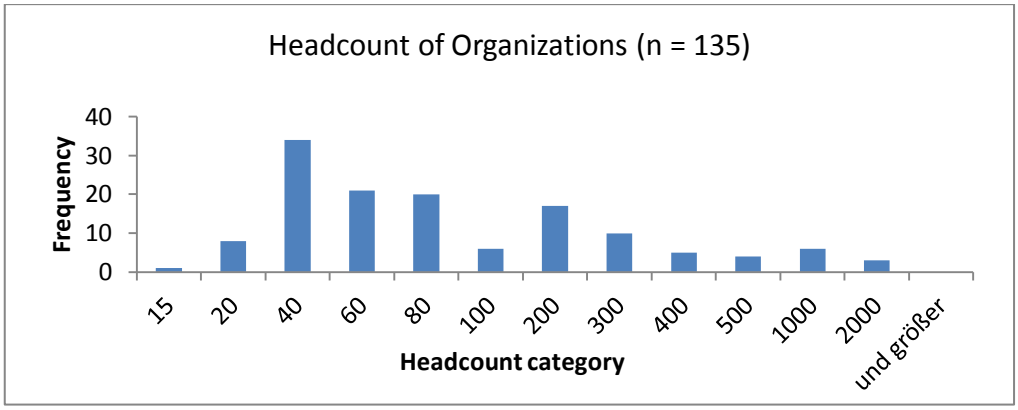

Figure 30 Headcount of Assessed Organizations

The mean headcount in the sample is 175.8 full time equivalents (FTE), median 70 FTE, maximum size 2000 FTE. With large organizations, substructures such as departments have been assessed. The term “und größer” in the graph means “and above”. A minimum size of 20 FTE was required to facilitate the assessments and ensure meaningful statements. This took place with regard to the VSM, which already differentiates between six subsystems or functions as well as building on the experiences of Crisan Tran (2006, p. 160), who to the knowledge of the author was the first to oper-

ationalize the VSM for a quantitative analysis. In the concluding remarks of her dissertation on the viability of start-up companies, she established that the importance of structures for young organizations may be subordinate to their viability because such firms are very clear and transparent in terms of structure. This assumption contradicts VSM theory; to the author, it seems more likely that measurement issues made the analysis difficult. Measuring (in the present case) 18 control functions and 4 principles in a, for example, 3 person organization can become a demanding research task.

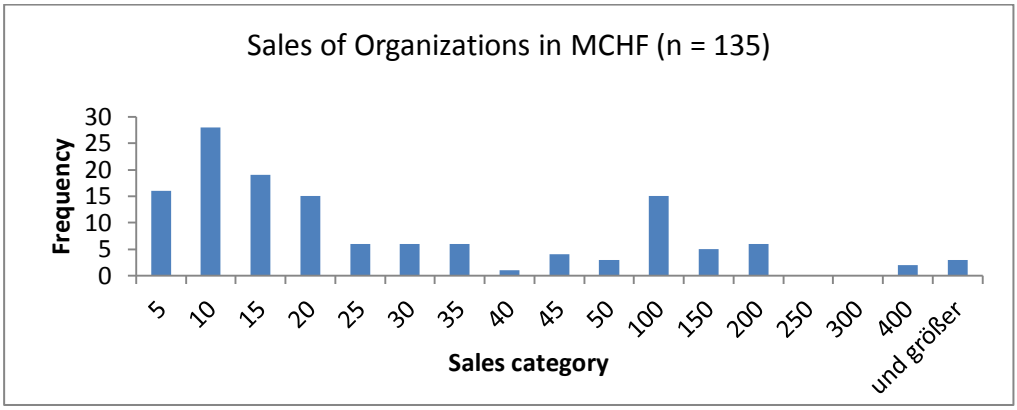

Figure 31 Sales of Assessed Organizations

Also in terms of business volume, the sample shows a broad spectrum of organizations. No sales volume requirements were formulated in the first place as these, together with minimum headcount requirements, would de facto have resulted in a per capita sales prescription and hence in a qualitative ratio for small firms. The mean sales volume in the sample is 56.1 million Swiss francs (MCHF), median 19 MCHF, minimum 1, and maximum 900 MCHF. At the time of writing (May 2015), 1 Swiss franc was worth £0.69 or €0.96 or US$1.09.

5.3.3.3 Sectoral Belonging

With regard to sectoral origin, 53 organizations or 39.3 % in the sample stem from the producing industry, 78 or 57.8 % from service industry and 4 or 3 % belong to the governmental or non-profit sector.

5.3.3.4 Management Qualification and Crisis Prevalence

Respondents had to determine whether they considered the qualifications of management of the assessed organizations as being “rather low” or “rather high”.

Table 24 Qualifications of Executives in Assessed Organizations

	Crisis Organizations		Non-Crisis Organizations	
Rather high qualification	30	41%	42	69%
Rather low qualification	44	59%	19	31%
Total	74		61	

Respondents assessed 41 % of executives in crisis organizations as highly qualified and 59 % as lowly qualified (69 % and 31 % with non-crisis organizations respectively). This suggests that the prevalence of lowly qualified executives with crisis firms is about two times as high as with non-crisis firms.

5.3.3.5 Dynamics of the Environment and Crisis Prevalence

Another categorization respondents had to perform concerned the dynamics of the environment of the assessed organizations. With 66 % and 64 % high or 34 % and 36 % low dynamics respectively, the difference between crisis and non-crisis organizations seem negligible. This suggests that crisis occurrence is not a function of the *dynamics* of the environment.

5.3.3.6 Age of Organizations and Crisis Prevalence

The age structure of the sample organizations has already been reported above. When age is compared to crisis occurrence, it can be seen that age is negatively correlated to crisis ($p = -0.15$), suggesting that, with increasing age, the risk of undergoing a crisis diminishes slightly. This – without further analysis – seems plausible as cumulated experience (i.e. requisite variety) as well as cumulated funds can make an organization less vulnerable to the effects of crisis. However, because the sample was chosen on the basis of crisis prevalence, these results may be biased.

5.4 Bivariate Statistics

5.4.1 Sample Distribution

To operationalize the VSM and its principles, 22 idealized control situations have been formulated. To assess the cases, respondents had to decide to what degree the situation of the assessed organizations corresponded to these idealized situations. Respondents could express this degree of correspondence in an eight-point Likert scale, with an additional “don’t know” option. A value of 1 on the Likert-Scale would mean no correspondence, whereas a value of 8 would indicate that the assessed organization fully corresponds with the idealized situation. According to that scoring scheme, organizations exhibiting favourable control situations showed left-skewed distributions (left side of the distribution flatter).

The following two charts depict the distribution of scores for non-crisis and crisis organizations (the categorization follows the initial one of the respondents).

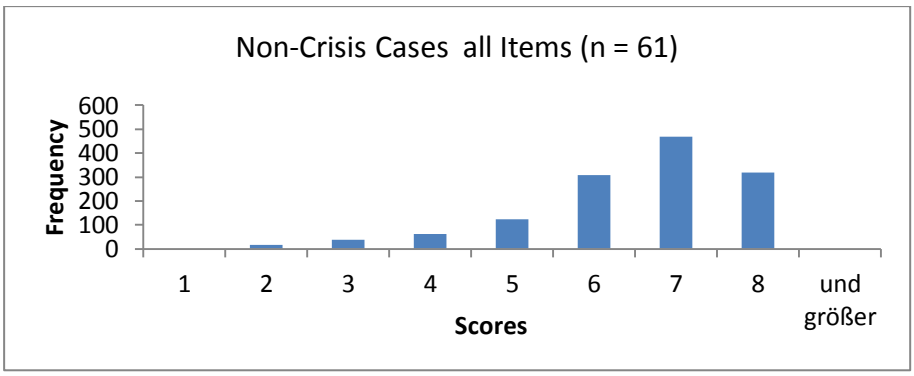

Figure 32 Score Distribution of Non-Crisis Cases

Data distribution of non-crisis cases shows a prevalence of high i.e. favourable scores with a mean score of 6.5. It is noteworthy that with non-crisis firms very few scores (8.9 %) can be observed in the lower half of the scale between 1 and 4.

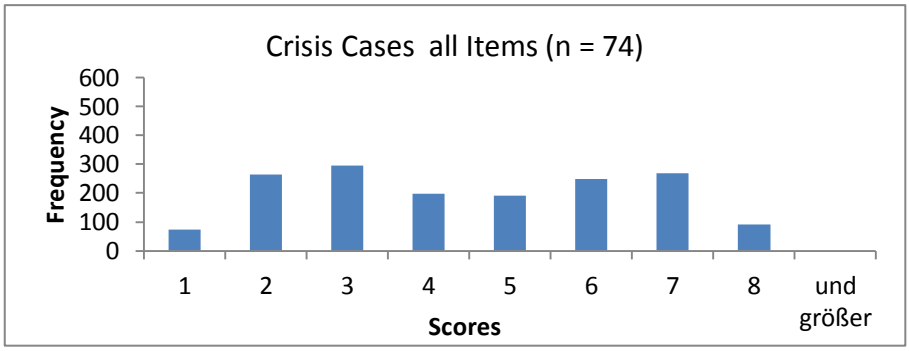

Figure 33 Score Distribution of Crisis Cases

Data distribution of crisis cases shows two peaks. One peak in the upper half of the scale and one in the lower half with an overall mean score of 4.5. 50.4 % of the scores lie between 1 and 4, 49.6 % between 5 and 8.

The overall (crisis *and* non-crisis cases) distribution of the data is left skewed (left side flatter). However, this is of negligible influence on the later statistical analysis as PLS-SEM is a non-parametric approach which does not assume normal distribution of the data.

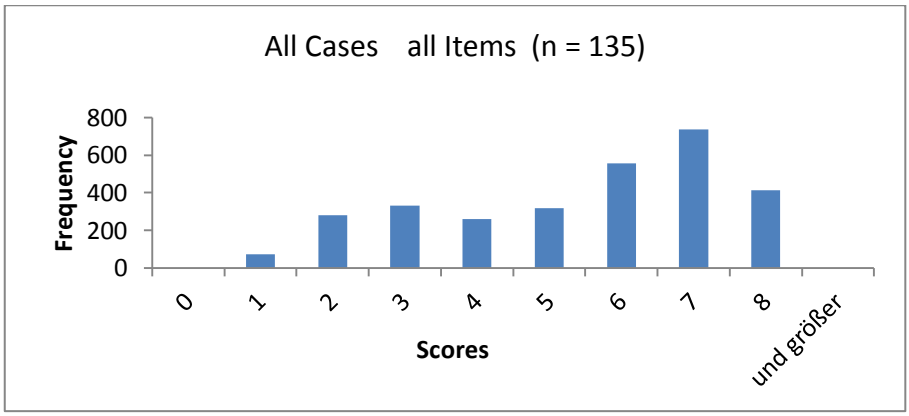

Figure 34 Score Distribution of All Cases

5.4.2 Theoretical Implications

A short theoretical consideration is necessary to interpret the above descriptive statistics on the distribution issue. Beer (1994b, p. 262) substantiates the invariant necessary and sufficient conditions for the viability of organizations which provided the basis of the present survey. Beer (2004, p. 31) finds: "*If all subsystems are vital to viability, then there is no mean-*

ing to 'more important'." [emphasis in original]. Accordingly, the absence of any kind or amount of viability conditions means non-viability, under the constraint of measurement or statistical prediction accuracy.

Theoretically, i.e. in the absence of measurement and interpretation errors, this claim would suggest that if only one VSM criterion was not met by an organization, this organization would not be able to maintain a separate existence and hence, over time, would experience a severe threat to its existence (crisis).

The findings of this preliminary statistical analysis demonstrate that the organizations in the sample apparently correspond fundamentally to Beer's theoretical notion.

Non-crisis organizations show very few deviations from viability conditions, providing high scores throughout the VSM criteria spectrum.

Organizations, on the other hand, before they experienced a crisis, showed major flaws or gaps in their compliance with the VSM conditions.

5.4.3 Score Differences Crisis and Non Crisis Organizations

The following table compares the sample-specific differences between item and construct scores of crisis and non-crisis organizations.

Table 25 Score Differences Crisis / Non-Crisis Organizations

Highest average score deficits of crisis organizations compared to non-crisis organizations in % of the maximum score of 8.			
Items	Items Score Deficit in %	Constructs Score Deficit in %	Constructs
2.4 Active On-going Coordination	32%		
4.4 Adaptation Process Environment	29%		
5.3 Final Decisions On System Change	30%		
P.3 Requisite Variety Expected Challenges	34%	32%	Requisite Variety
P.4 Requisite Variety Unexpected Challenges	31%		
		27%	Communication Channels
Reading examples:			
The average item score of crisis organizations with the item 2.4 is 32 % lower than with non-crisis organizations.			
The average construct score of crisis organizations with the construct Requisite Variety is 32 % lower than with non-crisis organizations.			

The radar graph below shows that besides the above maximum deviations, the scores in the sample are in general markedly lower for crisis organizations than for non-crisis organizations, although with notable local differences.

The black circle in the middle depicts the absolute crisis limit. This limit marks the boundary of 100 % crisis prevalence in the sample. From the score average of 4.18 per item (or 92 points in total) and below, all organizations in the sample without exception experienced an OC.

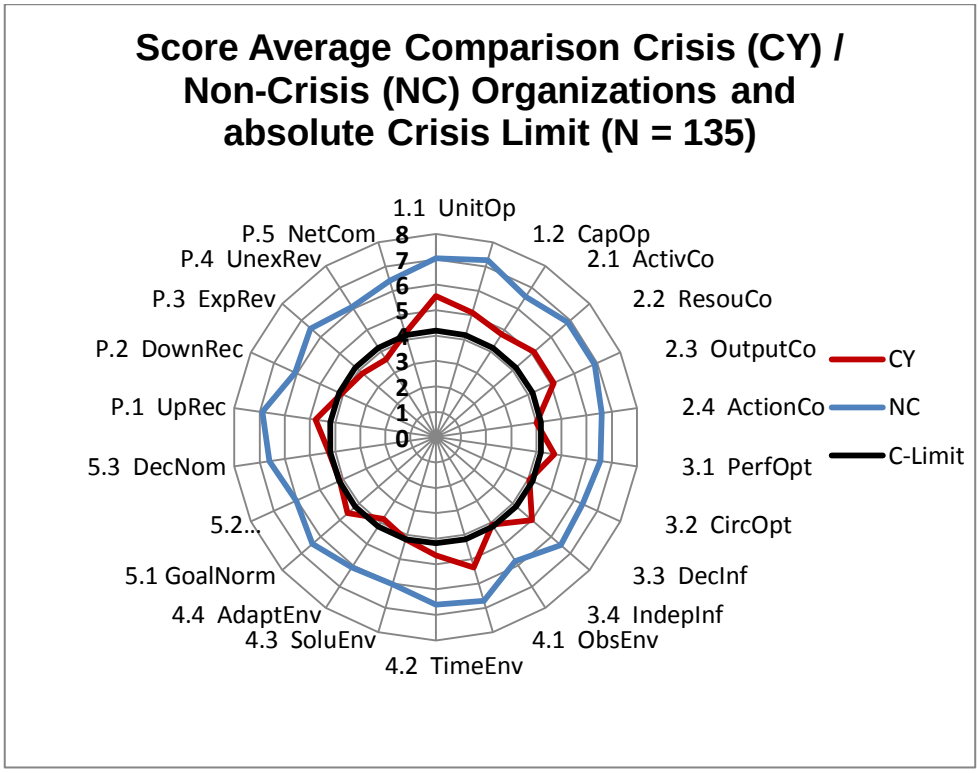

Figure 35 Score Average CY- / NC-Organizations and C-Limit

5.4.4 Results Regarding the Research Question

Based on the 135 data sets, each encompassing 35 independent variables of crisis and non-crisis organizations, and with regard to the research question, it can be concluded:

Non-crisis organizations (n = 61) firms exhibit high scores almost throughout the VSM viability criteria spectrum, with a sample mean of 6.5.

Crisis firms (n = 74) too show high scores but only in just under 50 % of the viability criteria spectrum. They exhibit (each individually different) low unfavourable scores in over 50 % of the spectrum, with a sample mean of 4.5.

The two means are significantly different at a 99 % confidence interval t(128[27]) = -6.83, $p < 0.0001$), with an effect size d = 1.16 ("large", threshold value 0.8, according to Cohen (1992, p. 157). In the context of the research project this means that crisis and non-crisis organizations can in fact be differentiated in terms of their system or organizational viability.

5.4.5 Results Regarding Crisis Analytics

The data set has been analysed for threshold values of total scores (sum of all item scores per case) that would divide the crisis from the non-crisis group. However, it turns out that there is no clearly defined split point but rather a crisis prevalence trajectory depending on system viability.

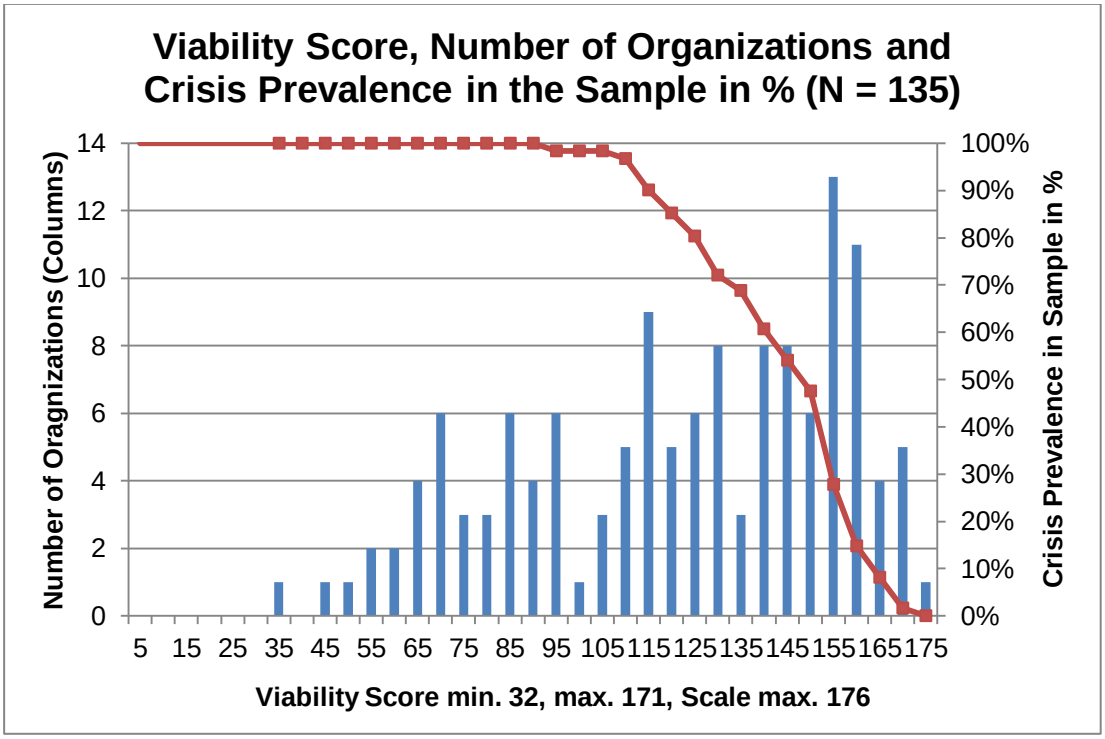

Figure 36 Crisis Prevalence in % Per Category vs. System Viability

[27] degrees of freedom

In Figure 36, the x-axis shows 35 intervals (categories) with five points each, which depicts the universe of possible score sums on the survey measurement scale (22 viability questions, 8 points each, implying a minimum score of 22 and a maximum score of 176). The observed maximum score was 171, i.e. no organization achieved the theoretical maximum, the minimum score amounted to 32 (i.e. no data points below 32 in the sample).

The columns represent the number of organizations that reached a score belonging to the respective category. Accordingly, two or three groups of organizations become apparent with split points at 100 and, less clear, with 135 points.

The graph (red; values on the right, secondary axis) illustrates crisis prevalence as a percentage per system viability score point category. It turns out that, below the threshold of 92 (i.e. an average score of 4.18 points on the eight point Likert scale), crisis prevalence per category is 100 %. This means that all 39 organizations scoring 92 and below, regardless of the particular score combination, experienced an organizational crisis, conversely, no non-crisis organization exhibits scores below 92.

Beyond the score of 95, crisis prevalence diminishes but persists at high values.

The crisis prevalence graph above largely overestimates crisis occurrence rates because the sample consists of 74 crisis and 61 non-crisis cases, suggesting both an absolute (in the sample) and a relative (compared to the population) overrepresentation of these cases. However, particularly because crisis cases prevail in the sample the graph indicates very clearly that high system viability scores drastically diminish the chance of organizations experiencing an organizational crisis.

5.4.6 Outlier Analysis

With reference to the discussion about external shocks as causes for organizational crises and also about the “unlimited funds” (or living death) groups, a number of cases in the sample can be considered as outliers. This

means that these assessments exhibit adverse scores with very high (i.e. favourable) viability scores but at the same time very low (i.e. unfavourable) crisis scores or vice versa.

Both groups have been left in the sample to account for such unusual circumstances. The model is robust enough to integrate these cases. The effect size of system viability on crisis occurrence, with 1.02, is well above the “large” threshold of 0.35, according to Cohen (1992, p. 157). Nonetheless, a short comparison regarding outliers is worthwhile.

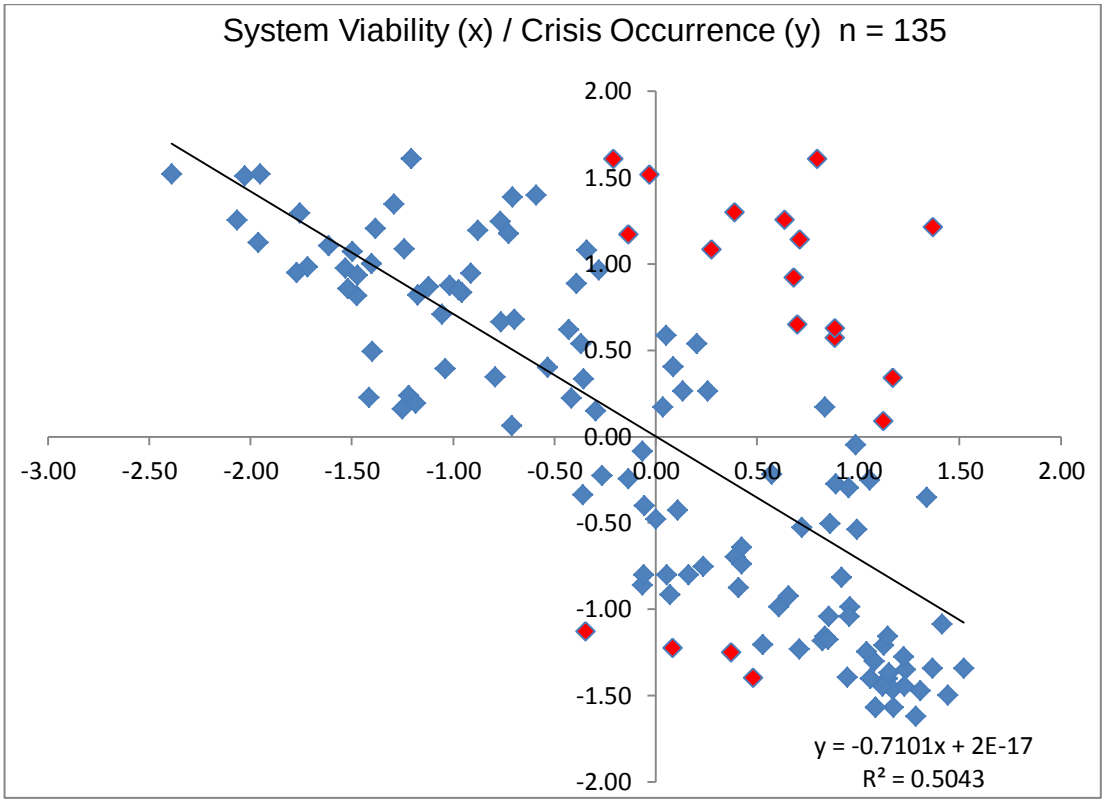

Figure 37 Scatter Plot System Viability / Crisis; Original Sample

Interpretation: The regression coefficient of system viability on crisis occurrence (both latent variable scores of the PLS-SEM) of the original sample with the outliers included has a coefficient of -0.71 (i.e. the higher system viability, the lower crisis occurrence), an R^2 of 0.50 and an effect size of 1.02 as the statistical interpretation of the PLS-SEM will show later. Outliers can be observed with high viability scores and high crisis scores at the same time (quadrant I in the northeast) and with low viability scores and low crisis

scores (quadrant III and IV, in the south), all potential outliers are marked in red.

