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Developing a Smart City Strategy by use of St. Gallen Management Model focused in Smart Mobility and Smart Environment

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Abstract. Cities are getting bigger and more crowded. This leads to an overuse of water-/ energy- resources and infrastructure, which are partly irreversible. In order to be a worth living place in the future, parts of a city have to change, e.g. housing, mobility, and supply of urban life, in harmony with nature and environment. For these changes a city, a so-called Smart City, needs a strategy. This paper will examine whether the St. Gallen Management Model (SGMM) can be a basis for the Smart City strategy process. For this purpose, the three sectors of the SGMM are analyzed in more detail and applied to the context of a Smart City, focusing on the power ranges Smart Mobility and Smart Environment. The analysis demonstrates that the transferability of the SGMM to the research application Smart City is well given, especially in the aspects stakeholders and environmental spheres of the sector environment and in the aspects frames of reference of the sector organization.

Keywords: Smart City, Strategies, SGMM, Smart Mobility, Smart Environment

1 Introduction

1.1 Motivation

A United Nations study shows that people have been moving to urban areas more and more since 1950. In 2050, 84.3% of the population in Germany will live in urban regions - for 2020, the value is 77.5% (United Nations, 2018). This change is followed by overloads in various parts of the city. For example, streets are crowded, which leads to high levels of congestion. The fresh water supply is insufficient, which is why fresh water has to be produced at great expense and wastewater has to be treated at great expense. The demand for energy is constantly increasing, which is why new and, above all, sustainable methods of generating electricity must be found. In addition, many city dwellers lead to high land use, increased consumption and pollution, of natural resources, increased air pollution and high noise emissions. These overloads are partly irreversible.

Overall, changes must take place in the areas of housing, mobility, and supply of urban life, which are in harmony with nature and environment. These changes will be expected to be shaped with the help of information and communication technologies (ICT) in order to consistently improve the quality of life of city dwellers. This redesigned type of city is called

a "Smart City" (Albino et al., 2015; Etezadzadeh, 2015; Gassmann et al., 2018).

1.2 Approach

For this context a strategy is needed to ensure that the transformation from a city to a smart city is successful. The strategy should fit the context of the application, here in particular mobility and environment.

This paper, therefore, deals with the question of what makes a successful strategy, which strategy makes sense for this context, and whether the St. Gallen Management Model is a suitable basis for the research area “Smart City”.

2 Theoretical Background

2.1 Strategic Management

Strategic management is defined as a "process which focuses on the formulation and implementation of strategies in [organizations]" (Welge et al., 2017). It is embedded between so-called normative management and operational management (Graf, 1999).

The normative management of an organization deals with both the main objectives of the organization and its norms, origins and principles in order to create value for the stakeholders. Thus, normative management creates the vision and mission of the organization and gives it an identity. In order to successfully realize the goals given by theoretical normative management, the organization has a strategic management in practice. It deploys resources based on the developments of the last years with the help of programs, structures, and systems using a scenario tree, so that new success potentials for the next years can be achieved. The main goal of operational management is to implement the input of normative and strategic management. Thus, this area includes all orders which will be handled with processes, cooperation, and performance in order to ensure that things are done in the visions’ way. (Bergmann & Bungert, 2013; Bleicher, 2011; Graf, 1999; Lombriser & Abplanalp, 2005)

There are various approaches to finally implement strategic management in practice. One approach is the interdisciplinary one. This is based on Charles Darwin's theory of evolution and follows the view that nothing can be controlled, but can be channeled and targeted, which is why this paper examine this further. An application model of the interdisciplinary (evolutionary) approach is the practice-oriented St. Gallen Management Model (SGMM). (Bea & Haas, 2016; Hungenberg, 2014)