Adjusted for the above indicated outliers, the same regression model with n = 116 (i.e. without outliers), looks different.

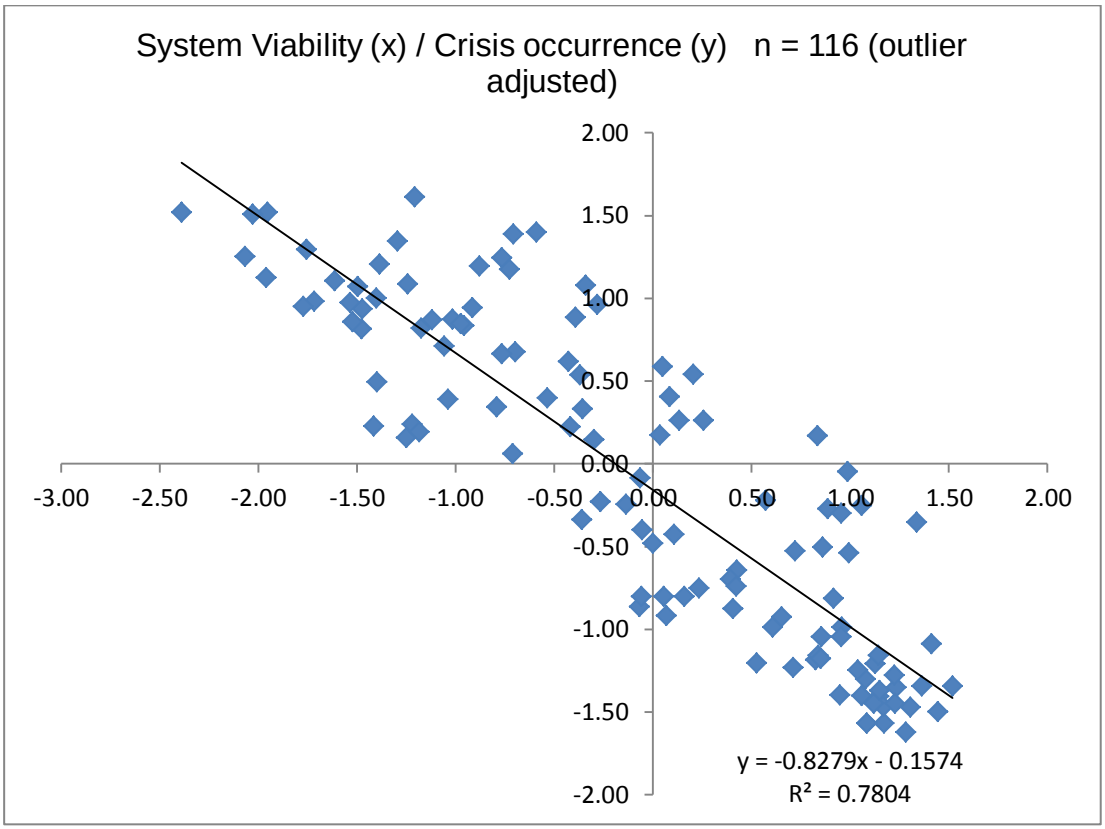

Figure 38 Scatter Plot System Viability / Crisis; Outlier Adjusted

Interpretation: The outlier adjusted regression coefficient of system viability on crisis occurrence has a coefficient of -0.83, an R^2 of 0.78 and an effect size of 3.55, indicating an even stronger relationship between the two constructs and superior predictive accuracy than the result with outliers included. The graph is a vivid depiction of the relationship between viability and crisis in the strict sense of the model.

5.4.7 Interrater Reliability

When respondents are involved in a survey that assesses more than one case each, the question arises of whether these respondents would base

their assessment on the same assumptions and would come to the same conclusion as when, for example, rating the same case.

To monitor the basic assumptions which guide the material evaluation and to gauge the scale, several measures have been taken.

Firstly, the introduction text of the survey informs respondents about the intentions, the purpose, the subject and the content of the survey in order to make them acquainted with the research project, in general, and the survey, in particular. Secondly, the control functions that are dealt with subsequently in the questions are introduced and explained, followed by important notices concerning functional and timing issues. The specificities of the measurement scales as well as the formal / informal perspective of the assessment are given to align the evaluations of the different respondents. Finally, respondent guidance on the structure of the questionnaire and the rich context information contained in the questions provide information on how to understand the questions and judge the cases in order to align respondents' judgements. However, the particular reference points on which the respondents base their judgements cannot be provided due to the variety of the cases involved. This is left to the respondent's general and case specific experience. In fact, the assessment of such cases, although done in the context of a quantitative study, is a qualitative and subjective undertaking with scope for interpretation and will therefore rarely provide completely aligned assessments.

Because the cases provided by the respondents are held anonymously, it is difficult to establish, whether or not cases were judged more than once. Statistical analysis of the control variables about the demographics (age, size, industry, etc.) of the organizations at least yielded no doublets.

However, the one doublet case that was noticed became obvious due to the fact that it had been confidentiality exempted from the bank client secrecy. It was rated by a banker as well as by a consultant. Both respondents categorized the case as a crisis case and assessed management quality as rather low. The correlation between their assessments (scores) was $r = 0.73$.

The judgements differed in terms of the assessed point in time by one year and, accordingly, in the observed events that led the respondents to come to their respective conclusions.

In summary, the consistency of the evaluations among respondents was actively and intensely supported by the research design. Assessor's evaluations of the one observed case that was evaluated by two assessors showed a high correlation factor of r = 0.73 with a "large" effect size of 0.53 (according to Cohen (1992, p. 157). Both observations indicate that the respondents applied largely the same evaluation principles.

5.5 Multivariate Statistics

The particularities of Partial Least Squares Structural Equation Modeling PLS-SEM were already stated in chapter 3. With regard to those statements, the specifics and findings of the PLS-SEM, which has been performed on the basis of the sample data discussed above, will be given.

5.5.1 The Structural Model

5.5.1.1 General

The structural model resulted from the theoretical basis of the VSM. It starts with the indicators for the first order constructs, uses the latter for second order constructs and so on, until the fourth-order and final construct, system viability, is reached. This construct is then regressed to the dependent variable, which measures crisis.

The original intention to operationalize crisis as a dummy variable (i.e. crisis yes = 1, crisis no = 0) ultimately became technically uncertain and materially undifferentiated. Instead, a combination of crisis and (inverted) viability indicators served as the target construct (see 4.6.4).

The structural model adheres very closely to Beer's VSM architecture. Four exceptions have been made, three structural and one material.

Firstly, system 3* (three star) has been included in system 3. This is a concession concerning the questionnaire size. However, 3* is included and separately coded in indicator 3.4.

Secondly, Beer besides subsystems one to five attaches great importance to several principles. These principles have been included, not only in the questionnaire, but also in the structural model as they are in fact an indispensable part of Beer's understanding of viability. Indicators P.x depict these "additions" on requisite variety, recursion and communication. Beer's fourth equally important principle, autonomy, is already included in S1.

Thirdly, system 2, as a co-ordination function very close to system 1 and working on a bilateral basis only, was assigned to the operations subgroup. Other VSM representations include system 2 in the metasystem (systems 3, 4 and 5, one level of recursion above system 1).

Finally, during the analysis, the inclusion of the dummy control variable on management quality was ultimately helpful in expressing the principle of requisite variety more effectively. This is theoretically sound because management quality is part of an organization's requisite variety.

On this basis, the following fundamental structural path model resulted.

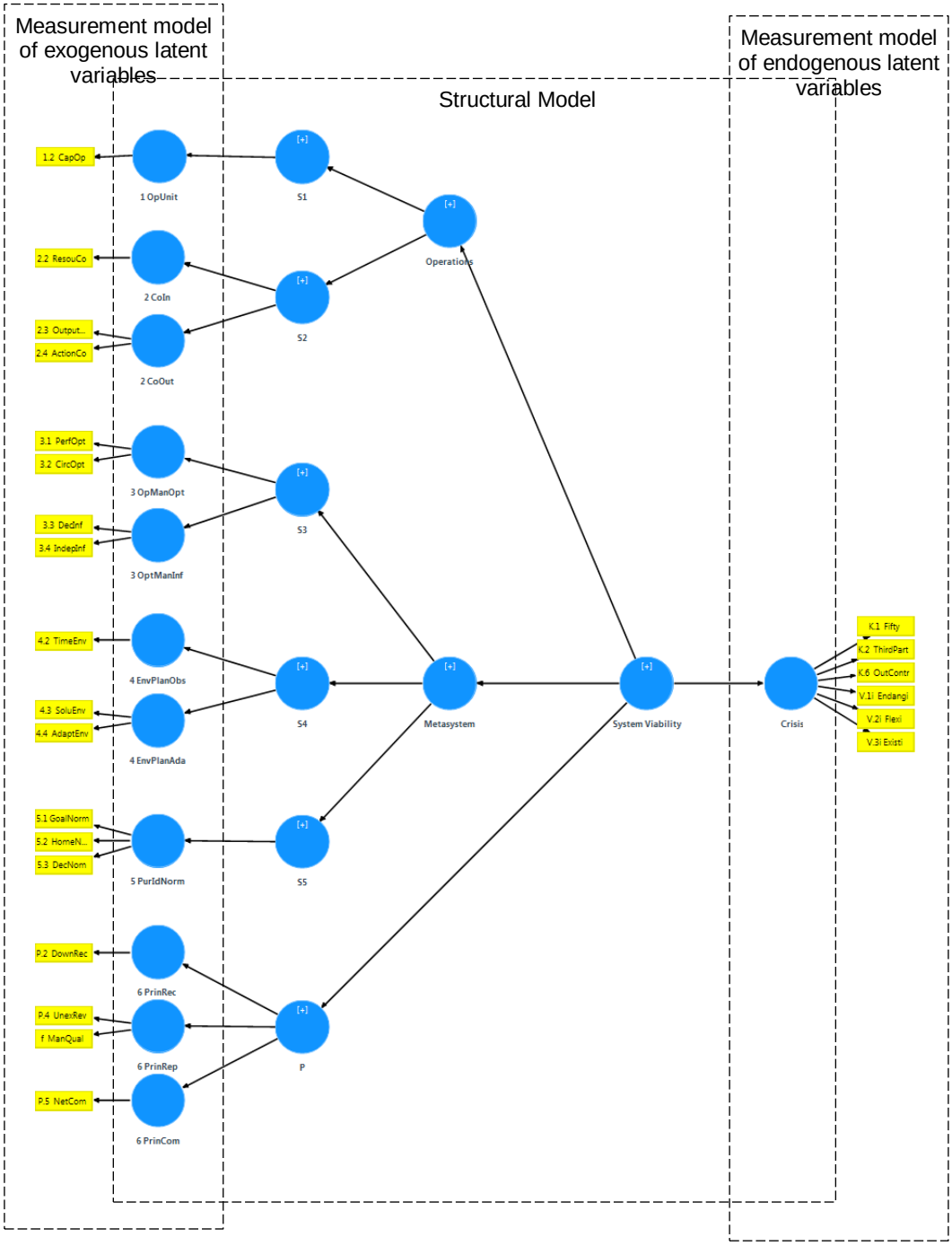

Figure 39 Structural Equation Path Model (Output SmartPLS)

5.5.1.2 Model Description

With regard to the conceptual model of PLS-SEM in chapter 3 (Figure 25), the above output of the actual model in use (software: smartPLS) has been complemented by the same frameworks with the same meaning.

Indicators

The overall path model depicts the hypothesis of the research project. The rectangular symbols in yellow are the indicators, manifest (or independent) variables, which are directly measured. Each indicator is based on the n = 135 numerical values and is a proxy for one distinct aspect of the VSM that has been subjected to a question (situation vignette) in the questionnaire. Compared to the original questionnaire, it can be seen that 5 of the 22 items are lacking. These five items have been removed for the following reasons:

Item 1.1 UnitOp (separate operating units per market) exhibited high correlation values with item 1.2. CapOp (capability to serve markets). In terms of its information content, it eventuated that 1.2 included 1.1 and could, therefore, be removed from both the statistics of both points of view as well as the theory. Removal of 1.1 increased the loading and significance of 1.2.

Item 2.1, ActivCo (coordination of activities), similar to 1.1 above, showed an intense correlation with 2.2 ResouCo (coordination of resources) as well as theoretical commonalities and was able to be removed, improving the test statistics of this item battery.

Item 4.1 ObsEnv (observation of the environment) was contained in item 4.2, TimeEnv (time dimensions of ObsEnv), with regard to its informational content, i.e. respondents unified the two items. The histogram of both items show similarities. In this case too, the removal of item 4.2 yielded better results.

Item P.1 UpRec (recursion upwards) asked about the recursion principle from the system in focus upwards, while P.2 asked the same downwards. As most of the respondents assessed a whole organization (i.e. not departments or other subunits of the organization) the question of whether the next higher level showed the same structures was not well understood. Again, removal improved test statistics. In terms of theory, a removal is justifiable as the next upper level of whole organizations can be considered as being outside of the organization. The basic concern about the recursiveness principle is still warranted.

Item P.3 ExpRev (requisite variety for expected issues) again seems to have been included by the respondents in P.4 UnexRev (requisite variety for unexpected issues) and could be removed. However, adding the control variable, f, management qualification, to this item battery, as reported, yielded better test statistics and corresponds with theory.

Constructs

The blue circular structures in the structural path model stand for the constructs which are measured indirectly, either by the indicators (measurement model) or by other constructs (structural or inner model).

The inner model represents the research question of the project. To the far right is the construct of crisis, measured by crisis indicators. To the left of the crisis construct, one finds the construct of system viability, from which an arrow points to the construct of crisis occurrence, depicting the central hypothesis of the research project: a causal relationship between system viability and the occurrence of OC.

To the left of the construct of system viability are the constituents of the VSM that are necessary and sufficient to ensure system viability. This logical structure of the VSM is best read backwards from right to left. Starting from the construct of system viability, three arrows point to the constructs of operations, metasystem and principles. This indicates, on a high abstraction level, the basic necessity of 1) an operating and 2) a planning system to ensure viability of a system and 3) the observance of a set of principles, as presented by Beer (2004, p. 21).

As mentioned earlier, the presence of Beer's basic principles' requisite variety, recursiveness and communication (the fourth, autonomy, was included in system 1) in the SEM and on this level, is an addition of the author in the sense of a reification or operationalization of these important principles. The rationale behind this is that Beer emphasizes the particular importance of these key conceptual building blocks throughout his work. According to Beer, these principles are fundamental when aiming at ensuring viability, hence the inclusion into the model.

Operation requires clearly defined and market focused units with responsibilities and skills corresponding to Beers system 1 members (S1). It is important to remember that these are the only systems in a viable system, which in itself are again viable systems. Viable systems, as the S1 members do, need coordination; this is done by system 2 (S2).

According to Beer (1994b, p. 116), a system which is needed to manage the collection of operational elements (S1) is necessarily metasystemic, i.e. stands logically above the operating systems on the next level of recursion. To fulfil its task, such a metasystem requires three functions: senior management (S3), strategic planning (S4) and normative management (S5).

The above commented the representation of the basic structure of the VSM in the structural equation model. VSM-experts might miss the algedonic (compound of Greek; αλγοσ 'algos' for sorrow, pain and ηδος 'hedos' for well-being) system. This alert or, more precisely, good-bad information system is designed to over-ride regular decision loops in critical situations. Its function is considered in indicator 3.4 IndepInf (independent information).

Besides the structural model, there are two measurements or outer models: The one on the left with 18 VSM indicators and the one on the right with 6 crisis indicators.

The 18 VSM indicators, measuring 18 typical control situations, are grouped into item batteries, which together exhaustively encompass all partial aspects of the VSM systems 1 to 5 and of the aforementioned principles.

For the detailed discussion of the content of the indicators and indicator batteries, see chapter 3, where the process of the operationalization of the VSM to develop the measuring instrument for this project is given.

Relations

An important specification of an SEM concerns the measurement theory i.e., under which assumption the constructs are measured. There are two possible ways to measure a construct: reflective and formative.

Reflective measurement means that the indicator (value) *reflects* the properties of the construct. Accordingly, the direction of causality and with it the direction of the arrow in the structural model points from the construct to the indicator or from the constructs to the sub-constructs, which act as their indicators. All relations in the structural model of this work are reflective.

An indicator battery is a collection of thematically related indicators that together measure the item. One example is S5, which consists of one item battery with three items (5.1, 5.2 and 5.3), measuring the core characteristics of normative management defined by the VSM. Reflective measurement, in this context, now means that the three indicators together cover most of the content of the construct, normative management (see Figure 40, left).

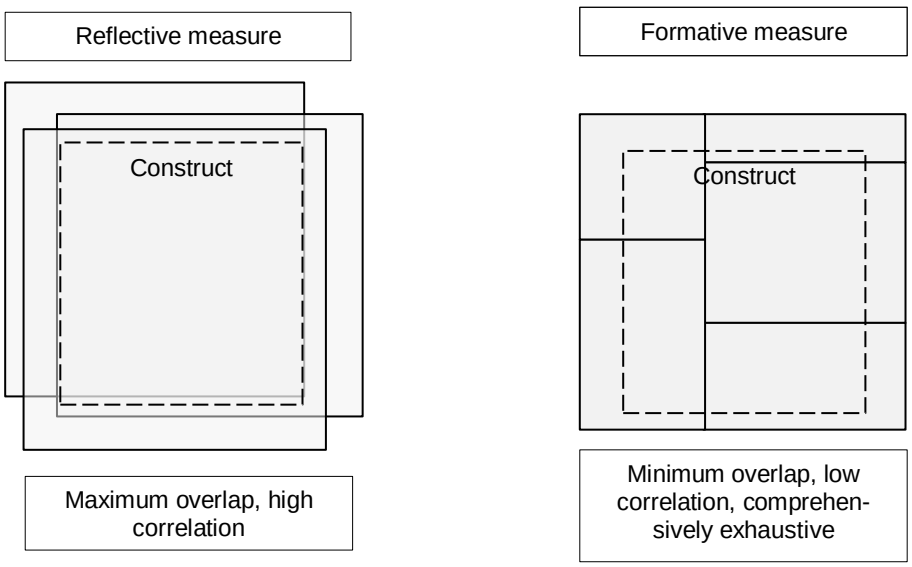

Figure 40 Theoretical Concepts of Measurement in SEM

Formative measurement means that the indicator (value) *forms* the properties of the construct. The direction of causality and thus the direction of the arrows in the structural model points from the indicator to the construct or from the constructs to the higher order construct acting as their indicators. An important and, in the social sciences, practically unrealizable requirement of formative indicators is that together they have to completely define the con-

struct with a minimum or no overlap between the indicators (see Figure 40, right).

Reflective indicator values are named *loadings*, whereas formative indicator values are called weights. The term, loading, depicts the *contribution* of a construct on an indicator.

The arrows between the constructs stand for causal relationships which must be supported by the underlying theory (VSM). These path coefficients are standardized, ranging between -1 and +1, the first assuming a strong negative, the latter a strong positive relationship. A path coefficient of 0 (zero) stands for no relationship at all.

5.5.2 Parameter Settings

The PLS-SEM has been run with the following parameter settings:

Table 26 Parameter Settings PLS-SEM (SmartPLS v.3.2.0)

PLS Algorithm	
The PLS algorithm is essentially a sequence of regressions in terms of weight vectors. The weight vectors obtained at convergence satisfy fixed point equations.	Ringle, Wénde, and Becker (2015). The algorithm calculates the construct scores as exact linear combinations of the associated observed indicator variables Hair et al. (2014, p. 79)
Weighting Scheme	Path weighing scheme (default)
Maximum Iteration	300
Stop Criterion	10^{-7}
Initial Weights	+1/ (-1) (Lohmöller Settings)
Bootstrapping Procedure	
Bootstrapping is a nonparametric procedure that can be applied to test whether coefficients such as outer weights, outer loading, and path coefficients are significant by estimating standard errors for the estimates. In bootstrapping, subsamples are created with randomly drawn observations from the original set of data (with replacement). The subsamples is then used to estimate the PLS path model.	This process is repeated until a large number of subsamples has been created, typically about 5'000. The parameter estimates e.g. outer weights, outer loadings and path coefficients estimated from the subsamples are used to derive standard errors for the estimates. With this information, t-values are calculated to assess each estimate's significance. Ringle et al. (2015)
Number of Subsamples	2000
Parallel Processing	Yes
Sign Changes	No
Amount of Results	Basic Bootstrapping
Confidence Interval Method	Bias-Corrected and Accelerated (BCa) Bootstrap
Test Type	Two tailed
Significance Level	0.01 (99 %)

5.5.3 Resulting Structural Path Model

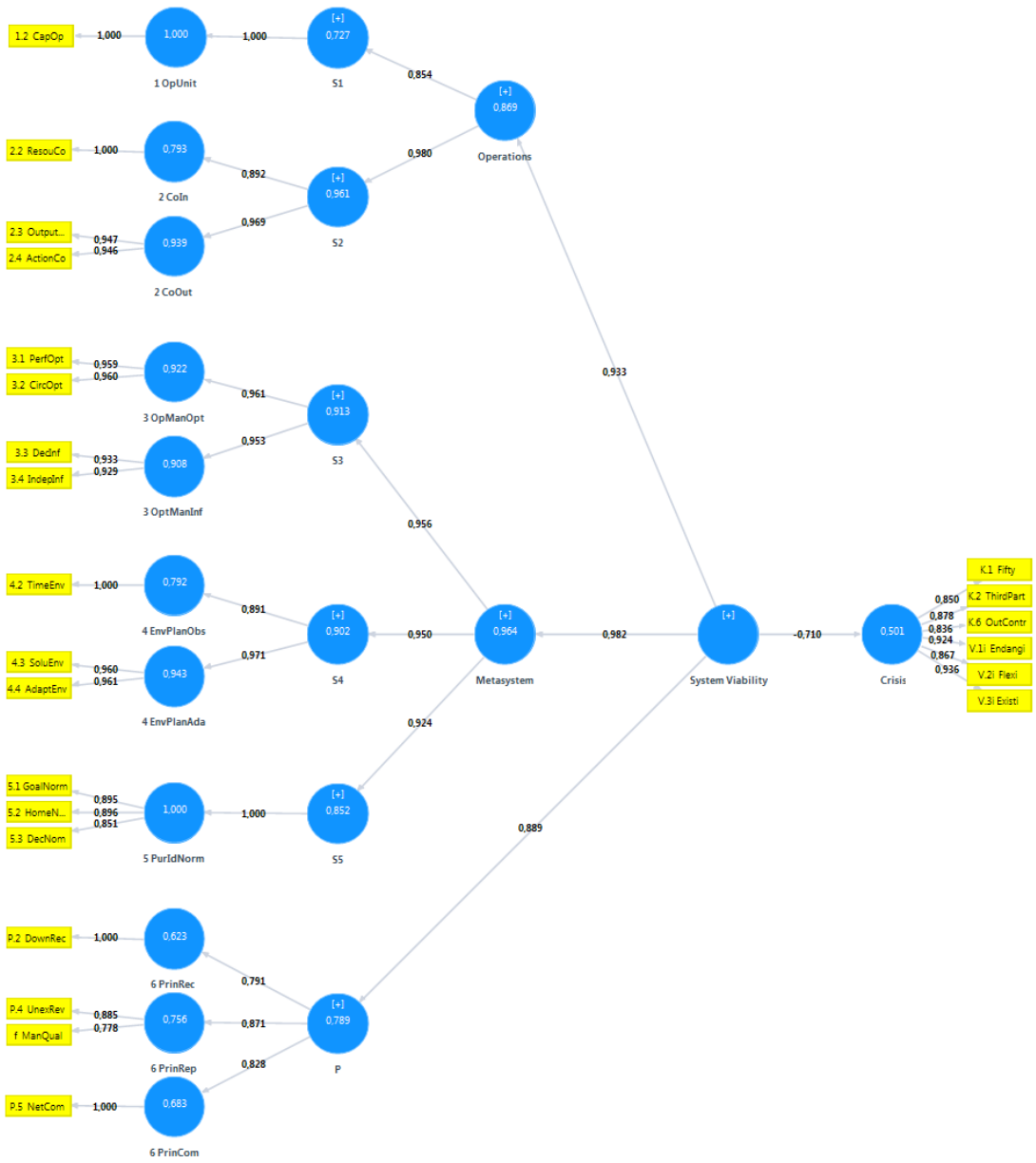

Figure 41 Loadings and Path Coefficients

The graph (smartPLS output) shows the loadings i.e. the relations between indicators (rectangulars) and constructs (circles) as well as the path coefficients, i.e. the relations between constructs (circles) and R^2 (in circles).

5.5.4 Evaluation of Measurement Models

The following evaluation process follows the recommended procedure of Hair et al. (2014, p. 96). Their explanations were often directly quoted – for

the ease of the reader, without placing each of their sentences in quotation marks. Additions are made by the author, where it appears necessary for a better understanding of the concepts.

Evaluation starts with the two measurement models (far left and far right). With reflective measurement models (arrows point from the construct to the indicator), evaluation implies assessing internal consistency reliability (measure: composite reliability) and validity (measures: convergent validity and discriminant validity).

All test statistic values are original output values of smartPLS v 3.2.0 unless otherwise stated.

Table 27 Indicator and Construct Designations

Abbreviation	Measure	Abbreviation	Measure
1.2 CapOp	Operative Capabilities	V.1i Endangi	Endangered (inverted)
2.2 ResouCo	Resource Coordination	V.2i Flexi	Flexible Adaptability (inverted)
2.3 OutputCo	Output Coordination	V.3i Existi	Sustained Existence (inverted)
2.4 ActionCo	Active on-going Coordination	K.1 Fifty	50:50 survival chance
3.1 PerfOpt	Performance Optimization	K.2 ThirdPart	Dependence on Third Parties
3.2 CircOpt	Circumstances Optimization	K.6 OutContr	Went Out of Control
3.3 DecInf	Decision Information	1 OpUnit	Operating Units
3.4 IndepInf	Independent Information	2 CoIn	Coordination Inputs
4.2 TimeEnv	Environment Monitoring timeinv.	2 CoOut	Coordination Outputs
4.3 SoluEnv	Alternative courses of action	3 OpManOpt	Operative Management Optimization
4.4 AdaptEnv	Adaptation process Environment	3 OptManInf	Operative Management Inform.
5.1 GoalNorm	Target State and Guidelines	4 EnvPlanObs	Environment Planning Observation
5.2 HomeNorm	Ops / Planning Homeostat	4 EnvPlanAda	Environment Planning and Adapt.
5.3 DecNom	Final Decisions System Change	5 PurIdNorm	Purpose Identity Norms
P.2 DownRec	Downward Recursiveness	6 PrinCom	Principle Communication Network
P.4 UnexRev	Unexpected Requisite Variety	6 PrinRec	Principle Recursiveness
f ManQual	Management Quality	6 PrinRep	Principle Repertory (Requisite Variety)
P.5 NetCom	Communication Network Prop.	Crisis	Crisis Intensity / Occurrence

The above key to the indicator and construct designations refer to the questionnaire and may be helpful when reading the following test statistics.

5.5.4.1 Internal Consistency Reliability (ICR)

ICR is measured by Cronbach's Alpha (CA), which provides an estimate of the reliability based on the intercorrelations of the observed indicator variables between 0 and 1. Because CA is sensitive to the number of items in the scale and assumes equal reliability of indicators, CA is used as a conservative measure of ICR.

The Cronbach's Alpha table is provided in the appendix.

Interpretation: All construct CA-values, with the exception of 6 PrinRep, are good or excellent (0.7 – 0.9). 6 PrinRep, with a value of 0.568, is just below 0.6 which, for exploratory research, is seen as acceptable.

5.5.4.2 Convergent Validity (CV)

CV is the extent to which a measure correlates positively with alternative measures of the same construct. To establish CV, outer loadings of the indicators (indicator reliability) and average variance extracted (AVE) are considered.

Indicator reliability

Outer loadings are the results of single regressions of each indicator variable on their associated construct. All indicators' outer loadings should be statistically significant; standardized outer loadings should be 0.708 or above.

The Outer Loadings of Indicators Table is provided in the appendix.

Interpretation: All outer loadings of the indicators exhibit values higher than 0.708 and are significant at the 99 % confidence interval.

Average Variance Extracted (AVE)

A common measurement to assess convergent validity is AVE, i.e. the grand mean value of the squared loadings of the indicators associated with the construct; it represents the communality of a construct. An AVE of 0.5 or above means that a construct explains more than half of the variance if its indicators.

The AVE table is provided in the appendix.

Interpretation: All constructs exhibit AVE values above 0.5 and are significant at the 99 % confidence interval.

5.5.4.3 Discriminant Validity (DV)

Discriminant validity and convergent validity together establish construct validity. Hair et al. (2014, p. 104) define DV as the extent to which a

construct is truly distinct from other constructs by empirical standards. DV is an assessment about the uniqueness of a construct. Two measures of DV are available: cross loadings and the Fornell-Larcker criterion.

As an important exception, DV does not apply to the relationship between lower-order constructs (LOC) and higher-order constructs (HOC) and between the LOCs in reflective-reflective hierarchical component models (HCM), as the SEM of this project (Hair et al. (2014, p. 231).

This is the case because HCM use the repeated indicator approach, which by definition makes the constructs similar to each other.

Cross Loadings

A cross loadings test examines whether the outer loadings of indicators associated with a construct are greater than all of its loadings on other constructs.

The Cross Loadings Table is provided in the appendix.

Interpretation: All indicator loadings on their associated construct are greater than their loadings on all other constructs. This means that all constructs are truly distinct from other constructs by empirical standards.

Fornell-Larcker Criterion (FLC)

The Fornell-Larcker criterion, as a more conservative approach than cross loadings, states that a construct should share more variance with its associated indicators than with any other construct, i.e. the AVE should surpass the squared correlation with any other construct.

The Fornell-Larcker Criterion Table is provided in the appendix.

Interpretation: All correlations of associated constructs exceed the non-associated ones, indicating that the constructs are distinct from each other. However, while operations correlate well with their associated constructs, S1 (0.8541) and S2 (0.9803), its correlation with S3 (0.8660) exceeds the one with S1.

From the point of view of theory, this comes as no surprise. Beer, in his literature on the VSM, sometimes assigns S3 either to operations or to a metasystem. This is related to the split character of this function at the border of operations and planning: S3 is part of the 3/4-homeostat supervized by S5 and, at the same time, monitoring S1 with the aim of optimizing operations.

Critique on cross loadings and the Fornell-Larcker Criterion

Henseler, Ringle, and Sarstedt (2015), in a recent research paper on DV, found that both the assessment of cross-loadings and the FLC failed to *"reliably detect the lack of discriminant validity in common research situations".* Building on the findings of Rönkkö and Evermann, they detected very low sensitivity values of 14.59 % for the FLC and 0 % in respect of PLS for cross-loadings.

As an alternative, they suggest using the heterotrait-monotrait ratio of correlations (HTMT) as a new approach to assess DV. Heterotrait-monotrait refers to multitrait-multimethod (MTMM) matrix analysis and compares two different correlations. First, the monotrait-heteromethod correlations, which quantify the relationship between two measurements (i.e. indicators) of the *same* construct by means of *different* methods. Second, the heterotrait-heteromethod correlations, which quantify the relationships between two measurements (i.e. indicators) of *different* constructs by means of *different* methods. The MTMM matrix analysis indicates DV when the monotrait-heteromethod correlations surpass the heterotrait-heteromethod correlations as per Henseler et al. (2015, pp. 120–121).

Heterotrait-monotrait Ratio of Correlations (HTMT)

HTMT can be used as a criterion with a threshold value of 0.85 ($HTMT_{0.85}$; conservative) or 0.9 ($HTMT_{0.90}$; more liberal). Below these values, DV is established. On the other hand, HTMT can be used as a test statistic. If a value of one (1) falls outside the confidence interval, the two constructs are empirically distinct (ibidem) p. 122.

All constructs but the construct “Crisis” are either LOCs (lower order constructs) or HOCs (higher order constructs). Accordingly, the only pair of constructs that must exhibit DV is the pair “Systems Viability” and “Crisis”.

Interpretation: The HTMT value is -0.7396 and lies well below the conservative $HTMT_{0.85}$ threshold and has a p-value of 0.000, suggesting that the HTMT-value is significantly different from one (1); both figures indicate that DV is established.

In summary, it can be stated that, even from a conservative perspective, the constructs in the model can qualify as distinct.

5.5.5 Evaluation of the Structural Model

After the measurement model has been assessed, the next step is to evaluate the structural or inner model. These procedures allow the fit between the collected real world data and the hypotheses based on the underlying theory (VSM) to be tested.

5.5.5.1 Collinearity Assessment

Collinearity between construct data indicates communalities (e.g. correlations) in the underlying measurements (indicators). Because the subjects of the presented measurement model are all control functions of organizations and since there is an overarching construct to be measured (“System Viability”), a certain degree of collinearity is unavoidable. Collinearity assessment measures this degree of collinearity in the data.

Variance Inflation Factor (VIF)

The variance inflation factor VIF is one measure to assess collinearity issues. It measures the degree at which variance is inflated due to collinearity effects. A VIF of one (1) means no collinearity, whereas values above one indicate ascending amounts of collinearity.

In the respective literature, there is no unanimous view about the threshold values for the VIF. Hair et al. (2014, p. 125) maintain that a value

above 5 indicates potential collinearity, especially when non-significant weights occur, which is not the case in this analysis. O'Brien (2007, p. 681) demonstrates that collinearity effects depend on the effects which R^2, sample size and variance of the dependent variable have on the coefficients. Depending on these effects, VIF values may be permitted to increase to 10, 20 or even 40.

The VIF table is provided in the appendix.

All VIF values lie between 1 and 7.65, well below 10.

Interpretation: Together with high R^2 values and significant weights, this indicates that variance is not inflated by collinearity effects.

5.5.5.2 Structural Model Path Coefficients

In an SEM, the relationships between the constructs of the inner model, called path coefficients, represent the research hypothesis. The central hypothesis of the present project concerns the supposition that system viability, as defined by the VSM, predicts the occurrence of crisis or, in other words, that organizations, which in the first place failed to meet the viability conditions of the VSM later on experience an organizational crisis.

In order to achieve a measure of system viability and compare it to crisis occurrence, this metric has to be derived incrementally from the basic constituents of a viable system, following Beer's theory. Both the central hypothesis and the derivation of system viability are subject to the structural model.

The connections between the constructs (blue circles) of the structural model are called path coefficients. A path coefficient value of one (±1) stands for a strong relationship and it is always statistically significant. Conversely, values close to zero would not only imply weak relationships between latent variables or constructs but also insignificant ones. The size of path coefficients stands for the strength of the effect on the construct they point at. Different paths in the model can be compared using this metric, given its significance. The significance of path coefficients is assessed by standard error

values, which are calculated by the bootstrapping procedure, which allows empirical t-values to be calculated, as Hair et al. (2014, p. 171) state. By bootstrapping 1500 random samples with [value, note of the author], replacements have been drawn from the original (n = 135) data set (i.e. the statistical model was calculated 1500 times based on distinct data bases). The samples serve as estimators for the path model and allow standard errors and t- and p-values to be calculated (contextual user information in smart PLS by Ringle et al. (2015).

In the present model, all path coefficients but one (System Viability -> Crisis) represent the VSM characteristics of the assessed organizations. The respective arrows point from the superordinated or higher order constructs (e.g. Metasystem) to the subordinated or lower-order constructs. This reflective model design means – on the combined basis of SEM and VSM theory – that the lower-order construct traits are *caused* by the higher-order constructs'. Accordingly, system viability causes the availability and VSM conformity of operations, of a metasystem and of the relevant VSM principles. These three constructs again cause the availability and VSM conformity of S1 to S2, of S3 to S5 and of the different principles, respectively. The same principle applies for the subsequent lower-order constructs.

The table of path coefficients is given in the appendix.

With values of 0.791 to 0.982, all path coefficients are relevant and, with p values of 0.0000 to 0.0002, also significant at the 99 % confidence interval. The most important path coefficient connecting "System Viability" with "Crisis" has a coefficient of -0.701 (i.e. viability is a "negative cause" of crisis) with a p value of 0.0000.

Interpretation: Path coefficients of the present model stand for the necessary and sufficient invariants of organizational viability as defined by the VSM. At the high level of abstraction, as they appear in the model, they are of equal or largely similar importance. This corresponds to the theoretical claim of the VSM that if only one VSM characteristic is lacking, the system loses its viability.

The construct “System Viability”, as defined by the various sub-constructs, is connected to the construct of crisis which is the dependent variable. This relationship corresponds to the main hypothesis, whether or not system viability has a causal relationship with organizational crisis. As expected, this path coefficient has a negative sign. It has a size of 0.701, which is significant, with a p-value of 0.0000 at the 99 % confidence interval level.

This suggests that, unless subsequent statistical tests support the opposite, organizations which in the first place failed to meet the viability conditions of the VSM, subsequently, do in fact experience an organizational crisis. In other words, organizational viability, as operationalized in this study, is in fact a predictor of organizational crisis.

5.5.5.3 Coefficients of Determination (R^2 value)

R^2 measures the correlation between the actual and the predicted construct values in the model; it is a metric of the model’s “*predictive accuracy”*, as Hair et al. (2014, p. 174) states. The same authors add that R^2 stands for the combined effects or explained variance on a construct (latent variable) by all the connected constructs that are linked to it, ranging from 0 (zero), no predictive accuracy, to 1, full predictive accuracy.

The table of R^2 values is given in the appendix.

All multi item construct R^2 values lie between 0.504 and 0.965 and are significant at the 99 % confidence interval.

Interpretation: Explained variance or predictive accuracy is high and significant in the model. R^2 of the crisis construct with 0.5043 means that system viability explains the major part of the variance in crisis occurrence. An effect size of f^2 1.02 represents a very large effect.

5.5.5.4 Standardized Root Mean Square Residual (SRMR)

Unlike for covariance based SEM (CBSEM) for PLS-SEM, there is no Goodness-of-Fit-Index. Ringle and Wende (2015) describe the standardized root mean square residual (SRMR) as a goodness of (model) fit measure for

PLS-SEM. Henseler et al. (2014) also state that the SRMR and the exact fit are the most reliable indicators of model misspecification. Furthermore, they add that researchers can rely on the SRMR to determine to what extent the composite factor model fits the data. SRMR measures the difference between observed and predicted correlation. A SRMR below 0.1 or, more conservatively, of less than 0.08 is considered a good fit, as Ringle and Wende (2015) point out.

The table of SRMR values is given in the appendix.

With 0.092 and 0.0886, both standardized root mean square residual values are below the threshold value of 0.1.

Interpretation: With values below 0.1, the model can be considered a good fit. Both metrics lie slightly above the conservative threshold of <0.08.

5.5.5.5 Predictive Relevance: Stone-Geissler's Q^2 Value

Hair et al. (2014) state that, for an SEM to exhibit predictive relevance, it should correctly predict data points of indicators in reflective measurement models. In PLS-SEM the blindfolding sample reuse technique predicts indicator values from latent variables. To do this, the PLS-SEM algorithm ignores every dth (the respective omission distance used in the analysis was d = 7) data point in the endogenous construct's indictors and estimates the parameters with the remaining data points, as stated by Hair et al. (2014, p. 183).

If the difference between the prediction value and the original value (prediction error) is small, the path model has a large predictive power. Q^2 values should surpass the zero line in order for the model to be viewed as relevant in terms of prediction.

The table of Q^2 values is given in the appendix.

All Q^2 values are well above the threshold value of zero.

Interpretation: The model has predictive relevance.

5.5.5.6 Heterogeneity Welch-Satterthwait Tests

Heterogeneity, according to Hair et al. (2014, p. 184), refers to different subgroups in the sample which present heterogeneous values or value combinations within the item batteries.

One heterogeneity source in this project's sample is, of course, the presence of the two subgroups, crisis and non-crisis organizations. By assessing the two groups *together* against observed viability, it is the intention to find out whether or not there is a *common* underlying principle. If it should eventuate that there is actually a significant relationship between system viability and crisis occurrence, then this must be the case *across* the two subgroups.

The alternative would be to test the two subgroups *individually.* But finding a positive relationship between system viability and crisis in each group individually would yield a much weaker statement than if this characteristic emerges from a heterogeneous sample.

To exclude hidden differences, an additional Multi-Group-Analysis (PLS-MGA) has been performed. The two groups are CY (crisis yes) and NC (no crisis) organizations. The Welch-Satterthwait test assesses whether the differences between the path coefficients of the two groups are significant.

The table of path coefficient differences between CY and NC groups is given in the appendix.

There are very small differences between path coefficients of crisis (CY) and non-crisis (NC) organizations. The differences are not significant at the 95 % level (default setting in PLS-MGA).

Interpretation: The relationships in the model hold in the subgroups too; there are no combined (heterogeneity) effects distorting the respective results.

Another potential source of heterogeneity was found in the professional background of the two different respondent groups, the bankers and

consultants. The way these two groups interpret and answer the situation vignettes in the questionnaire and how they compare these idealized situations to the reality of their business cases may differ. The large enough sample allowed testing to ascertain whether the model would exhibit significantly different results if had it been assessed by bankers or consultants respectively: 83 of the 135 cases of the sample had been assessed by bankers, while 52 cases were evaluated by consultants. Technically, the test was performed by doing a second Multi-Group-Analysis to test for such assessment driven heterogeneity in the sample.

The table of path coefficient differences between banker's assessments and consultant's assessment is given in the appendix.

There are very small differences between path coefficients of banker assessments and consultant assessments. The differences are not significant at the 95 % level (default setting in PLS-MGA).

Interpretation: The relationships in the model hold in the subgroups (crisis / non-crisis; bankers / consultants) too; there are no combined (heterogeneity) effects distorting the respective results.

5.5.6 Summary of Findings

The SEM has been established and tested as prescribed and required by the relevant literature.

The appropriateness of the structure of the measurement and the structural model has been verified and found to be compliant.

All statistical tests that apply to the model specification have been performed; their results lie within the relevant limit values.

Additional tests such as a multi-group analysis have been performed.

All test results suggest that the model is valid and the results can be used to test the hypothesis of this research project.

The results are collectively presented in Table 28.

Table 28 Summary of Statistical Findings

Tests	Result	Statement
Bivariate tests		
Bivariate statistical test of the VSM viability conditions indicator scores per group (crisis, non-crisis).	There is a significant difference between the scores of crisis organizations and the ones of non-crisis organizations at a 99 % confidence interval. Non-crisis organizations, on average, score significantly higher (better) than crisis organizations.	Using the VSM viability conditions, the group of crisis organizations could be clearly distinguished from the group of non-crisis organizations. The direction of the differences is plausible in the sense of the research question.
Multivariate statistical test of Partial Least Squares Structural Equation Model (PLS-SEM).		
Collinearity	Variance Inflation Factors exhibit some values above a conservative threshold of 5 but well below 10. Path coefficients and R^2 are large.	There are no collinearity issues in the model biasing path coefficient estimation.
Relationships (Path Coefficients)	All path coefficients are large and significant at the 99 % confidence interval. The path coefficient value between system viability and crisis occurrence is -0.701, suggesting a strong negative relationship.	System viability based on VSM theory has been mapped with the structural model down to the basic control functions. System viability is strongly negatively related with crisis occurrence.
Model Fit	The Model-Fit measure of the PLS-SEM SRMR lies below the threshold value of 0.1	The model is a good fit of the observed data.
Predictive Accuracy	All latent variables show R^2 values of 0.5 and above as well as large effect sizes and are significant at the 99 % confidence interval. The R^2 value of the crisis construct is 0.5043 with a large effect size. R^2 is significant at the 99 % confidence interval.	The model shows predictive accuracy. Crisis occurrence is explained (predicted) by system viability.
Predictive Relevance	All latent variables show Q^2 values well above the threshold value of zero.	The model has predictive relevance.
Test of heterogeneity in the sample.	The differences between the path coefficients of the crisis group and the non-crisis group are not significant. The differences between the path coefficients of the banker's assessments and the consultant's assessments group are not significant.	The results of the overall sample (crisis *and* non-crisis) are valid across the subgroups crisis and non-crisis. The results of the overall sample (crisis and non-crisis) are valid across the subgroups crisis and non-crisis.

The statistical results imply validity of the model and a significant causal relationship between system viability and the occurrence of organizational crisis.

5.6 Hypothesis Testing

The hypotheses of this project (see 1.6) read:

H_0: There is no significant predictive relationship between system viability and crisis occurrence in a sample of crisis- and non-crisis organizations.

H_1: There is a significant predictive relationship between system viability and crisis occurrence in a sample of crisis- and non-crisis organizations.

The term, system viability, in the above hypothesis refers to the viability conditions of the Viable System Model VSM as operationalized in the present project. The term, crisis, in the above hypothesis refers to the definition and operationalization in the present project. The term, predictive, in the above hypothesis refers to the anticipation of the dependent variable out of independent variable scores.

To test the hypotheses, the statistical results, as presented in Table 28, are valid and need to be considered.

Interpretation: The data, the model and the test results are valid and reliable.

Considering the results of the statistical analysis (as given in Table 28), the null hypothesis (H_0 above) has to be rejected and the hypothesis, H_1, has to be provisionally accepted, meaning: There is a significant predictive relationship between system viability and crisis occurrence.

6 DISCUSSION OF FINDINGS

6.1 Chapter Introduction

In this chapter, the findings of the research project will be discussed and contrasted using four areas of consideration: the reviewed literature on crisis aetiology, the extant theory (-elements) in this field of research and the implications of the findings for practice, as well as methodological aspects. The discussion will take place under consideration of the limitations of the project design.

6.1.1 Preliminary Definitions

At the outset of this chapter discussing the findings, the term organizational crisis is delimited again, which will ensure correct understanding of the discussion that follows.

Organizational crisis – in the context of the following discussion – is considered a situation in which an existential threat menaces an entire organization (death threat) and this situation is experienced by at least one stakeholder as utmost undesirable in the sense that the situation needs to be normalized as quickly as possible and with the greatest care and effort. Existential crises from disasters, sabotage or force majeure are not considered.

According to this definition certain crisis concepts, such as “crisis as a management tool”, “crisis of confidence”, “communication or growth crises”, or other combinations of the term, which do not imply an existential threat to an organization, as defined above, but are only “difficult situations”, are excluded from this discussion.

6.2 Findings Regarding Reviewed Literature on Crisis Aetiology

6.2.1 Introductory Remarks

The works that will be discussed here in some detail – by Seifert (2006) and Schulenburg (2008) – both aim at explaining and preventing OC by providing a theory of crisis genesis / development. They attempt to provide a theory of pathology of organizations i.e. a science of the cause and effect of diseases. As seen in the literature review and as will be discussed in the next section, a theory of crisis is still lacking, although the first attempts to postulate a theory date back to the middle of the last century.