2.1.1 St. Gallen Management Model

The SGMM offers the advantage that it can be changed at various positions, can be adapted to an organization without changing the core statement, and it reduces complexity enormously. For many years the condensed and clearly arranged third generation of the model was used. In 2017, this was replaced by the fourth generation, which is characterized by clearly separated sectors. In this paper, however, a combination of the third and fourth generation is presented, which integrates the advantages of both generations with respect to the topic of the paper. Consequently, all the advantages of the SGMM are achieved by the three main sectors: environment, organization, and management. All contributing factors are assigned to one of the sectors. These are shown in Figure 1 in blue, green, and orange, respectively. The external influences on the organization are included in the environment. The organization itself deals with the internal influences and the management sector handles the management of the organization. These relationships are presented in the following. (Rüegg-Stürm & Grand, 2017)

Sector: Environment This sector is subdivided into three aspects: environmental spheres, stakeholders, and resources. Environmental spheres provide the framework conditions for the organization and use according to this the resources. Exemplary environmental spheres

are society, nature, technology, or economy. Stakeholders either have a genuine claim on the organization, or have a representative function, or are affected in some way by the actions of the organization. Customers, dwellers, companies, or clubs are an example for this. The last aspect, the resources of an organization, are items or means that are brought to the organization by stakeholders on issues in order to share or exchange information about them. There are two types of resources: object-bound (like water, energy, or capital) and object-free resources (like know-how, trust, or patents). (Rüegg-Stürm & Grand, 2017, 2018)

Sector: Organization This sector is also subdivided into three aspects: types, frames of reference, and processes. Firstly, describing the six different types of organizations: companies, public companies, public organizations, non-governmental-organizations (NGO), non-profit-organizations (NPO), or pluralistic organizations. Secondly, the frames of references, which are based on the structure of strategic management and help to better sort future events and developments into the overall context and to legitimize them. For this purpose, they are divided into so-called horizons of meaning. The meaning's normative horizon gives the organization a sense of purpose and a responsible identity that creates a good social coexistence, makes cooperation possible, and thus increases economic success. In sum, it is the reason for the existence of the organization. The management of the meaning's strategic horizon acts on the basis of the meaning's normative horizon and carries out internal and external analyses. Afterwards, a strategy is chosen. Lastly, the meaning's operational horizon implements the chosen strategy to achieve long-term success. This encompasses three major processes: The management-process combines the design-, steering-, and development-process. The business-process takes over and regulates the practical implementation by means of customer- and performance-processes and their innovation. Finally, the support-process provides the necessary infrastructure and services. (Rüegg-Stürm, 2003; Rüegg-Stürm & Grand, 2017)

Sector: Management This sector is, according to Rüegg-Stürm and Grand, a reflective design practice that leads to stability through continuous and dynamic adaptation. This leads to the aspects of reflection and uncertainty. Reflection is important to ensure that goals and measures are realized, which results in continuous change and development. Other factors which influence reflective design practice are contingency and uncertainty, which hold opportunities and risks for the organization. Contingency is the possibility that organizational value creation can also take a different course - in line with the evolutionary theory approach. However, in combination with uncertainty (in terms of future development of the organization and their environment, other organizations, and the results of happenings) any change or renewal should be reflected, because uncertainty and contingency always require a detailed reflection. (Rüegg-Stürm, 2003; Rüegg-Stürm & Grand, 2017)

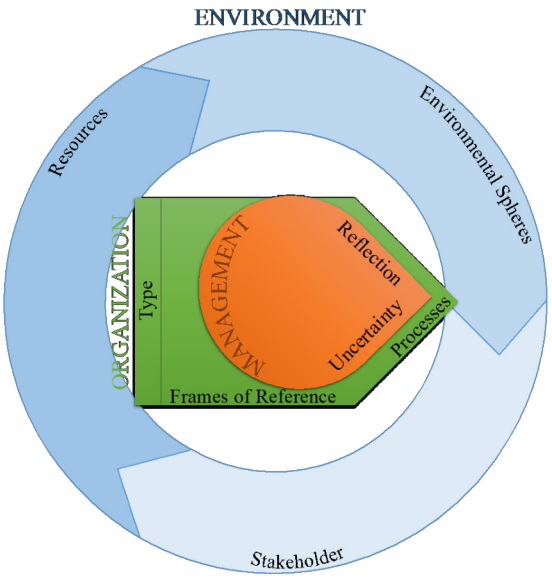


Figure 1: Structure of the SGMM used in this paper (own figure based on (Rüegg-Stürm, 2003; Rüegg-Stürm & Grand, 2017))