In contrast to such attempts, the author of this work has chosen not to aim to create a separate theory of crisis and consequently address the *pathology* of organizations as done, for example, in medicine. Instead, an existing theory of organizational *viability* was applied to the problem of OC, to understand what distinguishes OC organizations from viable ones. This approach had several advantages.

Firstly, applying the theory through the use of the questionnaire can happen diagnostically in the course of normal operations, i.e. without the necessity of already prevailing OC effects, which allows for real early detection.

Secondly, a system viability test serves both optimization purposes as well as OC detection at the same time.

Thirdly, the VSM as a diagnostic tool has *"enormous explanatory power*", as Jackson (1988, p. 562) recognizes. In cybernetic terms, this suggests that the VSM approach has enough requisite variety to analyse a very broad spectrum of cases without having to divert to conceptual complements or extensions.

Fourthly, the VSM as the theory in use has a long track record of application and (peer) review and, to date, has not been falsified.

These aspects should be kept in mind when contrasting other theories of crisis with the findings of the present project.

6.2.2 Findings in Relation to other Crisis Literature

6.2.2.1 Seifert's "The Genesis of Organizational Crisis"

Seifert (2006) proposed a theory of the genesis of crisis, as described in the literature review (see 2.7.2). Her findings are contrasted with those of this project below.

One of the building blocks of the OC approach of Seifert (2006) is a set of five OC explaining constructs, including (1) increasing combination of factors (complexity), (2) increasing denial, (3) decreasing degree of freedom (options), (4) increasing frequency of events (acceleration), and (5) decreasing support of key players. These important factors are *ex post symptoms* of OC, i.e. phenomena of OC, which are already in progress.

In contrast to Seifert's approach, the findings of this project are based on viability criteria which, in respect to OC, are ex ante avoidance criteria, as explained in the introductory remarks of this chapter. This methodical difference impedes a *direct functional* comparison with *Seifert's work*; however, a comparison is still worthwhile from a *phenomenological* point of view.

(1) Increasing combination of factors: Oscillation control is the primary task of system 2. It recognizes and pre-empts exuberant complexity between system 1 units. Variety engineering or variety balancing, on the other hand, is mainly a long-term concept of adaptation, where the response behaviour of the organization is adapted to the demands of environmental or internal complexity. To avoid exponentially increasing effects, variety engineering prefers negative (self-damping) feedback loops instead of positive (self-enforcing) ones. Moreover, the VSM prefers decoupled subsystems (e.g. system 1) and autonomy, with it limiting chain reaction effects or "combination of factors", as Seifert states. Finally, variety engineering includes temporary excess supply of variety, for instance, through consulting advisors, additional personnel or installation of new systems, depending on the degree of urgency.

(2) Increasing denial: Denial of facts or of deviations from normal operation is a psychological conception which, in cybernetic terms, implies a malfunction of a human homeostat (e.g. an executive) for reasons of discomfort avoidance in the short term. This reality has to be dealt with because the logic of the concerned homeostat is no longer consistent with the one of the overall system. Viable systems are designed as interlocking homeostats (checks and balances so to speak) which, on an on-going basis, compare the preferred state of the system with the actual state to recognize, indicate and counteract deviations. Furthermore, an algedonic loop across the whole system ensures that alarm signals from all over the organization directly reach the higher ranks. Denial of facts or symptoms is systemically considered by the consecutive design of homeostats and more importantly by early recognition of deviations, which pre-empts potentially embarrassing i.e. deniable situations for humans assuming a homeostat task. A denial *culture*, on the contrary, is a far more serious system characteristic, as it distorts normal operations by setting false targets or palliating actual values, which leads to erroneous control impulses. It is the antithesis of a viable system in which all facts are transparent and are dealt with. A denial culture in a viable system is therefore a contradiction. From a cybernetic point of view, such a system has changed its purpose from (sustainable) value adding to (non-sustainable) contenting of human exponents. Such system pathology has to be detected and remediated by system 5 or by the next level of recursion. One permanent detection tool in this sense is system 3*. It traces audits and questions formal and informal communications and structures of the system, with it revealing denied facts or activities of suppression for the attention of system 3.

(3) Decreasing degree of freedom: Diminishing room for manoeuvre and options for action due to a lack of resources (manpower, funds, credibility, goodwill) is also a typical characteristic in the course of OC. At the latest, when it goes hand in hand with the

overshooting of complexity (1) the situation turns existential because the cleft between requirements and capacity becomes unbridgeable. Seifert introduces this effect later when referring to interlinking effects. From the perspective of a viable system Seifert's concept (3) corresponds to an imbalance of adaptation requirements of system 4 with the change possibilities (not change *intentions*) of system 3, implying increasing deviation from optimal operations. System 5, monitoring the 3-4 homeostat, recognizes this imbalance and counteracts it, i.e. the board frees additional resources to facilitate counteraction (single-loop learning) or reduces complexity by cutting down tasks or areas of activities (double-loop) or questions the task altogether (triple-loop learning). If more power or different solutions do not solve the problem, the task may be ended and a fundamental change of process patterns introduced. These last considerations are based on the works of Argyris and Schön (1996) as well as Watzlawick, Weakland, and Fisch (2009), with the latter having used the terms "*first and second order solutions*".

(4) Increasing frequency of events: As the flipside of (1), this OC characteristic has very similar implications as exuberant complexity. It also increases the "problem per unit of time ratio". An increase in known (familiar) events requires faster single loop learning (*same* solutions but faster / more often; implying the capability to increase efficiency), while novel events require deutero- or double-loop learning (*different* solutions; implying availability of a repertory of behavioural alternatives). Apart from that, the statements above are applicable.

(5) Decreasing support of key players: When banks, suppliers or, for instance, partner businesses distance themselves from an organization, this may have an impact upon viability, depending on an organization's assets, organization and value adding structure or on the availability of alternative sources. From a cybernetic point of view, an organization, in essence, is an open system which ex-

changes information, energy and matter with the environment in order to avoid entropy. As long as this exchange with the environment can be assured within “physiological” limits, the system remains viable. Seifert, however, in addition to the above mentioned stakeholders also names the CEO and the employees of the organization as key players. However, decreasing support of these exponents would ultimately question the system’s existence as a whole because this in fact would question both the exchange with the environment as well as the coherence of the system itself.

From this methodical contrasting of the five central constructs to explain OC genesis according to Seifert (2006) on the one hand and the properties of viable systems on the other, it can be stated that the Viable System Model does in fact consider the OC genesis process and – with a view to the whole spectrum of VSM functions – moreover, has enough requisite variety to provide the necessary and sufficient functions for organizational viability beyond sheer survival.

6.2.2.2 Schulenburg’s “Emergence of Organizations Crisis”

Schulenburg (2008) provides a theory of crisis development on the basis of population economy theory (refer to Table 6 and the explanatory text sections). His findings will be contrasted to the findings of the research project at issue in order to determine its contribution.

Schulenburg (2008, p. 383), in discussing the results of his research (author’s own translations):

(1) Concludes that the identification of a research deficit with respect to the development or genesis of crises can be regarded as fulfilled.
(2) Explains the specification of the explanandum crisis development or genesis to delimit it from other sub-concepts of crisis.
(3) Forms an explanans of crisis development or genesis and derives statements about a generalized explanation of crises.

(4) Determines both the contribution and the quality of the generated explanans.

Of special interest with regard to this research are points (3) and (4), as they can be contrasted with the findings of the current research project. Points (3) and (4) deal with the same subject, with (4) simply being a more precise specification of (3).

For an explanation of OC, Schulenburg (2008) suggests a comprehensive model of OC development or genesis, encompassing 59 interconnected independent variables, which are related to the dependent variable, an "*existential threat*". A detailed coverage of all 59 variables and connections would not add value to this discussion. A selection of the most important final seven OC-explaining variables of the last array of his pyramidal structure (see Table 6) will be contrasted with the findings of this dissertation (the following numbers in brackets relate to Schulenburg's numeration).

Variable "(41) Existential threat": corresponds to the independent variable in Schulenburg's model.

Variable "(58) Target Disturbance": Such perturbations affect the targets of an organization and are also a major concern in the VSM analysis. Homeostats and their requisite variety are the building blocks of viable systems which absorb disturbances. If there is a lack of horizontal requisite variety ("horizontal" due to the horizontal line from the environment to the management of a system 1 unit) the problem has to be solved vertically, i.e. by the next level of recursion using a meta-language. Accordingly, Schulenburg's OC variable "(58) Target Disturbance" is considered when using the VSM functions for an OC analysis.

Variable "(44) Resource-Inputs of Stakeholders": Resource inputs of stakeholders are vital to normal operations of an organization. Stakeholders will reduce their inputs when they perceive the incentives they receive in return as of lesser value or as riskier than with other partners. From a cybernetic point of view, the exchange of information, energy and matter with the environment is vital for open systems as organizations are. A distorted value

balance can bring this exchange to a halt and threatens the organization. System 4 of the VSM permanently compares the requirements of the environment with the capabilities and value propositions of the organization, or more precisely, of system 3 and 2 together with system 1. Any deviations from the preferred state or between actual and target triggers action within system 3. If the "language" (problem solving capacity, decision-making-authority, repertory) of system 3 does not suffice to answer system 1 problems, it passes the problem over to system 5, the meta-language of which (triple-loop learning) is capable of solving the problem. Now, as Schulenburg's variable (44) suggests, stakeholders that already limit their resource inputs are a clear crisis symptom which, seen through the viability lens, should have been avoided beforehand. This variable too, has a counterpart in the VSM OC-analysis, where it is, however, of limited importance.

Variable "(19) Capability to absorb external shocks": The ability to cope with external, unusual challenges, which were not known when establishing the organization, is at the very core of a viable system – again demonstrating conformity between Schulenburg's Model and a VSM OC-analysis. Experience and organizational learning constantly enlarge requisite variety, so that exceptionally high or novel variety can be absorbed. However, (external or internal) shocks that surpass the physical limits in shorter time than a viable system can adapt do destroy a system – viable systems are not immortal.

Variable "(3) Turning away of stakeholders": This variable addresses the problem of stakeholders which turn their back on the organization due to a perceived value imbalance. This variable is a precursor of variable (44) above. The points stated for (44) are applicable.

Variable "(1) Absolute adaptation deficits": This variable addresses the problem of diminishing abilities to adapt to stakeholders' requirements. This variable is a precursor of variable (3) above. The points stated for (3) are applicable.

Variable “(39) Range of Services and Products”: Defined as the ability to cope with requirements of stakeholders, Schulenburg’s definition is very close to the one of requisite variety in cybernetic terms. Variable (39) affects (44) via (3).

Variable “(2) Absolute size of the resource buffer”: The effect of this most important variable is denied by Schulenburg because it does not directly influence (41) an existential threat. However, from a cybernetic point of view, a resource buffer (i.e. excess funds, manpower or reserves of any kind) is a variety attenuator in the sense that it provides time to learn and develop requisite variety. Although incoming variety *itself* is not reduced, its *effects* are. Here, Schulenburg’s approach does not correspond with VSM OC-analysis.

In summary, it can be stated that the central elements of Schulenburg’s model of OC-genesis are covered in the OC-analysis based on the VSM as applied in the present thesis.

6.2.3 External Shock vs. Internal Management Dispute

OC is the aftermath of a malfunction of organizational homeostats (control functions) as the findings of this thesis suggest. The vital homeostats of organizations, as defined by the VSM, include internal as well as external control loops with which the external environment of an organization and the internal environment are monitored, managed and co-ordinated.

These findings dismiss the discussion of whether *either* external shocks *or* the internal management is responsible for OC. According to the findings of this research project, a resourceful smart design and the continuous adaptation of the organization ensure adequate interplay with the outside environment, which allows sustainable existence to be permanently safeguarded.

6.2.4 Ansoff's Weak Signals Approach

As analysed in the literature review, Ansoff's approach to monitoring and extrapolating weak signals in order to recognize and pre-empt OC early is considered inadequate because of the problem of information *overload* (an excessively broad data stream, leading to difficulties in identifying the relevant information) and, at the same time, information *shortage* (insufficient information per individual case, meaning such weak signals cannot be precisely extrapolated). This is because Ansoff attempts to recognize potential *perturbations*, which are, by definition, countless and, therefore, uncontrollable.

The findings of the present thesis suggest that monitoring the system and its surroundings and learning from the respective insights yields more useful results than trying to understand slight traces of information about the most complex environment and extrapolating it into an unknown future. In concise terms: For sustainable effects, the findings of this study suggest that resilience and permanent self-optimization (i.e. reserves, learning and adaptation) after disturbances are more promising concepts than meticulous anticipation and pre-emption of perturbations.

6.2.5 Financial Metrics to Predict OC

The success of some financial metrics to forecast bankruptcy is the main reason for returning to finance based OC prediction and comparing this approach to the findings of this thesis.

Financial based failure prediction builds on the financial damage that has occurred in organizations during a latent or even manifest OC.

The finding of this thesis – that defective homeostats lead to OC (by tolerating, actively producing or failing to counteract perturbations and their aftereffects) – suggests that financial OC prediction fails to indicate the underlying problem and works only when the viability of the organization is already affected.

6.3 Findings Re Extant OC-Theory

6.3.1 Lack of Standard Crisis Theory

In the crisis research field, there is consensus about the lack of a standard (organizational) crisis theory, and this also applies to the subfield of crisis aetiology theory. Seifert (2006) speaks of the pre-paradigmatic stage and Krystek and Moldenhauer (2007, p. 40) state that a closed theory on the *causes* of crisis in general and on corporate crisis in particular are both lacking. Hutzschenreuter and Griess-Nega (2006b, p. 27) distinguish between several disciplinary theoretical approaches to crisis research, only to conclude that no theory of crisis exists. Schulenburg (2008, p. 4) speaks of "theorylessness".

The findings of this research project shed some light on this "theorylessness" in crisis research. They imply that organizational crises (OC) can better be understood when seen as a system perturbation rather than as a phenomenon seen from a disciplinary angle such as finance, marketing or production, as Logan (2005) also suggests. When an organization is perceived as a system rather than as a collection of assets, OC can be identified as a (singular) control problem rather than as an inexplicable series of local defects.

The respective control structure can be operationalized in the form of a finite and invariant set of necessary and sufficient conditions of organizational or system viability.

6.3.2 Disciplinary vs. Holistic Theoretical Approach

When observing organizations undergoing an organizational crisis, one's impression is of a very versatile and, in most of its details, even unspectacular *phenomenon*. Such diffuseness of OC also disguises its aetiology, which may explain the fact that many authors only focus on the perceivable symptoms of OC.

Manifold theoretical perspectives on OC, formulated within different disciplines, have already been proposed. Most of these theoretical approaches seem to provide reasonable (in the case of Altman and Hotchkiss (2006), even award-worthy) insights into phenomena of OC. Many explanatory models and remedies against OC *symptoms* exist. However, none exists against the *causes* of OC, despite declarations to the contrary. But the perception and cure of symptoms is only the second best alternative, following understanding and pre-empting the disease.

Schulenburg (2008, p. 384), in this vein, concludes that crisis is hardly ever analysed deductively, i.e. theory-based. Insights have not emerged out of a comprehensive and closed theoretical reference framework encompassing the whole organization; to now monodisciplinary and partial perspectives have dominated. Consequently, results and solutions are fragmentary and ignore holistic perspectives on the organization.

Based on the insight that a system is more than the sum of its elements, but the product of its interconnections, the findings of this research project suggest that OC can be understood if considered as the consequence of a *systemic defect in the control structure* of an organization.

The results suggest that a failure in the control structure (homeostats), which co-ordinates the manifold interconnections in a system towards the set goals must ultimately result in the failure to fulfil the *intended* (remember the POSIWID notion) purpose and, accordingly, in the failure of the system as a whole.

The findings imply that a successful OC response (i.e. when an OC is already present) addresses both causes and symptoms, by addressing the underlying control structures of the organizations as wholes as well as local specialist disciplinary issues and their interaction.

The insight about the control structure being the main cause of OC does not at all disqualify disciplinary approaches. They are absolutely indispensable in coping with the specific challenges exhibited by both the organization and the environment. However, from the point of view of control and

from a viewing angle which covers the functioning of the entire organization, a system's perspective on the control structures adds value as the results of this research project suggests.

But isn't the systems approach *itself* a disciplinary way of accessing the problem and isn't it all too easy to assume a so called holistic approach only to claim that every possible aspect has been considered? Other approaches, such as human resources or finance, may start from a different viewing angle but do also cover the organization as a whole.

The answer to both questions is a "yes, with a caveat". Management cybernetics can be considered a disciplinary approach (although the author would rather call it inter- or trans-disciplinary). But the very subject of it is the *system as such* or, put differently, the overall functioning of a complex productive (viable) system.

Other disciplines, such as human resources, care about the right people, at the right place, in the entire system and even about people designing the control system, but not about the control system *itself*. The same is true in the case of financial departments. They also evaluate the whole organization but they do so in terms of pecuniary values and streams, not in terms of the actual steering and functioning of the institution.

6.4 Praxis Implications

6.4.1 Viability Assessment of Organizations

This study aimed to test the relationship between system viability and crisis occurrence in a sample of 135 organizations by third parties. Due to the fact that all members of the sample exhibit different constellations in terms of the fulfilment of the viability criteria, the results of the path analysis were "averaged out", meaning that the results are valid for the sample but allow no conclusions on the level of the individual organization.

In order to use the questionnaire for the testing of individual organizations, the performance of a normalizing procedure based on actual results of a representative sample of organizations is envisaged, exhibiting the same numerical proportion of non-crisis and crisis organizations as in the population (for further details, see 7.7). The resulting test statistic providing reference values (cut-off values or intervals) would allow for *individual* assessments by comparing the individual system viability score with a standardized scale. A first indication of an absolute threshold value has already been given in this dissertation: 100 % of those organizations which scored 92 points or lower on the system viability scale (ranging from 0 to 176 points) underwent an existence-threatening OC.

Apart from the limitations with regard to making more sophisticated statements about the system viability of *individual* organizations, it can be stated that, on the basis of the VSM operationalization made in this project, and given good knowledge about the organization with the assessor, a viability assessment of an organization can be performed without in-depth knowledge of management cybernetics, by insiders and third parties.

Furthermore, based on the viability criteria set out in the VSM, it is possible to identify characteristics or shortcomings of an organization which make it prone to an existence-threatening OC. This opens up opportunities to further analyse such organizations and take preventative measures against OC by ensuring system viability. In so doing, the OC-typical situation of both a proliferation of complexity and a diminishing coping capacity can be avoided.

Using a VSM approach, experts or managers handling OC situations are empowered to better prioritize reorganization measures. This is because in OC-situations, all problems that occur seem equally urgent and important; therefore, knowledge on where to set the priorities is most valuable. An analysis based on the VSM gives managers of organizations, which are either in the latent or the manifest OC-phase, indications about *what functions* are to be addressed in reorganization as well as the *basic functionalities* these functions must encompass.

6.4.2 Versatility and Selectivity of the Approach

VSM analysis is based on an existing theory of system viability, whereas various other theoretical approaches deal with crisis assessment only. An advantage of the VSM approach pertains to its richness and versatility. Its use alongside OC assessments yields a broad spectrum of results about an organization, in general, not only about critical variables. Furthermore, the results indicate the degree to which a function is assured in an organization. This means that the results not only provide dichotomous assessments but also detailed indications about the seriousness of the findings and hints about possible solutions.

6.4.3 Application Example

To provide an impression as to how one can use a VSM analysis, a real case is described.

Q is a wholesale company in Switzerland. It imports rolled goods from European countries and sells them to 2’800 floor layers (customer base). The company has a warehouse with stock worth ten million CHF (Swiss francs). Five warehouse operators, a logistics team with five employees for goods picking and ten truck drivers as well as a sales force of eight field workers and eight sales persons in four subsidiaries are permanently employed. Twelve sales staff employees, a back office with eighteen employees together with the executive team of six people add up to a workforce of 74 people.

The owner-entrepreneur (CEO) leads the company together, with a CFO, a COO, a CMO, a head of sales (field) and a head of sales (staff).

The organization yields revenues of 24 million CHF and a gross margin of 36.5 %.

At the beginning of working with this organization, the consulting firm performed a viability assessment using a similar questionnaire to the one used in this research project. The analysis revealed the following:

1. Systems 5 function was dominated by the owner-entrepreneur CEO. No written basic normative documents had been available; information of the board members was provided ad hoc.
2. System 4 function was performed by the CEO in terms of strategic procurement and by the head of sales, two hierarchy levels below the CEO in terms of market intelligence. Insufficient information about the (intended and actual) system state was available to the head of sales.
3. System 3 functions were performed by the CEO, the CFO and the CMO in each of their respective fields, executive board meetings were dominated by CEO topics, decisions were taken by the CEO. System 3* functions by the CEO walking around provided a good contact to the shop floor level employees and, accordingly, actual information about the state of operations with the CEO.
4. System 2 function was ensured by the ERP[28] system co-ordinating demand (sales force) and supply (procurement, warehouse) as well as by the chief of logistics who co-ordinated delivery of goods sold using fixed delivery tours (all over Switzerland twice a week).
5. System 1 units were normal wholesale operations (1) and project businesses (2) with major overlaps and the latter overridden by the CEO (pricing).
6. The autonomy principle for system 1 units was not fulfilled; the units were directly controlled by the metasystem. Autonomy was given to the CFO due to the indifference of the CEO towards financial issues.
7. The recursiveness principle was not fulfilled for system 1 units, i.e. there were no control substructures on the level of the subunits.
8. The requisite variety principle in terms of customer solutions was fulfilled by a good horizontal absorption through well-trained field and staff sales personnel. Back office and pricing issues were largely absorbed vertically by the CEO himself.

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[28] Enterprise Resource Planning

On the basis of this viability assessment result, Q was advised to better separate normative, strategic and operative management, to install three sub-units with local managements and delegate profit responsibility to this level as well as to establish a financial control system to ensure economic decisions. With the exception of a financial reporting system, none of the advised measures were adopted. Nonetheless, to ensure operational improvements, a series of efficiency initiatives were defined and handed over for implementation to designated project managers. These initiatives were overruled by the CEO who, although recognizing the benefits of the initiatives, placed priorities on turnover generation and private labels (for margin reasons).

One year later, the organization had to be financially reorganized as a consequence of prior heavy investing activities without prior financing. The substantial shortfall in liquidity considerably reduced requisite variety vis-a-vis customers (product range, off the shelf supply, pre-financing of projects) and suppliers (demanded for advance payment). A loss of trust with banks decimated the options for action. Eventually, operations were spun off to avoid the demise of the organization as a whole.

This real example shows that VSM based analysis yielded ex ante early warnings before the crisis entered the manifest stage.

6.5 Findings Regarding Methodology

6.5.1 Situation Vignette Method

One important norm in quantitative survey research concerns the prevention of multi-barrelled questions. However, in social sciences phenomena are never one-barrelled but always multifaceted. For this thesis, a solution had to be found in order to discover the complex structures of organizations and their control characteristics with regard to organizational crisis.

Cybernetic reasoning on the issue of “multi-barrelled” questions demonstrates that one-barrelled qualitative questions do not exist or are at least an exception. Whether or not a question is considered one- or multi-barrelled depends on the level of recursion from which one looks at the subject in question. Accordingly, a seemingly correct one-barrelled survey question – such as “Do you like this apple?” – turns out to be a multi-barrelled question because the respondent has to integrate his answer into at least 15 aspects, including colour, size, form, texture, weight, haptics, consistency, temperature, lighting, position in space, context, etc. and, at the same time, consider influences of personal bias, such as hunger, tasting preference, allergies or the condition of his/her teeth. The question, in fact, turns to be multi-barrelled but the respondent would hardly answer: “Well, let’s see, the colour, the texture…all in all, I do (not) like this apple”.