2.2 Research Application "Smart City"

2.2.1 Definition of a "Smart City"

Currently, there is no set definition of a "Smart City". In Europe, Doctor Giffinger from the

Technical University of Vienna (2007), or Doctor Caragliu from the University of Amsterdam (2009), or Doctor Gassmann from the University of St. Gallen (2018), for example, have formed possible definitions with different aspects. Based on these definitions and the other published definitions (Schäfer, 2019), this paper presents a definition, where all previously mentioned aspects have been covered and even expanded.

A "Smart City" is a city that uses natural resources in an environmentally friendly and efficient manner, strengthens economic growth sustainably to ensure long-term competitiveness, and uses ICT effectively in the areas of mobility, energy, building management and services, based on digital control. The security of data should always be guaranteed and both residents and stakeholders should be involved in the transformation process to create greater transparency and acceptance. This bundle of measures and intelligent solutions should improve the life's quality of the city's residents and visitors and promote satisfaction.

2.2.2 Power Ranges of a "Smart City"

Derived from the definition and the research results of Doctor Giffinger, there are six power ranges: Smart Economy, Smart People, Smart Living, Smart Governance, Smart Mobility, and Smart Environment. In this form, these were recognized by the European Union in 2014. It is important that the power ranges influence each other and are linked to each other at all times. For this reason, as many power ranges as possible should be integrated in a Smart City project in order to avoid negative synergy effects. Below, the power range, Smart Mobility and Smart Environment, are presented in more detail. (Giffinger, 2007; Manville et al., 2014)

An intelligent approach to the environment (Smart Environment) is an essential component of the Smart City. The ecological footprint of the city should be minimized as much as possible. This appertains to creating attractive and natural conditions within the city, for instance by the creation of generous green spaces, sustainable buildings, and sustainable urban planning. Also, it includes all-encompassing energy efficiency, a focus on renewable energies, environmental protection, noise reduction, air improvement, less pollution, and resource management. An intelligent mobility concept (Smart Mobility) is for the dwellers itself and its visitors. The external conditions ought to be right, by which local and international accessibility is meant. The internal conditions, by which the systems within the city are described, should be innovative, safe, sustainable, and functional in real time. In this case, a good connection trough integrated ICT in the transport systems of the city is a prerequisite. In addition, motorized individual traffic is to be minimized in order to reduce fine dust, emissions, and noise pollution in the city centers. This can be achieved with the help of car and bike sharing programs, autonomous buses, increased use of local public transport, or other mobility concepts. (Albino et al., 2015; Gassmann et al., 2018; Giffinger, 2007; Magistrat der Stadt Wien, n.d.; Manville et al., 2014; Morvaj et al., 2011)

2.2.3 Goals of a "Smart City"

The goals of a Smart City can be derived from the definition on the one hand and be concluded from it on the other hand. These goals are climate neutrality and resource efficiency, diversity and openness, open-mindedness and innovation, competitiveness and prosperity, participation and inclusion, responsiveness and sensitivity, security and enough space, and that the city is liveable and loveable. These goals should therefore be on the normative level when designing a Smart City.

2.3 Research question

Based on the theoretical background, the question now arises whether the SGMM can be applied to the Smart City research application, because it was previously only used i.a. in companies, medicine, economics, or environmental management (Doleski, 2015; Rimbach, 2013; Schwegler, 2003; Winter & Rohner, 2010). Hence, it has to be clarified how

the environment of a Smart City with the focus on Smart Mobility and Smart Environment looks like in relation to environmental spheres, stakeholders, and resources; how the structure of the organization looks like in relation to the type, frames of reference, and processes; and how the management looks like.

3 Methods

Firstly, the developed SGMM will be applied to the Smart City research application in two steps. In this work, the three areas of the SGMM are considered individually, one after another: starting with the environment sector (blue), then the organization area (green) and finally the management area (orange). In the end, the complete strategy is constructed by the addition of all three areas with their respective aspects, (right side in Figure 2).

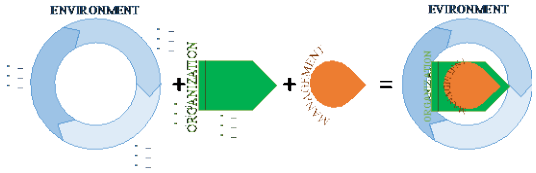


Figure 2: Strategy Development using the SGMM with the Smart City Influence

In the first step, the aspects of a sector, which were explained in chapter 2.1.1, are assigned to elements that are necessary for a Smart City. The sectors environment and organization are divided into three aspects and the sector management into two. In the second step, the subordinate elements of an aspect are linked to points that are particularly important in the area of mobility and environment. These points are grouped together as required to maintain clarity. The overall result of the procedure is that all points that are important in a Smart City project in the area of environment and mobility can be seen at a glance.

3.1 Stakeholder Analysis

In the sector of the environment, the stakeholder aspect is examined in more detail by means of a stakeholder analysis. The first step is the analysis of the expectations of the individual stakeholders regarding the Smart City (in its completed state), and the second step is the analysis of the expectations regarding the Smart City project (the implementation). In the third step, on the one hand the approval and on the other hand the influence and power of the individual stakeholders are weighted.

3.2 Frames of Reference Analysis

In the organization's sector, the aspect of the frames of references was examined in more detail by analyzing the horizons of meanings.

4 Major Findings

The results from the application of SGMM to the research application Smart City are shown in mind maps. In general, each sector is divided into the aspects. The aspects are then again divided into elements. At this point, the focus is placed on the sectors of environment and organization, because the deeper an organization is penetrated, the more individualized the management becomes.

4.1 Sector: Environment

The aspects of the sector environment are environmental spheres, stakeholders, and resources. Based on these, the elements of the aspect resources are for example object-bound and object-free. This is shown in Figure 3.

The result of the analysis shows that for a successful Smart City in the areas of mobility and environment, the following stakeholders must be part of the decision-making committee: dwellers, local (transport-, energy-, and water supply-) companies, politicians, investors, and state and federal legislation. This committee should be set up by the municipally of a city before the Smart City project starts.

4.2 Sector: Organization

The aspects of the sector environment are type, frames of reference, and processes. To illustrate, for example, the elements of the aspect "frames of reference" are normative, strategic, and operational. This is shown in Figure 4.

In the following, the aspect of frames of reference is discussed in more detail. On a normative level, the values and goals of a Smart City (see chapter 2.2.3) must be defined so that the existence of the organization and its relationship to the environment does not leave any questions unanswered. The strategic level serves to implement the normative level. Existence-promoting pre-requisites are to be created, which are acting in a long-term and future-oriented manner with regard to the environment. Considering this, a SWOT analysis of the city is created as the first measure. Consecutively, the normative goals are transformed into concrete goals, involving the stakeholders from the environment – see results of the stakeholder analysis in chapter 4.1. Next, working groups and vision are created so that infrastructure and resources can be planned. Finally, at the operational level, the normative level objectives are implemented. Since the implementation of the projects is largely project-specific, no concrete recommendations can be made at this point.