This ability of humans to integrate an evaluation over a multitude of aspects has been addressed in this research project with situation vignettes. Methodically, the control situations described in the vignettes correspond to the apple, exhibiting different traits. The vignettes describe the situations directly (using questions and examples) or indirectly (by allowing associations and addressing the experience of the respondent). The formulation of the situation vignettes has been done using utmost care by testing and retesting the questionnaire and by discussing the thought processes of respondents or test respondents with the author in pilot studies. Peer discussions about this methodology have taken place frequently to make sure the practical advantages would not give rise to methodological concerns. This elaborate process was necessary because it was clear from the beginning of the survey process that this particular target group of respondents would only complete a survey once.

6.5.2 Statistical Method

The decision to use structural equation modelling (SEM) for the analysis of the statistical data turned out to be appropriate. SEM exhibited enough requisite variety (i.e. capacity to deal with complex data structures and the

multitude of variables, interrelations and constructs). Partial least square (PLS) SEM made the analysis possible as it allows for a smaller n (compared to the closely related co-variance based method, CB-SEM). The effort to achieve n = 135 expert assessments of organizations from bankers and consultants was already considerable.

By using a situation vignette method, a completely new questionnaire was developed. The statistical analysis of the data yielded valid and reliable results. The findings of this project suggest that VSM survey analysis and PLS-SEM combine well and provide a viable instrument, which has the capacity to cope with considerable amounts of complexity without overly distracting the researcher with methodological questions.

6.6 Philosophical Considerations

The findings of this thesis allow some basic philosophical considerations about the nature of OC and the knowledge that can be acquired about it.

6.6.1 Ontological Perspective on OC

The first question to be answered in this context is: Does OC *exist* in the ontological sense of the word, or is OC simply a useful denomination to discuss an occurrence or experience?

The findings of this thesis suggest that no such thing as an OC exists. Instead, OC was found to be an *observer induced* designation for the *behaviour* of systems which exhibit malfunctioning homeostats. Thus OC is an auxiliary designation to give meaning to a perception or an experience of an observer about an object or, in concise terms, an idea. OC is not a directly approachable object such as a stone to be carved. Unlike such *real* existing objects which can be analysed ad infinitum, the *ideal* nature of OC allows *incomplete determination*, which may be one cause for the prevailing definitional diversity around the OC term.

Whether the perceived behaviour of a system is considered bad or good can only be decided if the specific *values of the respective observer* are taken into account: An existential threat to a specific organization may be a blessing for a competitor of this organization but a catastrophe (or crisis) for the stakeholders of that entity – without such an evaluative reference point the perceived behaviour would be nothing more than the aftermath of a defective system component. If OC is not observed, it does not exist, or in short: Observation *creates* OC.

Beer (1974, p. 330) underlines this when he states that the purpose of a system is what it does. Here he is basically saying that *organizations in crisis have changed their purpose*, for example, from earning money to burning money or, for instance, to bringing people to despair or damaging creditors. A changed purpose is the value-free view on what an observer would dramatize as an OC or a blessing depending on his or her standpoint. Ill-defined systems produce ill-defined outputs – often over a long period. The fixing of defective homeostats, such as the mindset of management, the production process or the market intelligence service, would restore the ability to produce the (observer-) intended output. OC is not a fate but only a fault, more precisely: the aftermath of a fault.

This view is in line with the functionalist nature of the VSM. Imagine a functional behaviour in its simplest form: A certain input of a black box triggers a certain output, called output one. A defective or altered black box for the same input creates a different output, called output two. The differential amount between output one and output two, first of all, is a simple fact with no quality at all. Only in case of a comparison with a reference or target value does the deviation reach a quality which can be interpreted as either favourable or unfavourable for the achievement of a particular objective. This reference value, which is normally in line with the intended purpose of the overall system, cannot be set by the system itself, it must be set from outside the

system in focus[29] by an observer (or operator). Good or bad, regular operation or OC, therefore, are attributions of an observer.

6.6.2 Epistemological Perspective on OC

The non-existence of OC per se (i.e. as a real object) noted above does not, however, imply that OC is not intelligible, immutable or even not of relevance. Defined as "*perception of unintended system behaviour that puts an existential threat on an organization*", it is approachable and researchable in many ways. For instance, it can be subdivided into phases (latent, onset, acute), categorized according to its course (slowly developing, sudden) or, for example, its cause (specific homeostat) which may help to understand or counteract it. This means that *acquiring knowledge* about the "*perception of unintended system behaviour that puts an existential threat on an organization*", is possible because it has a cause which is subject to experience and thus intelligible, irrespective of whether or not OC does "exist" per se.

As such the "*perception of unintended system behaviour that puts an existential threat on an organization*" is more than a working hypothesis resulting from pure reasoning. Because there is empirical evidence for its cause and this empirical evidence is accessible to research and to falsification.

6.6.3 If OC does not exist why is it researchable?

OC is researchable, because it is not the term "OC" which is the object of research but the underlying causes that make an observer perceive such a thing he or she would call an OC.

Researching OC is worthwhile because most observers, by calling their respective perception an OC, address an undesirable or even dangerous occurrence in an organization. The avoidance of such occurrences benefits stakeholders of such an organization and prevents detrimental effects.

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[29] „outside" the system in focus may be one level of recursion up, with the management.

As the results of the present thesis suggest, the causes which lead to the perception of OC include defective regulating elements in organizations. The malfunction of those elements produces unintended effects, which drive the performance of an organization outside the limits of existence. As with OC itself, some of these limits are *constructs*, such as equity limits, safety standards, operating licences, legislation, etc. However, although “only” constructed (as OC itself is), they are nonetheless effective mandatory limits for operation and, therefore, relevant for the continuation of an entity. Other limits of existence are (near) physical, such as the availability of liquidity, manpower, premises or resources. In both cases, OC effects erode the respective inventory and prerequisite of existence.

7 CONCLUSION

7.1 Chapter Introduction

This study was aimed at identifying the causes of slowly developing organizational crises using a cybernetic approach. Accordingly, the research question asked about the degree to which the necessary and sufficient conditions for organizational viability of the VSM would help to understand and predict organizational crises. This degree, as the last chapters have shown, is large and highly significant, revealing that the origin of crises[30] is a failure of control. This chapter, after drawing conclusions from the research findings, provides information about the limitations of the research design and outlines opportunities for further research.

7.2 Summative Claim

In summarizing the findings of this research project, it can be established that the overall aim of the study has been fulfilled with the finding that: organizational crises can indeed be understood and predicted on the basis of the viability conditions of Beer's viable system model, VSM.

The respective assessment can be performed on the basis of a questionnaire by third parties who exhibit good knowledge about the organization to be assessed.

The respective statistical results of the causal analysis are valid and reliable and show strong effect sizes.

The study revealed that by adopting a system's, or more precisely, a management cybernetic perspective on organizational crisis, the aetiology of

[30] most probably

such crises can be understood. This is an important prerequisite to pre-empt organizational crises.

The selectivity and the explanatory power of the theoretical basis of the chosen approach are high. Besides sheer crisis prognosis, the approach allows extensive further analysis, differentiation and interpretation on any desired level of an organization in any depth, using the same theoretical framework.

7.3 Limitations

7.3.1 Abstractness of VSM Theory

The VSM is a powerful tool, comprising a plurality of concepts to diagnose and design organizational tasks and functions. This multi-purpose capability comes at the price of abstraction. VSM analysis is comparable to a roadmap which shows the roads, crossings and the structure of the surrounding landscape, but does not show the roads and the landscape itself. This implies that a VSM analysis always needs translation. While this is always the case when applying theory to real world cases, it is especially true for the VSM. The questionnaire developed for this project in cybernetic terms is a transducer – i.e. it leads from cybernetics to plain business language. In so doing, explanation or diagnostic power is exchanged for more practical relevance. However, even the more practical form exhibits a degree of abstraction, which needs further interpretation and inquiry and requires knowledge about the theory. This means that even a VSM analysis on the basis of the situations vignettes developed in this project needs a prior instruction (which, in the questionnaire, is provided in the introductory part).

7.3.2 Level of Detail of the VSM Constructs

As reported, according to the VSM experts who were consulted at the outset of this dissertation project, a rich theory such as the VSM with its vast explanatory power cannot be squeezed into a questionnaire in full. The de-

tailed but still far from complete description of the VSM in chapter 3.5.5 gives an impression of this. It has, therefore, been the aim of this work to include the full *width* of the VSM (i.e. all systems and their major interplays, most aggregates, major principles), whereas in terms of *depth* (i.e. functional details, sub-mechanisms, measurement and metrics in homeostatic loops, etc.), the questionnaire was kept lean. The questionnaire would have become too lengthy, but also, the respondents' knowledge would not suffice. For a deep analysis of an organization, more individualized sophisticated procedures are necessary.

7.3.3 Sampling

Results of quantitative research are generalizable if the data collection is based on a strict random sampling approach. Based on randomly sampled data, it is possible to extrapolate with known confidence from the sample to the population. Such extrapolation is theoretically not possible with convenience sampling because the relationship between the sample and the data universe is not known.

Sampling in the present thesis occurred in three stages. The first being the choice of the banks and consultancies the author addressed in the German speaking part of Switzerland. The second sampling step occurred when the respective banks and consultancies decided (not) to participate in the study. The third sampling step was the choice of the participating banks and consultancies as to which crisis or non-crisis organizations to include in the assessment (which correspond to the set control variable restrictions).

Random sampling is given if all crisis or non-crisis organizations corresponding to the control variable restrictions have an equal and independent chance of being selected. The opposite, *convenience sampling*, would correspond to the selection of organizations because of the ease of their volunteering, availability or of easy access.

From the above, it becomes clear that the data collection approach of this study was something between random and convenience sampling with a

tendency to random because only few organizations within the control variable restrictions are not customers of a bank. Thus a large proportion of the population of organizations in the German speaking part of Switzerland had the chance to be part of the sample.

This means that the results of the study are not generalizable in the strongest sense of statistical requirements but most certainly provide a very good approximation of the real situation.

7.4 Contribution to Knowledge

The primary contribution to knowledge that this research project has provided is based on the assumption that, if organizations are observed through the lens of systems science in a methodically sound way, then system science can provide new insights about organizational phenomena such as OC. Accordingly, a sample of organizations, which experienced an OC and a control group of organizations which did not, was tested as to whether or not they fulfil the postulates of the theory of the Viable System Model (i. e. system viability).

Interpreting the results, it cannot be refuted that there is a strong relationship between the degree the postulates of the VSM are fulfilled by the organizations and the occurrence or, more precisely, the severity of the OC those organizations underwent. A threshold score of 92 out of 176 of system viability was even observable, below which 100 % of the assessed organizations experienced an OC.

In short, system viability of organizations is negatively related to the occurrence of crisis (OC) in these organizations.

This thesis' second major contribution to knowledge is that, at the rather high level of abstraction of analysis chosen, it is possible to assess a sample of organizations based on the VSM principles (i.e. assessing system viability) without prior knowledge about the VSM with the assessors, using

the questionnaire of this study. The codification of the VSM postulates into plain language in the questionnaire has apparently been managed. This is noteworthy, because knowledge about VSM theory is neither wide spread nor well understood in the broad management community – with the questionnaire of this study, this is no longer a disadvantage on this level of analysis. A translation of this questionnaire into a measurement instrument for individual organizations would contribute to assessing and locating an organization's crisis proneness or susceptibility.

A third contribution to knowledge is that the "situation vignette method" introduced in this thesis, in combination with a sufficiently broad Likert scale, allows multiple issues in one question to be evaluated (i.e. in one item). Such questions are not multi-barrelled, because the different issues are constituent concepts of one common umbrella term, which is the underlying subject of the question.

This works – as long as particular issues in a situation vignette are logically connected to each other, e.g. "do you often observe, analyse and valuate the market and draw marketing conclusions out of it" – as a comprehensive assessment, which is possible as long as no information about the individual issues in it is needed. De facto situation vignettes ask (validly) about one super-ordinated (umbrella) term by using the terms of its sub-ordinated concepts (compare in the above example: "marketing research" which would be the umbrella term, but because it is too empty, data could not be collected on this basis alone).

In the case of this research project's questionnaire, because the umbrella term was not known to the respondents (as it is cybernetic jargon), it was replaced by its sub-concepts which, together, integrated the super-ordinated concept. In addition, numerous examples have been added to trigger associations and experiences from the day to day work of the respondents.

7.5 Contribution to Literature

OC aetiology research is still in its infancy but some authors are already wallowing in their paradigmatic trenches, firing toxic salvos against dissenters, poisoning every new *fish* in the *creek* of OC research. The present work, notwithstanding, provides three main contributions in OC aetiology literature:

Firstly, the use of Beer's Viable System Model as the theoretical basis of a quantitative survey to explore the causes of OC.

Secondly, a universally applicable and easily understandable operationalization of the VSM postulates on the basis of which organizations can be tested without prior knowledge of cybernetics.

Thirdly, the use of partial least square structural equation modelling to map the VSM as a statistical model to assess the relationships between the numerous concepts, sub-concepts and principles of the VSM and, finally, regress the resulting system viability against OC with the result of a strong and significant – negative – relationship between the two.

These three main contributions to the literature can be useful for further research for practitioners, consultants and bankers to understand the viability of organizations and to prevent OC early enough.

7.6 Conclusions for Managers and Scholars

For managers of organizations the findings of this dissertation (re-)recommend the VSM as an important reference model for the analysis, design and controlling of organizations when the sustainable existence of the organization is a goal. The VSM helps in understanding what makes organizations sustainable over time and allows structures to be built and processes arranged in a way that the organization continuously adapts to its ecosystem, i.e. environment; this includes strategies with which the environment is influenced or even changed in order to achieve co-ordination between an organi-

zation and its environment. The insight that organizations are homeostats made out of further homeostats provides managers with a useful instrument.

Although the measuring instrument of this research project is not yet standardized for the individual use in organizations, it already provides a useful translation of uncommon VSM concepts into management language. Addressing the contents of the questionnaire qualitatively (comparable to a checklist) yields useful insights into the overall governance structure of an organization and gives indications as to where further analysis might be beneficial. The issue of management bias in the context of this research project when assessing the organizations has only been relevant due to the necessarily retrospective nature of the assessments of OC organizations, which would have resulted in a self-(critical) assessment of managers. When applied to organizations in regular operating mode as part of a continual improvement process, this bias is negligible because the focus of the analysis is on the organization and change, rather than on the manager in charge and responsibility.

Orientating an organizational system towards the VSM principles (i.e. system viability) not only allows for economic benefits superior to those obtained when maximizing profits, but makes an organization also less susceptible for OC in the first place, as Schwaninger and Grösser (2010) state. Organizations capitalizing upon this insight, however, must not neglect risk management, contingency planning and building reserves as this would disregard the fact that viable organizations are not immortal. Sufficiently large and/or fast alterations in the system and its niche might produce conditions that “lie outside physiological limits” of the organization so that – often resource consuming – re-positioning measures have to be taken to ensure long term survival of the organization.

For scholars the findings of this research project suggest that the VSM, although “*for many people too abstract and complex*” as some academics find, provides a rich but, at the same time, compact theory, which can be useful in explaining controlling, governance, and structural or management questions in organizations or systems in general.

Accordingly, the VSM has the potential to benefit scholars in two ways; firstly as a powerful theory in research projects, secondly as a (potentially most) rewarding and still under-researched object of study.

Besides these two purposes, and once the initial hurdle to adopt the VSM has been taken, the model serves a personal purpose: It quickly becomes a handy yet well-grounded thinking tool, when reflecting on all kinds of issues which can be approached in system terms.

Not least, the findings suggest that the VSM should be part of the curriculum on the undergraduate and graduate level in management education. Knowledge of this powerful and, at the same time, manageable (at least at entry level) tool is an indispensable must in management and organizational studies. In the opinion of the author, the VSM belongs to the very basics in management education: An introduction to the VSM would provide huge benefits for students, requiring only little space in the timetable.

In terms of OC research, the findings of this thesis offer an alternative route to the symptom-oriented perspective on OC. Systemic or, more precisely, cybernetic in nature, this alternative route to understanding OC aetiology addresses the necessary and sufficient control functions of an organization, as opposed to the countless detrimental phenomena and aftereffects that accompany OC. The big advantage of this functional approach lies in its countable, finite number of principles that are at work in organizations that can be used for targeted and focused research on OC aetiology.

This is not to say that previous approaches to understanding OC aetiology are to be dismissed; however, based on the underlying VSM principles, as applied in this thesis, it becomes increasingly possible to ask relevant distinctive questions and helps differentiate detrimental from only annoying incidents. An example may shed light on this issue: Knowing that – from a cybernetic point of view – an important co-ordination function has failed or is defective in an organizational area (because an increase of frictional losses or in Beer's terms "oscillation" is observed) makes the analyst look deeper into that system 2 function. S/he may find out that, for example, a conflict be-

tween exponents hinders effective co-ordination, training of one exponent is insufficient or that an adverse incentive scheme produces such frictional loss. Dissolving the conflict would then restore the system 2 function. Not all conflicts are of organizational relevance; purely personal conflicts from a cybernetic point of view are not relevant (nevertheless, they may spread and become relevant); if conflicts, however, affect viable parts of an organization, then VSM analysis or a VSM-aware management will draw attention to such areas and allow building-up effects and thus a potential subsequent OC to be pre-empted.

One difficulty in OC research is the subliminal latent development of OC throughout an organization and the associated (early) OC detection problem. The findings of this thesis show that defective homeostats, i.e. control and regulation (management) functions, are responsible for the later onset of OC. Due to the close interconnectedness of such homeostats in organizations[31], local limitations of self-corrective abilities and ill-defined monitoring with management bodies[32], OC may cumulatively build-up.

Finally, the *VSM itself was tested* in this project. By evaluating two groups of organizations, a crisis and a non-crisis group, on the basis of the VSM concepts, the model's explanatory power was corroborated. The fact of some outliers with low viability scores and no crisis (or vice-versa) can be explained, for example, as not-yet crisis cases or by the fact that, although viable, systems are not immortal, only depending on speed, extent, kind (quality) or duration of change they undergo.

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[31] Similar to the notion of "close coupling", which deals with interconnected value adding processes and, in terms of OC, with domino effects promoting critical developments.

[32] Supported by one of three "i" (ignorance, inertia, incompetence) which are typical defects of management homeostats.

7.7 Future Research

From the insights of this project, it can be concluded that the potential of the viable system model for further insights in the areas of crisis prevention and crisis pre-emption has not yet been realized. Respective initiatives can benefit from the models' still underestimated potential.

This research project contributes to both, a better understanding of organizational crises and organizational viability as well. Future endeavours in crisis research may consider the systemic character of organizational crisis and build on this knowledge when developing effective e.g. early warning, crisis management or crisis recovery models. Furthermore, the systemic characteristics of organizational crisis suggest that important insights into the dynamic relationships between management action and organizational crisis contributors and triggers can be gained by investigating the interplay of important homeostats and information flows.

Further research on the VSM *functions* in the mathematical sense of the word could enhance understanding and acceptance of VSM theory. Beer concentrated so much on the applicability and topological presentation of the VSM that he failed to openly and transparently set forth the basis and underpinnings of the model. Research on these VSM basics could enhance and widen the reputation of the VSM and, at the same time, allow for its further development.

Future research is also envisaged to *standardize* the viability assessment done in this research project in a sample of 135 organizations. In order to allow valid *individual* assessments (of an organization), test theory suggests that the test results (here: the resulting system viability scores) have to be compared to either a threshold value (criterion oriented interpretation) or to a reference population (norm oriented interpretation). This can be done by researching respective threshold-values for either item scores or population classes.

Both approaches require a representative sample of organizations to be assessed that exhibits the same numerical proportion of non-crisis and crisis organizations as in the population, using the questionnaire of this dissertation project. Based on this sample, cut-off values can be derived in two ways: either to arrive at score-percentiles of crisis-proneness on the basis of which an assessed organization could be positioned within a reference group; or to arrive at threshold-values of item scores, which would allow a comparison of individual test results with a normalized criterion scale.

8 REFERENCES

References

Abatecola, G. (2012). Interpreting corporate crises: Towards a co-evolutionary approach. *Futures, 44*(10), 860–869.

Altman, E. I. (1984). The success of business failure prediction models. *Journal of Banking & Finance, 8*(2), 171–198.

Altman, E. I., & Hotchkiss, E. (2006). *Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt* (3. ed.). Hoboken, NJ: Wiley.

Ansoff, I. (1975). Managing Strategic Surprise by Response to Weak Signals. *California Management Review, 1975*(vol. XVIII no. 2), 21–33.

Appelbaum, S. H., Keller, S., Alvarez, H., & Bédard, C. (2012). Organizational crisis: lessons from Lehman Brothers and Paulson & Company. *International Journal of Commerce & Management, 22*(4), 286–305.

Argenti, J. (1976). *Corporate collapse: The causes and symptoms*. London: McGraw-Hill.

Argyris, C., & Schön, D. A. (1996). *Organizational learning* (Reprinted with corr.). *Organization development series*. Reading, Mass: Addison-Wesley Pub.

Ashby, W. R. (1956). *An introduction to Cybernetics*. London: Chapman & Hall Ltd.

Ashby, W. R. (1960). *Design for a Brain: The origin of adaptive behaviour* (2nd edition). New York: John Wiley & Sons.

Astrachan, C. B., Patel, V. K., & Wanzenried, G. (2014). A comparative study of CB-SEM and PLS-SEM for theory development in family firm research. *Innovative and Established Research Methods in Family Business, 5*(1), 116–128.

Auspurg, K., Hinz, T., Liebig, S., & Sauer, C. (2009). Experimentelle Befunde zu komplexen Settings in Faktoriellen Surveys. *Methoden und Instrumente der Sozialwissenschaften, 2*(2), 23–39.

Balcaen, S., & Ooghe, H. (2006). 35 years of studies on business failure: an overview of the classic statistical methodologies and their related problems. *The British Accounting Review, 38*(1), 63–93.

Balduck, A.-L., & Buelens, M. (2008). *A Two-Level Competing Values Approach to Measure Nonprofit Organizational Effectiveness*. Working Paper (No. 510). Gent. Retrieved from

Gent University, Faculteit Economie en Bedrijfskunde website: http://wps-feb.ugent.be/Papers/wp_08_510.pdf

Ballon, E. (2013). *Erste Bewertung einer Folgenabschätzung der Europäischen Kommission. Vorschlag der Kommission für eine Verordnung über Insolvenzverfahren: Folgenabschätzung für einen Vorschlag der Kommission für eine Verordnung des Europäischen Parlaments und des Rates zur Änderung der Verordnung (EG) Nr. 1346 / 2000 über Insolvenzverfahren.*

Beer, S. (1967). *Cybernetics and management* (2nd ed.). London: English Universities P.

Beer, S. (1974). Immanent Forms of Imminent Crisis. *INFOR, 12*(3), 318–330.

Beer, S. (1984). The Viable System Model: its provenance, development, methodology and pathology. *Journal of the Operational Research Society, 1984*(35), 7–26.

Beer, S. (1994a). *Brain of the firm: The managerial cybernetics of organization ; companion volume to "The heart of enterprise"* (2.ed., paperback). Chichester u.a: Wiley.

Beer, S. (1994b). *The heart of enterprise: The managerial cybernetics of organization ; companion volume to BRAIN OF THE FIRM*. Chichester u.a: Wiley.

Beer, S. (2004). *Diagnosing the system for organizations companion volume to Brain of the firm and The heart of enterprise* (Repr.). Chichester [u.a.]: Wiley.

Ben-Eli, M. (2009, July). *The Cybernetics of Crisis and the Challenge of Sustainability.* Malik Management Center St. Gallen, St. Gallen. Retrieved from http://integralleadershipreview.com/4564-feature-article-the-cybernetics-of-crisis-and-the-challenge-of-sustainability/

Bill Richardson. (1995). Paradox management for crisis avoidance. *Management Decision, 33*(1), 5–18.

Blöse, J. (2006). *Unternehmenskrisen: Ursachen, Sanierungskonzepte, Krisenvorsorge, Steuern*. Berlin: E. Schmidt.

Boin, A., & Lagadec, P. (2000). Preparing for the future: Critical Challenges in Crisis Management. *Journal of Contingencies and Crisis Management, 8*(4), 185–191.

Bretz, M. (2015). *Unternehmensinsolvenzen in Europa Jahr 2014/15*. Creditreform Wirtschaftsforschung (Unternehmensinsolvenzen in Europa). Neuss/Wien.

Brickley, J. A., Smith, C. W., & Zimmerman, J. L. (2009). *Managerial economics and organizational architecture* (5. ed., internat. student ed.). Boston: McGraw-Hill/Irwin.

Burns-Nurse, J. E. (2002). *Organisational Crisis - Is there such a thing?* Working paper. Dortmund, Germany.

Cameron, K. (1980). Critical questions in assessing organizational effectiveness. *Organizational Dynamics, 9*(2), 66–80.

Cameron, K. S., Whetten, D. A., & Kim, M. U. (1987). Organizational Dysfunctions of Decline. *The Academy of Management Journal, 30*(1), 126–138.

Campbell, N. A., Reece, J. B., & Markl, J. (2006). *Biologie* (6., überarb. Aufl., [2. Aufl. der dt. Übers., geringfügig überarb. Nachdr.]). *Bc : Biologie*. München [u.a.]: Pearson Studium.

Carmeli, A., & Schaubroek, J. (2008). Organisational Crisis-Preparedness: The Importance of Learning from Failures. *Long Range Planning, 41*(2), 177–196.

Clemson, B. (1984). *Cybernetics: A new management tool*. *Cybernetics and systems series: Vol. 4*. Tunbridge Wells, Kent: Abacus Press.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Conant, R. C., & Ashby, W. R. EVERY GOOD REGULATOR OF A SYSTEM MUST BE A MODEL OF THAT SYSTEM. *Int. J. Systems Sci., 1*(2), 89–97.

Creditreform. (2014). *Corporate Insolvencies in Europe, 2013/14*. Neuss Deutschland.

Crisan Tran, C.-I. (2006). *Beers Viable System Model und die Lebensfähigkeit von Jungunternehmen. eine empirische Untersuchung* (Dissertation). Universität St. Gallen HSG, St. Gallen.

Dawkins, R., & Vogel, S. (2008). *Geschichten vom Ursprung des Lebens: Eine Zeitreise auf Darwins Spuren*. Berlin: Ullstein Buchverlage.

Deming, E. W. (1982). *Out of crisis*. Cambridge, Mass.: Massachusetts Institute of Technology.

Devargas, M. (1999). Survival is not compulsory: an introduction to business continuity planning. *Computers & Security, 18*(1), 35–46. 8

Diekmann, A. (2010). *Empirische Sozialforschung: Grundlagen, Methoden, Anwendungen* (Orig.-Ausg., [21.] Aufl., vollst. überarb. u. erw. Neuausg). *Rororo: 55678 : Rowohlts Enzyklopädie*. Reinbek bei Hamburg: Rowohlt-Taschenbuch-Verl.

Dubrovski, D. (2007). Management Mistakes as Causes of Corporate Crises: Countries in Transition. *Managing Global Transitions, 5*(4), 333–354.

EFQM. (2016). European Foundation for Quality Management EFQM. Retrieved from www.efqm.org

Ernst, A. (2008). Krisen. Retrieved from http://www.hls-dhs-dss.ch/textes/d/D26214.php

Espejo, R., & Reyes, A. (2011). *Organizational systems: Managing complexity with the viable system model*. Heidelberg, New York: Springer.

Etzioni, A. (1960). Two Approaches to Organizational Analysis: A Critique and a Suggestion. *Administrative Science Quarterly, 5*(2), 257–278.

Fink, S. (2002). *Crisis management: Planning for the inevitable*. Lincoln: iUniverse.

Fischbacher-Smith, D. (2014). Organisational ineffectiveness: environmental shifts and the transition to crisis. *Journal of Organizational Effectiveness: People and Performance, 1*(4), 423–446.

Frost, B. (2005). *Lebensfähigkeit vom Communities of Practice im organisationalen Kontext* (Dissertation). Universität St. Gallen HSG, St. Gallen.

Gemoll, W., & Vretska, K. (2010). *Griechisch-deutsches Schul- und Handwörterbuch* (10., völlig neu bearb. Aufl., [Nachdr.] / bearb. und durchges. von Therese Aigner .). München [u.a.]: Oldenbourg.

Girolami, D., Schmidt, R., & Adesso, G. (2015). Towards quantum cybernetics. *Annalen der Physik, 527*(9-10), 757–764.

Gomez, P., & Probst, G. (1995). *Die Praxis des ganzheitlichen Problemlösens: Vernetzt denken, unternehmerisch handeln, persönlich überzeugen*. Bern: P. Haupt.

Greiner, L. (1972). Evolution and revolution as organizations grow: A company's past has clues for management that are critical to future success. *Harvard Business Review,* 37–46.

Greve, G. (2010). *Organizational burnout: Das versteckte Phänomen ausgebrannter Organisationen* (1st ed.). Wiesbaden: Gabler.

Grösser, S. N. (2012). *Systemic management for intelligent organizations: Concepts, models-based approaches and applications*. Heidelberg, New York: Springer.

Hafen, M. (2007). *Grundlagen der systemischen Prävention: Ein Theoriebuch für Lehre und Praxis* (1st ed.). Heidelberg: Verl. für Systemische Forschung im Carl-Auer-Verl.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equations modeling (PLS-SEM)*. Los Angeles: SAGE.

Hales, S., Hough, A., Hoverstadt, P., Mettam, D., & Searles, J. (2010). *The Organisational Maturity Model (OMM): Building Viable Organisations* (No. v5). Manchester. Retrieved

from SCiO website: http://www.scio.org.uk/sites/default/files/A4-OMM-Manager-v5-Web.pdf

Hambrick, D. C., & D'Aveni, R. A. (1988). Large Corporate Failures as Downward Spirals. *Administrative Science Quarterly, 33*(1), 1–23.

Haq, M. (2015). A Comparative Analysis of Qualitative and Quantitative Research Methods and a Justification for Adopting Mixed Methods in Social Reserach. *International Journal of Multiple Research Approaches, 9*(2).

Heine, K., & Rindfleisch, H. (2013). Organizational decline: A synthesis of insights from organizational ecology, path dependence and the resource-based view. *Journal of Organizational Change Management, 26*(1), 8–28.

Henning, W., Rózsa, J., Radner, B., & Murday, J. (2010). *Einsatz externer Sanierungsberater aus Bankensicht: Ergebnisse einer Studie zum Thema "Work-out und Sanierungsberatung"* (KSI Krisen-, Sanierungs- und Insolvenzberatung Wirtschaft - Recht - Steuern No. 02/2010). Berlin. Retrieved from KSIdigital.de website: www.ksidigital.de

Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., . . . Calantone, R. J. (2014). Common Beliefs and Reality About PLS: Comments on Ronkko and Evermann (2013). *Organizational Research Methods.*

Henseler, J., Ringle, C., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115-135.

Hermann, C. F. (1963). Some Consequences of Crisis Which Limit the Viability of Organizations. *Administrative Science Quarterly*, (8), 61–82.

Heylighen, F., & Joslyin, C. (2002). Cybernetics and Second-Order Cybernetics. In R. A. Meyers (Ed.), *Encyclopedia of physical science and technology* (3rd ed., pp. 155–169). San Diego: Acad. Press.

Heylighen, F., Joslyn, C., & Turchin, V. (1999). What are Cybernetics and Systems Science? Retrieved from http://pespmc1.vub.ac.be/cybswhat.html

Hofmänner, S. (2007). *Die Effizienz der öffentlichen Hand: Drei empirische Beiträge über die Verwendung der schweizerischen Staatsausgaben. Die schweizerischen öffentlichen Ausgaben im internationalen Vergleich Eine Untersuchung der Effizienz öffentlicher Leistungen der Schweizer Kantone und Gemeinden Anreize uns Wechselwirkungen zwischen der schweizerischen Invalidenversicherung und der Sozialhilfe* (Dissertation), Basel.

Holopainen, M., & Toivonen, M. (2012). Weak signals: Ansoff today. *Futures, 44*(3), 198–205.

Hoverstadt, P. (2009). *The fractal organization: Creating sustainable organisations with the viable system model*. Chichester: Wiley.

Hoverstadt, P. (2010). The Viable System Model. In M. Reynolds & S. Holwell (Eds.), *Systems Approaches to Managing Change: A Practical Guide* (pp. 87–133). London: Springer London.

Hurrle, B., & Kieser, A. (2005). Sind Key Informats verlässliche Datenlieferanten? [Are rey informants reliable data sources?]. *Die Betriebswirtschaft Business Administration Review, 65*(6), 584–602.

Hutzschenreuter, T., & Griess-Nega, T. (2006a). *Krisenmanagement: Grundlagen, Strategien, Instrumente* (1. Aufl.). Wiesbaden: Gabler.

Hutzschenreuter, T., & Griess-Nega, T. (2006b). *Krisenmanagement: Grundlagen, Strategien, Instrumente* (1. Aufl.). Wiesbaden: Gabler.

Hwang, P., & Lichtenthal, D. J. (2000). Anatomy of Organizational Crises. *Journal of Contingencies and Crisis Management, 8*(3), 129–140.

Jackson, M. C. (1988). AN APPRECIATION OF STAFFORD BEER'S 'VIABLE SYSTEM' VIEWPOINT ON MANAGERIAL PRACTICE. *Journal of Management Studies, 25*(6), 557–573.

Jackson, M. C. (2000). *Systems approaches to management*. New York: Kluwer Academic/Plenum.

Jaroschinsky, A., & Werner, H. (2015). *Studie zum deutschen Restrukturierungsmarkt: Marktentwicklung, Beauftragung und Positionierung von Restrukturierungsgesellschaften* (1. Aufl.). [Heidelberg]: Heidelberger Hochsch.-Verl.

Kaplan, R. S., & Norton, D. P. (2006). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment* (9. print.). Boston, Mass.: Harvard Business School Press.

Keating, C. B., Sousa-Poza, A., & Kovacic, S. (2005). Complex System Transformation: A System of Systems ENgingeering (SoSE) Perspective. *26th Annual National Conference of the American Society for Engineering Management 2005,* 200–207.

Kinzel, T. G. (2009). *Die Eignung des Z''-Score Modells nach Altman als Instrument der Insolvenzprognose: Eine Untersuchung der Prognostizierbarkeit der jüngsten europäischen Unternehmenskrisen*. München: GRIN Verlag.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). *Methodology in the social sciences*. New York: Guilford Press.

Kovoor-Misra, S., Clair, J. A., & Bettenhausen, K. L. (2001). Clarifying the Attributes of Organizational Crises. *Technological Forecasting and Social Change, 67*(1), 77–91.

Krystek, U., & Moldenhauer, R. (2007). *Handbuch Krisen- und Restrukturierungsmanagement*. Stuttgart: Kohlhammer.

Leonard, A. (1990/revised 2004). *Coming Concepts: The Cybernetic Glossary for new management*. unpulished. Retrieved from http://i2s.anu.edu.au/sites/default/files/unified-systems/cybernetic_glossary.pdf

Leonard, A. (1994). *The System Perspective: Methods and Models for the Future* (The Millenium Project; Futures Research Methodology). Tokyo.

Leonard, A. (2009a). The Viable System Model and Its Application to Complex Organizations. *Systemic Practice and Action Research, 22*(4), 223–233.

Leonard, A. (2009b, March). *The VSM Applied to Complex Organizations in Crisis*. Address to the 2nd Cwarel Isaf Institute Conference. Cwarel Isaf Institute, St. Gallen. Retrieved from www.allennaleonard.com/VSNCII.html

Lin, F., Liang, D., & Chen, E. (2011). Financial ratio selection for business crisis prediction. *Expert Systems with Applications, 38*(12), 15094–15102.

Logan, B. A. Crisis: A Catalyst for Organizational Transformation. In *26th Annual National Conference of the American Society for Engineering Management 2005* (pp. 264–271).

Malik, F. (2001). *Strukturmodell der lebensfähigen Unternehmung (VSM): The Viable System Model*. Seminardokumentation (No. 06.010.001 / 2). St. Gallen. Retrieved from http://www.malik-management.com/pdfs/vsm/strukturmodell_vsm_malik.pdf

Malik, F. (2008). *Strategie des Managements komplexer Systeme (Strategy of the Management of Complex Systems): Ein Beitrag zur Management-Kybernetik evolutionärer Systeme (A Contribution to Management.Cybernetics of Evolutionary Systems)*. Hochsch., Habil.-Schr.--St. Gallen, 1977. (Neuausg., 10. Aufl.). Bern: Haupt.

Marsen, S. (2014). "Lock the Doors": Toward a Narrative-Semiotic Approach to Organizational Crisis. *Journal of Business and Technical Communication, 28*(3), 301–326.

Masak, D. (2007). *SOA?: Serviceorientierung in Business und Software* (1st ed.). Berlin: Springer.

McKinley, W., Latham, S., & Braun, M. (2013). Organizational Decline and Innovation: Turnarounds and Downward Spirals. *Academy of Management Review, 39*(1), 88–110.

Mellahi, K., & Wilkinson, A. (2004). Organizational failure: a critique of recent research and a proposed integrative framework. *International Journal of Management Reviews, 5*(1), 21–41.

Mitroff, I. I., & Anagnos, G. (2001). *Managing crisis before they happen: What every executive and manager needs to know about crisis management*. New York: Amacom.

Mitroff, I. I., Pauchant, T. C., & Shrivastava, P. (1988). The Structure of Man-made Organizational Crises: Conceptual and Empirical Issues in the Development of a General Theory of Crisis Management. *Technological Forecasting and Social Change, 33,* 83–107.

Mitroff, I. I., Shrivastava, P., & Udwadia, F. E. (1987). Effective Crisis Management. *The Academy of Management Executive (1987-1989)*, (Vol. 1, No. 4 (Nov., 1987)), pp. 283-292.

Mittelstaedt, R. E. (2005). *Will your next mistake be fatal?: Avoiding the chain of mistakes that can destroy*. Upper Saddle River N.J.: Wharton School Pub.

Müller, J. (2013). *Turnaround: Ein Leitfaden für Manager und Verwaltungsräte*. *NZZ Libro*. Zürich: Verlag Neue Zürcher Zeitung.

Nunamaker, J. F, Jr., Weber, E. S., Smith, C. A. P., & Chen, M. (Eds.) 1988. *Crisis planning systems: tools for intelligent action*. System Sciences, 1988. Vol.III. Decision Support and Knowledge Based Systems Track, Proceedings of the Twenty-First Annual Hawaii International Conference on. : Vol. *3*.

Nystrom, P. C., & Starbuck, W. H. (1984). To avoid organizational crises, unlearn. *Organizational Dynamics, 12*(4), 53–65.

O'Brien, R. M. (2007). A Caution Regarding Rules of Thumb for Variance Inflation Factors. *Quality & Quantity, 41*(5), 673-690.

Pauchant, T. C., & Mitroff, I. I. (1992). *Transforming the crisis-prone organization: Preventing individual, organizational, and environmental tragedies* (1st). San Francisco: Jossey-Bass Publishers.

Pearson, C. M., & Clair, J. A. (1998). Reframing Crisis Management. *The Academy of Management Review, 23*(1), 59–76.

Peltola, S. (2012). Can an old firm learn new tricks? A corporate entrepreneurship approach to organizational renewal. *Business Horizons, 55*(1), 43–51.

Pfeifer, W. (Ed.). (2010). *Etymologisches Wörterbuch des Deutschen*. Koblenz: Ed. Kramer im Rhenania-Buchversand.

Pickering, A. (2010). *The cybernetic brain: Sketches of another future*. Chicago: University of Chicago Press.

Pinkwart, A. (1992). *Chaos und Unternehmenskrise*. Wiesbaden: Gabler.

Platt, H. D. (2004). *Principles of corporate renewal* (2. ed.). Ann Arbor, Mich.: Univ. of Michigan Press.

Popper, K. R., & Keuth, H. (2005). *Logik der Forschung* (11. Aufl.). *Gesammelte Werke in deutscher Sprache / Karl R. Popper: Vol. 3*. Tübingen: Mohr Siebeck.

Probst, G., & Raisch, S. (2005). Organizational crisis: The logic of failure. *Academy of Management Perspectives, 19*(1), 90–105.

Richardson, K. A. (2005). *Managing organizational complexity: Philosophy, theory and application*. Greenwich, Conn: Information Age Publ.

Ringle, C. & Wende, S. (2015). Standardized Root Mean Square Residual (SRMR): The standardized root mean square residual (SRMR) is a goodness of (model) fit measure for PLS-SEM. Retrieved from http://www.smartpls.de/documentation/srmr

Ringle, C. M., Sarstedt, M., & Straub, D. W. (2012). A Critical Look an the Use of PLS-SEM in *MIS Quarterly*. *MIS Quarterly, 36*(1), iii-8.

Ringle, C. M., Wénde, S., & Becker, J.-M. (2015). SmartPLS 3. Boenningstedt: SmartPLS GmbH. Retrieved from www.smartpls.com

Rosa, N. (2016). *Barriers to the diffusion of the Viable System Model* (Dissertation Master of Science Technology Management). University College London, London.

Rosenthal, U., Boin, A., & Comfort, L. K. (2001). *Managing crises: Threats, dilemmas, opportunities*. Springfield, Ill.: Charles C Thomas.

Roux-Dufort, C. (2009). The Devil Lies in Details! How Crises Build up Within Organizations. *Journal of Contingencies and Crisis Management, 2009*(17), 4–11.

Rudolph, J. W., & Repenning, N. P. (2002). Disaster Dynamics: Understanding the Role of Quantity in Organizational Collapse. *Administrative Science Quarterly, 47*(1), 1.

Rüegg-Stürm, J., & Grand, S. (2015). *The St. Gallen Management Model: English translation of the fourth generation of the German text* (1., English translation of the second German edition 2015). Bern: Haupt.

Sabir, I. (2014). *A Holistic Emotions Measurement Model. Using the Viable System Model to Diagnose Workforce Emotions* (Doctoral Thesis). The University of Hull, Hull.

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2014). PLS-SEM: Looking Back and Moving Forward. *Long Range Planning, 47*(3), 132–137.

Scheffer, M., Bascompte, J., Brock, W. A., Brovkin, V., Carpenter, S. R., Dakos, V., . . . Sugihara, G. (2009). Early-warning signals for critical transitions. *Nature, 461*(7260), 53–59. doi:10.1038/nature08227

Schulenburg, N. (2008). *Entstehung von Unternehmenskrisen: Eine evolutionstheoretische Erklärung*. Wiesbaden: Betriebswirtschaftlicher Verlag Gabler.

Schwaninger, M. (2000). *Das Modell Lebensfähiger Systeme: Ein Strukturmodell für organisationale Intelligenz, Lebensfähigkeit und Entwicklung*. Diskussionsbeitrag No. 35 (Diskussionsbeiträge des Instituts für Betriebswirtschaft an der Universität St. Gallen No. 35). St. Gallen. Retrieved from Universität St. Gallen HSG; Institut für Betriebswirtschaft website:
http://www.tranquilla.ch/serveattachment/984e4202df9fe30e5459fa815a35c6dc/D35.pdf

Schwaninger, M. (2006a). Design for Viable Organizations: the Diagnostic Power of the Viable System Model. *Kybernetes, 7/8*(35), 955-966.

Schwaninger, M. (2006b). Theories of Viability: a Comparison. *Systems Research and Behavioral Science, 2006 // 23*(23 // 3), 337–347.

Schwaninger, M. (2009). *Intelligent organizations: Powerful models for systemic management* (2nd ed.). Berlin, Heidelberg: Springer.

Schwaninger, M., & Grösser, S. N. (2010). Crisis Prevention - What Is Necessary to Avoid the Next Crisis? In *Cybernetics and Systems 2010 - Proceedings of the 20th European Meeting on Cybernetics and Systems Research : 20th European Meeting on Cybernetics and Systems Research 2010* (pp. 315–320). Vienna, Austria: Austrian Society for Cybernetic Studies.

Schwaninger, M., & Scheef, C. (2016). A Test of the Viable System Model: Theoretical Claim vs. Empirical Evidence. *Cybernetics and Systems, 47*(7), 544–569.

Seifert, C. (2006). *The Genesis of Organisational Crisis. A Theory-Building Approach* (Dissertation). University of Otago, Dunedin.

Senge, P. M. (2011). *Die fünfte Disziplin / The Fifth Discipline.: Kunst und Praxis der lernenden Organisation / The Art and Practice of the Learning Organization* (11., völlig überarbeitete und aktualisierte Auflage). *Systemisches Management*. Stuttgart: Schäffer-Poeschel.

Siddiqui, Z. (2013). *How to Write a Business Case Study*. Ann Arbor. Retrieved from Univesity of Michigan William Davidson Institute website: http://globalens.com/DocFiles/PDF/cases/Preview/GL1429140P.pdf

Stocker, G. (2006). *Avoiding the corporate death spiral: Recognizing and eliminating the signs of decline*. Milwaukee: American Society for Quality, Quality Press.

Thom, R. (1975). *Structural Stability and Morphogenesis: An outline of a general theory of models. The Advanced Book Program The Mathematical physics monograph series*. Reading, Mass.: W. A. Benjamin.

Trahms, C. A., Ndofor, H. A., & Sirmon, D. G. (2013). Organizational Decline and Turnaround: A Review and Agenda for Future Research. *Journal of Management, 39*(5), 1277–1307.

Tulloch, S. (1997). *The Oxford dictionary and thesaurus*. Oxford: Oxford University Press.

Turner, B. A. (1976). The Organizational and Interorganizational Development of Disasters. *Administrative Science Quarterly, 21*(3), 378–397.

Ulrich, H. (1970). *Gesammelte Schriften: Die Unternehmung als produktives soziales System*. Bern: P. Haupt.

Wallace, M., & Wray, A. (2009). *Critical reading and writing for postgraduates*. *Sage study skills*. Los Angeles: SAGE.

Watzlawick, P., Weakland, J. H., & Fisch, R. (2009). *Lösungen: Zur Theorie und Praxis menschlichen Wandels* (7., unveränd). Bern: Huber.

Weiber, R., & Mühlhaus, D. (2010). *Strukturgleichungsmodellierung: Eine anwendungsorientierte Einführung in die Kausalanalyse mit Hilfe von AMOS, SmartPLS und SPSS*. *Springer-Lehrbuch*. Berlin, Heidelberg: Springer.

Weick, K. E. (2011). Organizing for Transient Reliability: The Production of Dynamic Non-Events: Organizing for Transient Reliability. *Journal of Contingencies and Crisis Management, 19*(1), 21–27.

Weick, K. E., & Sutcliffe, K. M. (2007). *Managing the unexpected: Resilient performance in an age of uncertainty* (2nd ed.). San Francisco: Jossey-Bass.

Welsch, C. (2009). *Organisationale Trägheit und ihre Wirkung auf die strategische Früherkennung von Unternehmenskrisen* (1st ed.). Wiesbaden: Gabler.

Wicks, D. (2001). Institutionalized Mindsets of Invulnerability: Differentiated Institutional Fields and the Antecedents of Organizational Crisis. *Organization Studies, 22*(4), 659–692.

Wirz, C. c. (2009, January 29). Wenn die Krise auch eine Maschine ist: Chinesisch fürs Poesiealbum. *Neue Zürcher Zeitung*, p. 15.

Wu, W.-W. (2010). Beyond business failure prediction. *Expert Systems with Applications, 37*(3), 2371–2376.

Zammuto, R. F. (1984). A comparison of multiple constituency models of organizational effectiveness. *Academy of Management. The Academy of Management Review (pre-1986), 9*(000004), 606.