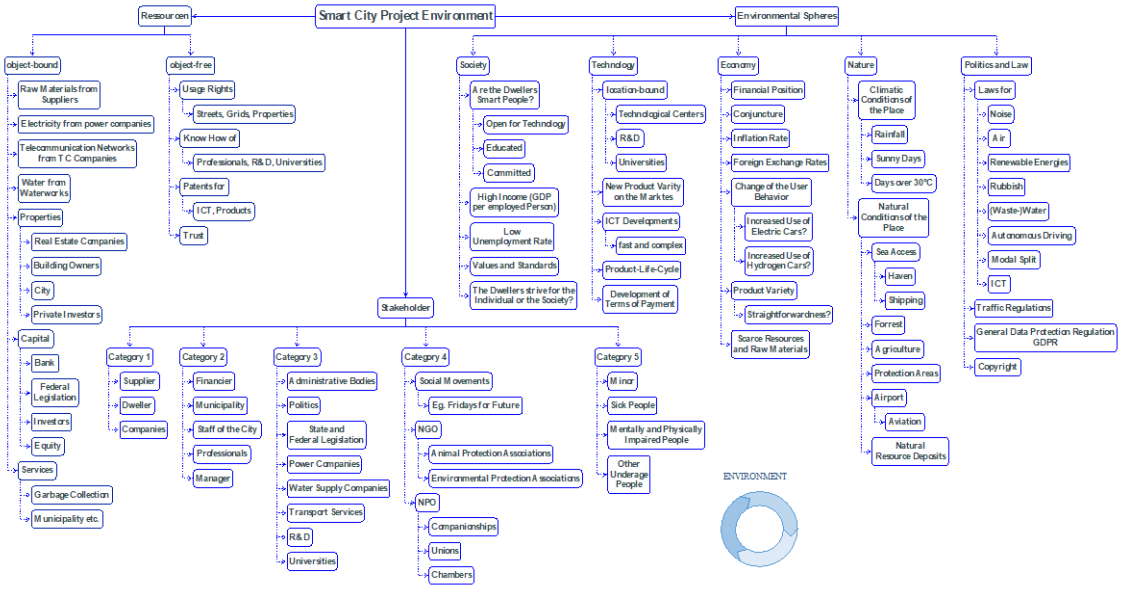
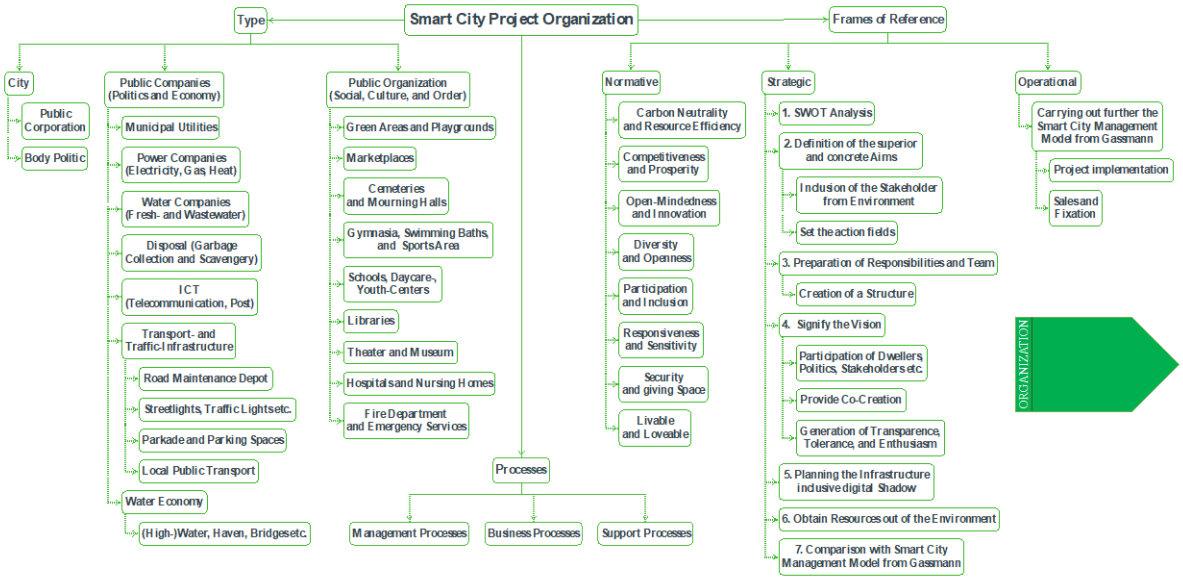


Figure 4. Analysis Results for the Smart City Strategy in the Sector Organization