Zelewski, S. (1994). *Unternehmenskrisen und Konzepte zu ihrer Bewältigung*. Arbeitsbericht Nr. 3 (Arbeitsberichte No. 3). Leipzig. Retrieved from Universtät Leipzig, Institut für Produktionswirtschaft und Industrielle Informationswirtschaft website: http://www.pim.wiwi.uni-due.de/uploads/tx_itochairt3/publications/arbeitsbericht_nr_3.pdf

9 APPENDIX

9.1 Questionnaire

Translation only

Expert Survey

as a Part of

the Doctoral Dissertation of Michael D. Pfiffner

on the Subject of

Viability of Organizations
and the Occurrence of Organizational Crisis.

An Organizational Cybernetic Approach Towards the
Early Recognition and Prevention of Organizational Crises.

(working title of the thesis at the time of the survey)

001 / _____

Zurich, Januar 30th 2015

Contact: Michael D. Pfiffner Bergstrasse 15 8400 Winterthur Switzerland +41 52 203 02 63
m.d.pfiffner@student.bradford.ac.uk / mbpmail@bluewin.ch

1. Purpose of the Survey

This survey aims to gather information on the **control functions of organizations or organizational units (OU**, i. e. organizations which are parts of bigger organizations).

The term **organization** here refers to firms, not for profit organizations or authorities. The term **control function** encompasses everything which produces control effects; this may include entire organizational units (see 3. / 4.).

2. Subject of the Survey

You, as the expert, **assess** a specific **organization**, which belongs to **either** the **crisis** **or** the **non-crisis group**:

Group 1: Organizations which **did clearly undergo an existential organizational crisis**

Group 2: Organizations which **did clearly not undergo an existential organizational crisis.**

Membership to one of these two groups is determined by separate questions below. **Crises due to natural disaster, acts of violence, sabotage, accidents or the like are not of interest here.**

Per questionnaire (this document) only data on the control functions of **one specific organization** or **OU** well known to the expert is collected.

3. Content of the Survey

You assess the control functions of the organization or OU in question. These **control functions need not accord with the formal logic of the hierarchy or organigram** (BoD, EB, CEO, COO, QM, department heads, group heads, etc.) of the organization; they may be ensured otherwise, **e. g. informally** or by **rules or systems**.

In smaller organizations, it is possible that several control functions may be performed by the same person or body (n:1). Otherwise in bigger organizations, it is possible that one control function is performed by more than one person or body (1:n).

The survey is based on **six control functions that** you will repeatedly encounter. The functions are explained in the following table as well as again in the questions themselves.

Control functions

1	**Service units (SU): Operational service providers** such as service centres, specialist departments, plants, branches, subsidiaries, project teams, profit centres, etc. with the function of control and provision of goods or services.	→This is where the "product" or service is created and the **value is added**.
2	**Coordination:** Regulations, instructions, systems, standards, coordination bodies, reservation systems, manuals, schedules, coordination meetings, interface rules, quality, safety, overarching production schedules, etc.	→Minimizes **frictional losses** between the activities of SUs. Sets the **rules for co-operation**.
3	**Operational Management:** Management in charge, management functions which optimize the Organisation's or OU's overall results and performance and which allocate the available resources.	→Manages the organization (all entities) in global terms from an **overall perspective**
3a	**Audit:** Sources of information of the Operational Management for **independent management information** (i.e. uninfluenced by line interests)	→Provides neutral **information**, checks **conditions** and **states**.
4	**Environment analysis and planning for the future:** Observing, forecasting and interpreting the overall environment, reflection of environment vis-a-vis the organisation's self-representation (model), developing courses of action.	→Integrates external and internal view and suggests / initiates **changes; Planning units**
5	**Normative Management, Identity:** Determines the purpose, direction, norms and values of the organisation's fundamental governance (pilot control), defines the organisation's target state; final decision, closure.	→Coins the identity, sets **overall parameters**, takes **final decisions** where necessary.

4. Important Notice

4.1. Precedence of Function over Function Holder

- In the context of the present case, it is **irrelevant** who or what (person, function or body) ultimately **performs the control functions**.
- **What we are concerned with here is whether and how well they are performed.**

4.2. Assessed Point in Time

Please asses the condition of the organization or OU…

- **…for crisis organizations approx. in the year before the outbreak of the existential crisis.**
- **…for non-crisis organizations approx. in the last year before today.**

4.3. Assessed Organizational Level

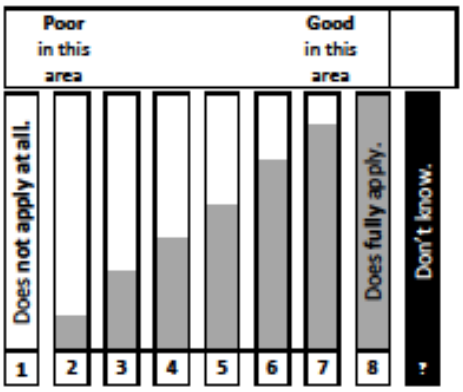
Please asses the control functions of the organization or OU…

- …steadily **within** the same chosen **organizational level** (e.g. division, branch, enterprise group), **i.e. constantly from the same perspective.**

4.4. Type of Question and Type of Assessment

- The questions are formulated as **idealized situations.**
- You as the expert assess on the same scale, **how completely and how good** the organization did or does correspond to this ideal situation.
- The scale covers the whole spectrum from flawed to mediocre and good. It is, therefore, possible that your assessment in most areas will end up either at one end or the other of the scale.
- **Rating Scale:**

Situation description



4.5. Comprehensive View

Please asses **all control effects**. Therefore, please do always take into account both…

- **formal/official** control functions, properties and structures **as well as**
- **informal/unofficial** (i.e. "unofficial channels") control functions, properties and structures

Where ever significant control effects occur *in* the organization, please consider it in your assessment.

5. Basic Information (please fill in the fields)

Information on the Organization at the *assessed point in time:*		Information on the Expert:		Information on the Survey:	
a Long-term identification No. of the organization		**i** Identification No. of the expert		**n** Date of assessment	
b Age of the organization **(Minimum of 5 years)***		**j** Run No. of assessment of expert.		**o** Date of crisis break out	approx.
c Number of employees **(Minimum of 20 empl.)***		**k** Identification of bank		**p** Assessed point in time ..... years before today **(Maximum 4)***	
d Actual sales or budget in million CHF (Swiss Francs)		**l** Time required for assessment in minutes		**q** Assessed level of organization: Entire organization	
e Dynamic of organization's environment 0 = rather low 1 = rather high		**m** **Knowledge of the expert about the case from 1 to 6 (Minimum of 5 required).***		or Organizational unit (OU), please indicate organization level such as division, department or the like: _____	
f Management qualification 0 = rather low 1 = rather high					
g Sector; 1 = Services, 2 = Production, 3 = Gov/NPO					
h Bank-Rating from 1 (bad) to 100 (excellent)					

*** Please observe the minima and maxima with the points**
- **b** Minimum age of the organization of 5 years
- **c** Number of employees minimum 20
- **m** Knowledge of the expert about the case min. 5 out of 6
- **p** Point in time of assessment maximum 4 years ago.

For these values a tolerance of ± 10% applies.

Group membership of the assessed organization Please tick as appropriate:	Crisis-Organization: The organization clearly <u>has undergone an existential crisis</u>.		<u>Non-Crisis</u>-Organization: The organization clearly has <u>NOT undergone</u> an existential crisis.	

6. Expert Survey

To what extent do you think that the following statements are applicable to the organizations assessed?	Poor in this area							Good in this area	
Please use the assessment scales to evaluate **whether and to what degree the situation descriptions are applicable**. Where you cannot make an assessment, please make assumptions based on what you consider to be suitable indicators and observations. Please use the "Don't know" column only when it is really impossible for you to make an assumption – in most cases however, an assumption is possible. **It is possible that your assessment in most areas will end up either at one end of the scale or the other.**	Does not apply at all.							Does fully apply.	Don't know.
Thank you for **unambiguous** assessments (ticks): ☒	1	2	3	4	5	6	7	8	?

1	Autonomous Operational Service Provision Units (SU)	1	2	3	4	5	6	7	8	?
	In the organization there are one or several operational units (hereinafter: service units SUs) **that...**									
1.1	... **have sole** (i.e. exclusive) **responsibility for logically definable market areas** (e. g. by customers or products or geographical areas, etc.). If there is only one market area, **the interface to the market is clearly defined** (e. g. sales *or* production *or* project management).	☐	☐	☐	☐	☐	☐	☐	☐	■
1.2	...**are competent, able and flexible to serve their market areas comprehensively** (in conjunction with third parties where necessary).	☐	☐	☐	☐	☐	☐	☐	☐	■

2	Coordination Inputs	1	2	3	4	5	6	7	8	?
	To prevent friction losses and inefficiencies between SUs, there are effective coordination functions (for mutual approval, to determine responsibilities, boundaries, allocation, regulation, codes of behaviour, criteria for decision making, etc.), in relation to...									
2.1	...**internal and external activities of SUs** (e. g. sales areas, schedules, communication, methods, standards, policies, exchange of information, etc.).	☐	☐	☐	☐	☐	☐	☐	☐	■
2.2	...**resources that are jointly used by the SUs, i.e. shared resources** (e.g. reservations of systems, devices, spaces, funds, capacities, etc.).	☐	☐	☐	☐	☐	☐	☐	☐	■

2	Coordination Outputs	1	2	3	4	5	6	7	8	?
	By constant performance monitoring, the normal parameters of the organisation (actual and target control parameters, completion of tasks, quality, quantities, etc.) are ...									
2.3	...**monitored on an ongoing basis and deviations were identified.**	☐	☐	☐	☐	☐	☐	☐	☐	■
2.4	**Significant deviations always trigger regulatory measures or, where necessary, adjustments to the system.**	☐	☐	☐	☐	☐	☐	☐	☐	■

3	Operational Management Streamlining	1	2	3	4	5	6	7	8	?
	Operational management monitors and optimises the performance of the organisation as a whole - including its own - by means of controlling measures, allocation of resources and changes to the parameters **with regard to...**									
3.1	...**the overall performance** (effectiveness, productivity, gains, support services, quality or the like) **constantly or frequently and systematically** (i.e. following appropriate rules).	☐	☐	☐	☐	☐	☐	☐	☐	■
3.2	...**opportunities, risks and synergies; these are always recognized, utilized or respectively dealt with appropriately.**	☐	☐	☐	☐	☐	☐	☐	☐	■

	Poor in this area						Good in this area		
	Does not apply at all.							Does fully apply.	Don't know.
	1	2	3	4	5	6	7	8	?
3 Operational Management Information									
Operational Management (OM) gathers...									
3.3 ...internal (i.e. concerning the organisation itself) and external (concerning the market and environment) information for management and decision-making from a suitable reporting system on an ongoing basis.	☐	☐	☐	☐	☐	☐	☐	☐	■
3.4 ... repeatedly information independent from line management regarding the state of the organization (condition, load, stress, error potential) by means of surprise or random sporadic audits, surveys, direct conversations or analyses. If necessary, OM triggers regulative measures or system adjustments.	☐	☐	☐	☐	☐	☐	☐	☐	■
4 Environment analysis and planning for the future Observation	1	2	3	4	5	6	7	8	?
The organisation's overall environment (political, environmental, technological, social, legal, sectoral, market, etc.) is constantly or frequently ...									
4.1 ...monitored with regard to the qualities (properties) and developments that are relevant or potentially relevant to the organisation.	☐	☐	☐	☐	☐	☐	☐	☐	■
4.2 This is done with an eye on the current situation, possible scenarios and future developments (future circumstances and dynamism).	☐	☐	☐	☐	☐	☐	☐	☐	■
4 Environment analysis and planning for the future Courses of Action	1	2	3	4	5	6	7	8	?
Those tasked with environment analysis and planning for the future (e.g. observation of distribution and procurement markets, R&D, organisational development, trend analysis, monitoring of technology and regulation, market research, customer panels, financial market, media and sectoral research)...									
4.3 ...combine information from the environment, from their organisation and from corporate policy (self-image, target state, parameters, freedom of action), recognise opportunities and risks and from these develop timely scenarios and courses of action (plans).	☐	☐	☐	☐	☐	☐	☐	☐	■
4.4 ...frequently initiate necessary - if need be - controversial adjustment discussions with the exponents of Operational Management and of the Normative Management, with it contributing to the further development of the organization.	☐	☐	☐	☐	☐	☐	☐	☐	■
5 Purpose, Identity and Normative Management	1	2	3	4	5	6	7	8	?
Normative Management ensures...									
5.1 ...availability of binding guidelines and a target state definition both informing the organization as a whole (pilot control, identity)	☐	☐	☐	☐	☐	☐	☐	☐	■
5.2 ...that those in charge of Environment analysis and planning for the future and Operational Management co-operate in a way that yields the best possible development of the organization.	☐	☐	☐	☐	☐	☐	☐	☐	■
5.3 Normative Management is willing and able, when necessary, to take final decisions (closure of the decision making process) or decisions that would fundamentally change the system (change of basic mission and self-conception).	☐	☐	☐	☐	☐	☐	☐	☐	■

		Poor in this area						Good in this area		
		Does not apply at all						Does fully apply		Don't know
		1	2	3	4	5	6	7	8	?
P	**Principles Recursion**	1	2	3	4	5	6	7	8	?
P.1	SU's overarching units (e.g. company, division, holding company) are themselves able to act as independent organizations at their level with all necessary functions which can fulfil their remit independently.	☐	☐	☐	☐	☐	☐	☐	☐	■
P.2	SU's subordinate units (e.g. department, area, group) are themselves able to act independently at their level with all necessary functions and can fulfil their remit independently.	☐	☐	☐	☐	☐	☐	☐	☐	■
P	**Principles Repertoire**	1	2	3	4	5	6	7	8	?
	The ability to react (i.e. the capability to react in a timely, appropriate and formally correct manner), scope of action (the set of suitable behaviours) and the range of offerings (available solutions to a problem) of the organisation or the management are always sufficient to...									
P.3	...master expected internal (organisation) or external (environment, customer, competitor, stakeholder) issues or challenges, if need be with the aid of third party services.	☐	☐	☐	☐	☐	☐	☐	☐	■
P.4	...master even unexpected internal or external issues or challenges, if need be with the aid of third party services.	☐	☐	☐	☐	☐	☐	☐	☐	■
P	**Principles Communication**	1	2	3	4	5	6	7	8	?
P.5	All units of the organization are networked at all times by efficient (sufficient capacity) communications channels or processes or intermediaries ("official channels", willingness to interact, telecoms). These channels are neutral; i.e. communication, contents and cooperation are neither disrupted nor distorted by the transmission process over these channels.	☐	☐	☐	☐	☐	☐	☐	☐	■

Caution: Scale does change here. →

V Viability

The organization assessed...		1 perishing	2 in jeopardy	3 ailing	4 faltering	5 survivable	6 sustainably viable	7 thriving
V.1	...- at *the assessed point in time* - in terms of its **degree of vulnerability** (i. e. risk level) can be accurately characterised as...	☐	☐	☐	☐	☐	☐	☐

		1 Does not apply at all.	2 Does not really apply.	3 Does apply to a degree.	4 Does largely apply.	5 Does mostly apply.	6 Does substantially apply.	7 Does absolutely apply.
V.2	.....- at *the assessed point in time* - is in a position to adapt to even rapidly occurring and/or very changeable circumstances.	☐	☐	☐	☐	☐	☐	☐
V.3	...is...- at *the assessed point in time* - fundamentally in a position to maintain its existence for an unlimited period of time.	☐	☐	☐	☐	☐	☐	☐

K Crisis Independence

There were or are...		1 Does not apply at all.	2 Does not really apply.	3 Does apply to a degree.	4 Does largely apply.	5 Does mostly apply.	6 Does substantially apply.	7 Does absolutely apply.
K.1	...periods where the organisation's existence was/is under threat and the outcome was/is in doubt (≥ 50% collapse : ≤ 50% survival).	☐	☐	☐	☐	☐	☐	☐
K.2	...situations or developments that the organisation would not have survived without external help (of third parties).	☐	☐	☐	☐	☐	☐	☐
K.3	Did the organisation cease to exist as an independent unit?	No ☐			Yes ☐			

K Crisis Capability

There were or are situations or periods where the organisation for an uncomfortably long period was/is...		1	2	3	4	5	6	7
K.4	...unable to fulfil its core mandate (purpose).	☐	☐	☐	☐	☐	☐	☐
K.5	...unable to meet its financial obligations.	☐	☐	☐	☐	☐	☐	☐
K.6	There were/are periods where the demands faced by the organisation massively exceed(ed) its capabilities, resulting in it spinning out of control or the leadership of the organization losing control.	☐	☐	☐	☐	☐	☐	☐

K Crisis Type

In the case of a Crisis Organization (otherwise leave the fields empty): The crisis...			
K.7	...situation develops/developed slowly, continuously, insidiously.	No ☐	Yes ☐
K.8	...situation was triggered (not caused) by a particular key event.	No ☐	Yes ☐
K.9	What was this key event? (Please insert descriptive key word(s)).		

You have reached the end of the survey.
Many thanks for your assessment. Your data and details will remain anonymous and confidential.

9.2 Statistical Data Measurement Model

9.2.1 Internal Consistency Reliability

9.2.1.1 Cronbach's Alpha

Cronbach's Alpha					
Constructs	Original Sample (O)	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	P Values (0.01)
1 OpUnit	1,000	1,000			
2 CoIn	1,000	1,000			
2 CoOut	0,884	0,884	0,023	38,336	0,000
3 OpManOpt	0,914	0,914	0,015	59,141	0,000
3 OptManInf	0,845	0,845	0,029	29,042	0,000
4 EnvPlanAda	0,916	0,916	0,019	47,976	0,000
4 EnvPlanObs	1,000	1,000			
5 PurIdNorm	0,855	0,853	0,025	33,706	0,000
6 PrinCom	1,000	1,000			
6 PrinRec	1,000	1,000			
6 PrinRep	0,568	0,562	0,082	6,897	0,000
Crisis	0,943	0,943	0,009	106,252	0,000
Metasystem	0,958	0,957	0,005	176,350	0,000
Operations	0,904	0,904	0,015	59,845	0,000
P	0,763	0,762	0,032	23,920	0,000
S1	1,000	1,000			
S2	0,895	0,894	0,017	51,839	0,000
S3	0,926	0,925	0,011	81,721	0,000
S4	0,908	0,907	0,015	61,692	0,000
S5	0,855	0,853	0,025	33,706	0,000
System Viability	0,966	0,966	0,004	261,486	0,000

9.2.2 Convergent Validity

9.2.2.1 Indicator Reliability / Outer Loadings

Outer Loadings					
Indicators	Original Sample (O)	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	P Values (0.01)
1.2 CapOp <- 1 OpUnit	1,000	1,000	0,000		
2.2 ResouCo <- 2 CoIn	1,000	1,000	0,000		
2.3 OutputCo <- 2 CoOut	0,947	0,947	0,009	99,961	0,000
2.4 ActionCo <- 2 CoOut	0,946	0,946	0,010	93,897	0,000
3.1 PerfOpt <- 3 OpManOpt	0,959	0,924	0,256	3,751	0,000
3.2 CircOpt <- 3 OpManOpt	0,960	0,925	0,256	3,753	0,000
3.3 DecInf <- 3 OptManInf	0,933	0,933	0,011	81,380	0,000
3.4 IndepInf <- 3 OptManInf	0,929	0,929	0,012	77,088	0,000
4.2 TimeEnv <- 4 EnvPlanObs	1,000	1,000	0,000		
4.3 SoluEnv <- 4 EnvPlanAda	0,960	0,960	0,008	114,840	0,000
4.4 AdaptEnv <- 4 EnvPlanAda	0,961	0,961	0,009	112,846	0,000
5.1 GoalNorm <- 5 PurIdNorm	0,895	0,894	0,023	38,650	0,000
5.2 HomeNorm <- 5 PurIdNorm	0,896	0,896	0,016	54,627	0,000
5.3 DecNom <- 5 PurIdNorm	0,851	0,848	0,029	29,683	0,000
K.1 Fifty <- Crisis	0,850	0,848	0,035	24,085	0,000
K.2 ThirdPart <- Crisis	0,878	0,878	0,029	30,027	0,000
K.6 OutContr <- Crisis	0,836	0,836	0,036	23,356	0,000
P.2 DownRec <- 6 PrinRec	1,000	1,000	0,000		
P.4 UnexRev <- 6 PrinRep	0,885	0,889	0,016	54,784	0,000
P.5 NetCom <- 6 PrinCom	1,000	1,000	0,000		
V.1i Endangi <- Crisis	0,924	0,925	0,014	65,353	0,000
V.2i Flexi <- Crisis	0,867	0,867	0,023	38,330	0,000
V.3i Existi <- Crisis	0,936	0,936	0,011	88,622	0,000
f ManQual <- 6 PrinRep	0,778	0,769	0,062	12,544	0,000

9.2.2.2 Average Variance Extracted (AVE)

AVE					
Constructs	Original Sample (O)	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	P Values (0.01)
1 OpUnit	1,000	1,000	0,000		
2 CoIn	1,000	1,000	0,000		
2 CoOut	0,896	0,896	0,018	48,860	0,000
3 OpManOpt	0,921	0,921	0,013	70,735	0,000
3 OptManInf	0,866	0,866	0,022	40,108	0,000
4 EnvPlanAda	0,923	0,923	0,016	57,345	0,000
4 EnvPlanObs	1,000	1,000	0,000		
5 PurIdNorm	0,776	0,774	0,030	26,074	0,000
6 PrinCom	1,000	1,000	0,000		
6 PrinRec	1,000	1,000	0,000		
6 PrinRep	0,694	0,693	0,042	16,448	0,000
Crisis	0,779	0,779	0,026	29,460	0,000
Metasystem	0,727	0,726	0,024	29,744	0,000
Operations	0,777	0,777	0,027	28,983	0,000
P	0,589	0,591	0,030	19,349	0,000
S1	1,000	1,000	0,000		
S2	0,826	0,826	0,023	35,616	0,000
S3	0,818	0,818	0,022	36,655	0,000
S4	0,845	0,844	0,021	40,962	0,000
S5	0,776	0,774	0,030	26,032	0,000
System Viability	0,644	0,644	0,024	26,448	0,000

9.2.3 Discriminant Validity

9.2.3.1 Cross Loadings

Cross Loadings												
Constructs / Indicators	1 OpUnit	2 CoIn	2 CoOut	3 OpMan Opt	3 Opt ManInf	4 Env PlanObs	4 Env PlanAda	5 PurId Norm	6 Prin Rec	6 Prin Rep	6 Prin Com	Crisis
1.2 CapOp	1,0000	0,7383	0,6664	0,7045	0,6804	0,6599	0,5840	0,6707	0,6299	0,5828	0,6327	-0,6097
2.2 ResouCo	0,7383	1,0000	0,7522	0,7421	0,6776	0,6975	0,6319	0,6604	0,4590	0,5030	0,6909	-0,5063
2.3 OutputCo	0,6014	0,7250	0,9473	0,7624	0,7393	0,7484	0,6756	0,6641	0,4495	0,5401	0,5946	-0,5001
2.4 ActionCo	0,6608	0,6992	0,9461	0,7874	0,7477	0,7711	0,7357	0,7577	0,5716	0,6170	0,7237	-0,6220
3.1 PerfOpt	0,6395	0,7024	0,7899	0,9590	0,7865	0,6952	0,7947	0,7548	0,5078	0,5505	0,6459	-0,5495
3.2 CircOpt	0,7122	0,7217	0,7810	0,9602	0,8104	0,7649	0,8217	0,8282	0,6357	0,6614	0,7623	-0,7037
3.3 DecInf	0,6511	0,6597	0,7861	0,7965	0,9327	0,6693	0,6957	0,6510	0,4900	0,5207	0,6651	-0,5008
3.4 IndepInf	0,6146	0,6007	0,6739	0,7516	0,9285	0,6623	0,6980	0,7010	0,4760	0,5308	0,6147	-0,5055
4.2 TimeEnv	0,6599	0,6975	0,8024	0,7610	0,7155	1,0000	0,7569	0,7482	0,5073	0,5849	0,6800	-0,5973
4.3 SoluEnv	0,5220	0,6077	0,7029	0,8045	0,7154	0,7239	0,9604	0,7572	0,4381	0,5566	0,6529	-0,5206
4.4 AdaptEnv	0,5998	0,6063	0,7287	0,8137	0,7231	0,7301	0,9607	0,7883	0,5391	0,5880	0,7062	-0,5923
5.1 GoalNorm	0,6480	0,5943	0,6726	0,7046	0,6802	0,6448	0,6223	0,8947	0,5814	0,5286	0,6318	-0,5353
5.2 HomeNorm	0,5567	0,6083	0,7044	0,8044	0,7004	0,7681	0,8829	0,8964	0,4545	0,6124	0,6670	-0,5597
5.3 DecNom	0,5673	0,5407	0,6040	0,6684	0,5326	0,5589	0,6151	0,8507	0,5465	0,5907	0,5807	-0,5982
P.2 DownRec	0,6299	0,4590	0,5389	0,5963	0,5191	0,5073	0,5088	0,5980	1,0000	0,5123	0,5444	-0,5570
P.4 UnexRev	0,5642	0,4332	0,5489	0,6054	0,5207	0,5446	0,5638	0,5983	0,5243	0,8851	0,5681	-0,7174
f ManQual	0,3882	0,4075	0,4642	0,4294	0,4115	0,4187	0,4143	0,4843	0,3029	0,7780	0,3395	-0,3738
P.5 NetCom	0,6327	0,6909	0,6959	0,7341	0,6880	0,6800	0,7075	0,7120	0,5444	0,5608	1,0000	-0,6510
V.1i Endangi	-0,5374	-0,4762	-0,5965	-0,6339	-0,5343	-0,5569	-0,5584	-0,6085	-0,4956	-0,6241	-0,6308	0,9244
V.2i Flexi	-0,5563	-0,4573	-0,5502	-0,5837	-0,5036	-0,5719	-0,5560	-0,6154	-0,5369	-0,6305	-0,5967	0,8670
V.3i Existi	-0,5456	-0,4644	-0,5695	-0,6207	-0,5054	-0,5739	-0,5843	-0,6216	-0,5536	-0,6322	-0,5924	0,9358
K.1 Fifty	-0,4389	-0,3666	-0,4276	-0,5101	-0,3774	-0,4478	-0,3757	-0,4826	-0,4119	-0,5620	-0,4438	0,8502
K.2 ThirdPart	-0,5618	-0,4175	-0,4633	-0,5323	-0,4028	-0,4793	-0,4476	-0,4981	-0,4765	-0,5667	-0,5168	0,8781
K.6 OutContr	-0,5780	-0,4831	-0,5018	-0,5617	-0,5121	-0,5118	-0,5102	-0,5366	-0,4570	-0,5775	-0,6382	0,8358

9.2.3.2 Fornell-Larcker Criterion 1/2

Fornell-Larcker Criterion (1)											
	1 OpUnit	2 CoIn	2 CoOut	3 Op-ManOpt	3 Opt-ManInf	4 Env PlanAda	4 Env PlanObs	5 Pur IdNorm	6 Prin Com	6 Prin Rec	6 Prin Rep
1 OpUnit	1,0000										
2 CoIn	0,7383	1,0000									
2 CoOut	0,6664	0,7522	0,9467								
3 OpManOpt	0,7045	0,7421	0,8185	0,9596							
3 OptManInf	0,6804	0,6776	0,7853	0,8321	0,9306						
4 EnvPlanAda	0,5840	0,6319	0,7452	0,8423	0,7488	0,9605					
4 EnvPlanObs	0,6599	0,6975	0,8024	0,7610	0,7155	0,7569	1,0000				
5 PurIdNorm	0,6707	0,6604	0,7507	0,8250	0,7260	0,8045	0,7482	0,8809			
6 PrinCom	0,6327	0,6909	0,6959	0,7341	0,6880	0,7075	0,6800	0,7120	1,0000		
6 PrinRec	0,6299	0,4590	0,5389	0,5963	0,5191	0,5088	0,5073	0,5980	0,5444	1,0000	
6 PrinRep	0,5828	0,5030	0,6109	0,6319	0,5649	0,5958	0,5849	0,6549	0,5608	0,5123	0,8333
Crisis	-0,6097	-0,5063	-0,5923	-0,6535	-0,5406	-0,5794	-0,5973	-0,6398	-0,6510	-0,5570	-0,6804
Metasystem	0,7233	0,7447	0,8511	0,9446	0,8830	0,9211	0,8494	0,9220	0,7763	0,6063	0,6719
Operations	0,8541	0,8969	0,9375	0,8496	0,8066	0,7447	0,8154	0,7812	0,7500	0,6001	0,6367
P	0,7324	0,6566	0,7385	0,7824	0,7063	0,7252	0,7092	0,7861	0,8278	0,7910	0,8706
S1	1,0000	0,7383	0,6664	0,7045	0,6804	0,5840	0,6599	0,6707	0,6327	0,6299	0,5828
S2	0,7347	0,8916	0,9691	0,8405	0,7936	0,7489	0,8128	0,7634	0,7372	0,5425	0,6084
S3	0,7240	0,7430	0,8383	0,9607	0,9534	0,8333	0,7724	0,8126	0,7440	0,5845	0,6268
S4	0,6466	0,6935	0,8106	0,8631	0,7815	0,9713	0,8906	0,8321	0,7398	0,5387	0,6275
S5	0,6698	0,6608	0,7514	0,8265	0,7274	0,8080	0,7505	0,9999	0,7127	0,5961	0,6552
System Viability	0,7933	0,8024	0,8940	0,9356	0,8729	0,8825	0,8558	0,9055	0,8188	0,6695	0,7350

Fornell-Larcker-Criterion 2/2

Fornell-Larcker Criterion (2)										
	Crisis	Meta-system	Oper-ations	P	S1	S2	S3	S4	S5	System Viability
Crisis	0,8826									
Metasystem	-0,6648	0,8526								
Operations	-0,6360	0,8733	0,8817							
P	-0,7624	0,8209	0,7918	0,7675						
S1	-0,6097	0,7233	0,8541	0,7324	1,0000					
S2	-0,5969	0,8640	0,9803	0,7536	0,7347	0,9089				
S3	-0,6265	0,9561	0,8660	0,7795	0,7240	0,8545	0,9047			
S4	-0,6206	0,9501	0,8150	0,7628	0,6466	0,8170	0,8609	0,9191		
S5	-0,6393	0,9237	0,7814	0,7858	0,6698	0,7641	0,8141	0,8354	0,8808	
System Viability	-0,7101	0,9822	0,9329	0,8890	0,7933	0,9151	0,9461	0,9256	0,9065	0,8023

9.3 Statistical Data Structural Model

9.3.1 Collinearity Assessment

9.3.1.1 Variance Inflation Factor (VIF)

VIF's by indicator

	VIF		VIF		VIF		VIF
1.2 CapOp	1.0000	3.2 CircOpt	6.0055	5.1 GoalNorm	3.4384	V.2i Flexi	3.5602
1.2 CapOp	2.4192	3.3 DecInf	2.1544	5.1 GoalNorm	2.3634	V.3i Existi	6.6000
1.2 CapOp	3.5698	3.3 DecInf	3.1648	5.2 HomeNorm	2.3762	f ManQual	1.1862
1.2 CapOp	1.0000	3.3 DecInf	4.4262	5.2 HomeNorm	6.6249	f ManQual	1.2207
2.2 ResouCo	1.0000	3.3 DecInf	3.5619	5.2 HomeNorm	7.6532	f ManQual	1.4568
2.2 ResouCo	3.0591	3.4 IndepInf	2.1544	5.2 HomeNorm	2.3762		
2.2 ResouCo	2.3113	3.4 IndepInf	2.7464	5.3 DecNom	1.8580		
2.2 ResouCo	3.8702	3.4 IndepInf	3.0329	5.3 DecNom	2.1415		
2.3 OutputCo	2.6886	3.4 IndepInf	2.9303	5.3 DecNom	2.4723		
2.3 OutputCo	3.1817	4.2 TimeEnv	1.0000	5.3 DecNom	1.8580		
2.3 OutputCo	3.1764	4.2 TimeEnv	2.3418	K.1 Fifty	3.0801		
2.3 OutputCo	4.5903	4.2 TimeEnv	3.0669	K.2 ThirdPart	3.5879		
2.4 ActionCo	2.6886	4.2 TimeEnv	4.0884	K.6 OutContr	2.6204		
2.4 ActionCo	3.1792	4.3 SoluEnv	3.5028	P.2 DownRec	1.0000		
2.4 ActionCo	2.9482	4.3 SoluEnv	3.8304	P.2 DownRec	1.5826		
2.4 ActionCo	4.6702	4.3 SoluEnv	5.3583	P.2 DownRec	2.2617		
3.1 PerfOpt	3.4325	4.3 SoluEnv	5.4736	P.4 UnexRev	1.1862		
3.1 PerfOpt	4.1364	4.4 AdaptEnv	3.5028	P.4 UnexRev	1.7265		
3.1 PerfOpt	5.2488	4.4 AdaptEnv	3.9040	P.4 UnexRev	2.2139		
3.1 PerfOpt	4.5838	4.4 AdaptEnv	5.0301	P.5 NetCom	1.0000		
3.2 CircOpt	3.4325	4.4 AdaptEnv	5.7065	P.5 NetCom	1.7084		
3.2 CircOpt	4.4112	5.1 GoalNorm	2.3634	P.5 NetCom	3.3741		
3.2 CircOpt	7.5491	5.1 GoalNorm	2.9045	V.1i Endangi	5.0846		

VIF's by value

Variance Inflation Factor (VIF)

Construct	VIF	Construct	VIF	Construct	VIF	Construct	VIF
5.2 HomeNorm	7,6532	4.3 SoluEnv	3,8304	3.4 IndepInf	2,9303	5.3 DecNom	1,8580
3.2 CircOpt	7,5491	K.2 ThirdPart	3,5879	5.1 GoalNorm	2,9045	P.4 UnexRev	1,7265
5.2 HomeNorm	6,6249	1.2 CapOp	3,5698	3.4 IndepInf	2,7464	P.5 NetCom	1,7084
V.3i Existi	6,6000	3.3 DecInf	3,5619	2.4 ActionCo	2,6886	P.2 DownRec	1,5826
3.2 CircOpt	6,0055	V.2i Flexi	3,5602	2.3 OutputCo	2,6886	f ManQual	1,4568
4.4 AdaptEnv	5,7065	4.3 SoluEnv	3,5028	K.6 OutContr	2,6204	f ManQual	1,2207
4.3 SoluEnv	5,4736	4.4 AdaptEnv	3,5028	5.3 DecNom	2,4723	f ManQual	1,1862
4.3 SoluEnv	5,3583	5.1 GoalNorm	3,4384	1.2 CapOp	2,4192	P.4 UnexRev	1,1862
3.1 PerfOpt	5,2488	3.2 CircOpt	3,4325	5.2 HomeNorm	2,3762	2.2 ResouCo	1,0000
V.1i Endangi	5,0846	3.1 PerfOpt	3,4325	5.2 HomeNorm	2,3762	P.5 NetCom	1,0000
4.4 AdaptEnv	5,0301	P.5 NetCom	3,3741	5.1 GoalNorm	2,3634	1.2 CapOp	1,0000
2.4 ActionCo	4,6702	2.3 OutputCo	3,1817	5.1 GoalNorm	2,3634	1.2 CapOp	1,0000
2.3 OutputCo	4,5903	2.4 ActionCo	3,1792	4.2 TimeEnv	2,3418	P.2 DownRec	1,0000
3.1 PerfOpt	4,5838	2.3 OutputCo	3,1764	2.2 ResouCo	2,3113	4.2 TimeEnv	1,0000
3.3 DecInf	4,4262	3.3 DecInf	3,1648	P.2 DownRec	2,2617		
3.2 CircOpt	4,4112	K.1 Fifty	3,0801	P.4 UnexRev	2,2139		
3.1 PerfOpt	4,1364	4.2 TimeEnv	3,0669	3.4 IndepInf	2,1544		
4.2 TimeEnv	4,0884	2.2 ResouCo	3,0591	3.3 DecInf	2,1544		
4.4 AdaptEnv	3,9040	3.4 IndepInf	3,0329	5.3 DecNom	2,1415		
2.2 ResouCo	3,8702	2.4 ActionCo	2,9482	5.3 DecNom	1,8580		

The table indicates VIF's are given per indicator for every hierarchical construct level. Accordingly every indicator appears four times with the respective VIF.

9.3.1.2 Structural Model Path Coefficients

Structural (or inner) Model Relationsships	Original Sample (O)	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	p Values (99 %)	Confi-dence Interval Low	Confi-dence Interval Up
S1 -> 1 OpUnit	1,0000	1,0000	0,0000			1,0000	1,0000
S2 -> 2 CoIn	0,8916	0,8914	0,0174	51,2613	0,0000	0,8432	0,9288
S2 -> 2 CoOut	0,9691	0,9690	0,0050	194,0226	0,0000	0,9548	0,9797
S3 -> 3 OpManOpt	0,9607	0,9260	0,2549	3,7683	0,0002	-0,9603	0,9753
S3 -> 3 OptManInf	0,9534	0,9529	0,0089	106,9010	0,0000	0,9257	0,9715
S4 -> 4 EnvPlanAda	0,9713	0,9712	0,0044	221,2077	0,0000	0,9584	0,9809
S4 -> 4 EnvPlanObs	0,8906	0,8900	0,0186	47,8687	0,0000	0,8378	0,9288
S5 -> 5 PurIdNorm	0,9999	0,9999	0,0000	25.064,6063	0,0000	0,9998	1,0000
P -> 6 PrinCom	0,8278	0,8297	0,0321	25,7962	0,0000	0,7251	0,9003
P -> 6 PrinRec	0,7910	0,7911	0,0379	20,8956	0,0000	0,6714	0,8731
P -> 6 PrinRep	0,8706	0,8718	0,0220	39,5807	0,0000	0,8058	0,9176
Operations -> S1	0,8541	0,8527	0,0250	34,1243	0,0000	0,7800	0,9077
Operations -> S2	0,9803	0,9801	0,0032	305,3286	0,0000	0,9713	0,9875
Metasystem -> S3	0,9561	0,9561	0,0078	122,6007	0,0000	0,9335	0,9731
Metasystem -> S4	0,9501	0,9502	0,0085	111,1791	0,0000	0,9238	0,9680
Metasystem -> S5	0,9237	0,9236	0,0133	69,4856	0,0000	0,8848	0,9531
System Viability -> Operations	0,9329	0,9328	0,0109	85,7134	0,0000	0,9726	0,9891
System Viability -> Metasystem	0,9822	0,9821	0,0032	310,0823	0,0000	0,8989	0,9549
System Viability -> P	0,8890	0,8893	0,0175	50,9304	0,0000	0,8374	0,9298
System Viability -> Crisis	-0,7101	-0,7125	0,0447	15,8701	0,0000	-0,8177	-0,5944

9.3.1.3 Coefficients of Determination (R^2 value)

Effect sizes f^2 in the last column: own addition ($f^2 = R^2 / 1-R^2$) after Cohen (1992) p. 157

R^2

	Original Sample (O)	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	P Values	Confidence Interval Low	Confidence Interval Up	Effect Size (f^2)
1 OpUnit	1,0000	1,0000	0,0000			1,0000	1,0000	
2 CoIn	0,7949	0,7949	0,0309	25,7240	0,0000	0,7110	0,8627	3.88
2 CoOut	0,9391	0,9390	0,0097	97,1064	0,0000	0,9117	0,9597	15.42
3 OpManOpt	0,9229	0,9224	0,0131	70,2758	0,0000	0,8826	0,9513	11.97
3 OptManInf	0,9089	0,9081	0,0170	53,5998	0,0000	0,8570	0,9439	9.98
4 EnvPlanAda	0,9434	0,9433	0,0085	110,6710	0,0000	0,9186	0,9621	16.67
4 EnvPlanObs	0,7932	0,7924	0,0330	24,0413	0,0000	0,7018	0,8626	3.84
5 PurIdNorm	0,9999	0,9999	0,0001	12.532,8115	0,0000	0,9995	1,0000	
6 PrinCom	0,6852	0,6894	0,0528	12,9860	0,0000	0,5258	0,8105	2.18
6 PrinRec	0,6257	0,6273	0,0591	10,5819	0,0000	0,4508	0,7623	1.67
6 PrinRep	0,7579	0,7605	0,0381	19,8960	0,0000	0,6494	0,8420	3.13
Crisis	0,5043	0,5097	0,0633	7,9608	0,0000	0,3506	0,6668	1.02
Metasystem	0,9647	0,9646	0,0062	155,1561	0,0000	0,9460	0,9783	27.34
Operations	0,8702	0,8703	0,0202	42,9929	0,0000	0,8080	0,9119	6.71
P	0,7902	0,7911	0,0309	25,5445	0,0000	0,7012	0,8645	3.77
S1	0,7295	0,7278	0,0424	17,1856	0,0000	0,6084	0,8239	2.70
S2	0,9610	0,9607	0,0063	152,7768	0,0000	0,9433	0,9752	24.65
S3	0,9141	0,9141	0,0149	61,3816	0,0000	0,8715	0,9470	10.65
S4	0,9026	0,9030	0,0162	55,7187	0,0000	0,8533	0,9371	9.27
S5	0,8533	0,8532	0,0245	34,8591	0,0000	0,7829	0,9085	5.82

9.3.1.4 Standardized Root Mean Square Residual (SRMR)

Outcome	SRMR
Common factor models	0.0920
Composite models	0.0886

9.3.1.5 Predictive Relevance: Stone-Geissler's Q^2 Value

Latent Variables	Q^2	Latent Variables	Q^2	Latent Variables	Q^2	Latent Variables	Q^2	Latent Variables	Q^2
1 OpUnit	0,9998	3 OptManInf	0,7859	6 PrinCom	0,6786	Metasystem	0,6998	S1	0,7260
2 CoIn	0,7907	4 EnvPlanAda	0,8695	6 PrinRec	0,6154	Operations	0,6749	S2	0,7920
2 CoOut	0,8412	4 EnvPlanObs	0,7898	6 PrinRep	0,5156	P	0,4581	S3	0,7467
3 OpManOpt	0,8494	5 PurIdNorm	0,7748	Crisis	0,3856	S1	0,7260	S4	0,7618
S5	0,6562	System Viability	n.a.						

9.3.1.6 Heterogeneity Welch-Satterthwait Test

Multi-Group-Analysis Crisis vs. Non-Crisis Organizations:

Path Coefficient	Path Coeffi-cients-diff (| CY - NC |)	t-Value (CY vs NC)	p-Value (CY vs NC)	Path Coefficient	Path Coeffi-cients-diff (| CY - NC |)	t-Value (CY vs NC)	p-Value (CY vs NC)
Metasystem -> S3	0.0083	0.3971	0.6926	System Viability -> Crisis	0.1379	0.8575	0.3944
Metasystem -> S4	0.0189	0.8440	0.4016	System Viability -> Metasystem	0.0018	0.2431	0.8087
Metasystem -> S5	0.0482	1.2451	0.2177	System Viability -> Operations	0.0910	2.0853	0.0412
Operations -> S1	0.1622	1.5859	0.1179	System Viability -> P	0.0773	0.3289	0.7434
Operations -> S2	0.0247	2.1508	0.0355				
P -> 6 PrinCom	0.2725	0.7774	0.4400				
P -> 6 PrinRec	0.6172	2.0075	0.0493				
P -> 6 PrinRep	0.0971	0.9648	0.3383				
S1 -> 1 OpUnit	0.0000	0.4161	0.6787				
S2 -> 2 CoIn	0.1465	2.3322	0.0230				
S2 -> 2 CoOut	0.0354	2.7161	0.0085				
S3 -> 3 OpManOpt	0.0300	0.0543	0.9569				
S3 -> 3 OptManInf	0.0436	1.5362	0.1296				
S4 -> 4 EnvPlanAda	0.0141	1.3558	0.1799				
S4 -> 4 EnvPlanObs	0.0867	1.4121	0.1630				
S5 -> 5 PurIdNorm	0.0006	1.2206	0.2270				

Multi-Group-Analysis Banker's Assessments vs. Consultant's assessments:

Path Coefficient	Path Coeffi-cients-diff (| Bankers - Consult-ants |)	t-Value (Bankers vs Consult-ants)	p-Value (Bankers vs Consult-ants)	Path Coefficient	Path Coeffi-cients-diff (| Bankers - Consult-ants |)	t-Value (Bankers vs Consult-ants)	p-Value (Bankers vs Consult-ants)
Metasystem -> S3	0.022	1.440	0.155	System Viability -> Crisis	0.238	2.142	0.037
Metasystem -> S4	0.011	0.588	0.559	System Viability -> Metasystem	0.010	1.487	0.143
Metasystem -> S5	0.009	0.384	0.702	System Viability -> Operations	0.024	0.975	0.334
Operations -> S1	0.031	0.449	0.655	System Viability -> P	0.105	1.811	0.076
Operations -> S2	0.006	0.561	0.577				
P -> 6 PrinCom	0.124	1.289	0.203				
P -> 6 PrinRec	0.010	0.147	0.884				
P -> 6 PrinRep	0.051	1.205	0.233				
S1 -> 1 OpUnit	0.000	0.482	0.632				
S2 -> 2 CoIn	0.039	0.732	0.467				
S2 -> 2 CoOut	0.009	0.726	0.471				
S3 -> 3 OpManOpt	0.015	0.742	0.461				
S3 -> 3 OptManInf	0.017	1.046	0.300				
S4 -> 4 EnvPlanAda	0.010	1.320	0.192				
S4 -> 4 EnvPlanObs	0.063	1.596	0.116				
S5 -> 5 PurIdNorm	0.000	0.743	0.461				

9.4 Curriculum Vitae of the Author (as per 2017)

Full Name	Michael D. PFIFFNER	
Address	Bergstrasse 15, 8400 Winterthur, Switzerland	
Country	Switzerland	
Nationality	Swiss	
Language	German (mother tongue) , English, French	
Date of Birth	9. October 1963	
Marital Status	Married, one daughter (1999)	
Contact	mbpmail@bluewin.ch	
Employment	Project Director with BHP - Hanser & Partner AG in Zurich, numerous mandates, OC and non-OC cases	since 2001
	Turnaround Manager as CEO of a Furniture Production and Interior Design Company in Switzerland	2000 – 2001
	Manager Marketing and Sales and Sales Promotion with a wholesale trading Company of the Angst & Pfister Group in Zurich	1996 – 2000
	CMO and Branch(es) Manager with AGI Group in the field of HVAC insulation and fire protection CEO of a spin-off trade company of the AGI Group	1991 – 1996
	CEO of a SME in the field of water protection technology	1989 – 1991
	Managing Clerk and Sales Representative in the field of HVAC with ELCO Energy Systems, Zurich.	1981 – 1989
Education	PhD: Doctoral Thesis, University of Utrecht, School of Governance, The Netherlands	2012 - 2017
	Postgraduate Education / Doctoral Training, MSc, University of Bradford, School of Management, UK	2009 – 2011
	MBA: Master of Business Administration, University of Rochester, NY, USA and University of Bern, Switzerland	1999 – 2001
	Post-graduate course in Marketing Management, University of St. Gallen HSG, Switzerland	1995 – 1996
	BSc BA: Bachelor of Science in Business Administration, Swiss Federal Diploma, University of Applied Sciences, Zurich, Switzerland	1990 – 1994
	Business School, Zurich, Switzerland	1979 - 1981