Figure 3. Analysis Results for the Smart City Strategy in the Sector Environment



5 Discussion

From the main findings it can be concluded that on the one hand a precise analysis of the environment and its aspects is crucial for the success of the project. The stakeholders are important for the development process of a Smart City, because they have a huge implementation power to act for their Smart City, which is based on high willingness. For a thriving project, at least one stakeholder of each category should be involved in the project in order to avoid an imbalance and in consequence to avoid a coupling of interests of some stakeholders. Therefore, the decision-making committee should consist of representatives from the above-mentioned stakeholders. On the other hand, the organization should know exactly its strengths and weaknesses in order to be able to act optimally, as well as their specific project goals. As a result, the decision-making body, under qualified management and motivated helpers, can successfully carry out the project within the budget and time frame. In practice, these theoretical findings help enormously in the areas of mobility and environment when starting an urban transformation to a Smart City. The municipality of a city knows which stakeholders need to be involved in the project from the very first beginning in order to be successful. In addition, the findings provide valuable information on the entire range and depth of a Smart City project.

To the best of my knowledge and belief, an application of the SGMM (in third, fourth, or a combination) or other strategy models to the research area Smart City has not yet been analyzed. Furthermore, in this paper the application of SGMM was only studied on two areas, namely Smart Mobility and Smart Environment. Therefore, the SGMM should be adapted and applied to all six power ranges of a Smart City to elucidate interactions and multiple functions of stakeholders. This will highly probable result in an adaptation of the model that has been set up. For example, some stakeholders will have different attitudes toward and demands on the Smart City depending on their role and position within the different power ranges. Nonetheless, in this study the SGMM was successfully adapted and applied to the research application Smart City for the development of strategies for Smart City projects.

6 Conclusion and Outlook

The here demonstrated analysis shows that the SGMM can be applied to the research application Smart City in the areas of Smart Mobility and Smart Environment. However, it is essential to ensure that a thorough classification of all relevant elements to the sectors is made, as this is the basis for the Smart City strategy. Finally, all power ranges should be considered and the strategy should be tested in reality in order to validate the feasibility of strategies proposed by SGMM Smart City strategies as well as to integrate not captured influences arising from reality into the SGMM Smart City projects.

Acknowledgement

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7 References

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, *22*(1), 1–19. https://doi.org/10.1080/10630732.2014.942092

Bea, F. X., & Haas, J. (2016). *Strategisches Management* (8.). UVK Verlagsgesellschaft mbH. http://www.utb-shop.de/strategisches-management-7074.html

Bergmann, R., & Bungert, M. (2013). *Strategische Unternehmensführung* (2nd ed.). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-31840-5

Bleicher, K. (2011). *Das Konzept Integriertes Management: Visionen—Missionen—Programme* (8.). Campus Verlag. https://books.google.de/books?id=vUk-FjKHdBIC

Doleski, O. D. (2015). *Integrated Business Model: Applying the St. Gallen Management Concept to Business Models*. Springer.

Etezadzadeh, C. (2015). *Smart City – Stadt der Zukunft?* Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-09795-0

Gassmann, O., Böhm, J., & Palmié, M. (2018). *Smart City—Innovationen für die vernetzte Stadt—Geschäftsmodelle und Management* (1st ed.). Carl Hanser Verlag.

Giffinger, R. (2007). *Smart Cities Ranking of European Medium-Sized Cities* (p. 16). Universität Wien. https://doi.org/10.1016/S0264-2751(98)00050-X

Graf, H. G. (1999). *Prognosen und Szenarien in der Wirtschaftspraxis*. Hanser. https://books.google.de/books?id=1X2HPQAACAAJ

Hungenberg, H. (2014). *Strategisches Management in Unternehmen: Ziele—Prozesse—Verfahren* (8th ed.). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-06681-9

Lombriser, R., & Abplanalp, P. (2005). *Strategisches Management: Visionen entwickeln, Strategien umsetzen, Erfolgspotenziale aufbauen* (4th ed.). Versus.

Magistrat der Stadt Wien. (n.d.). *Smart City Wien*. https://smartcity.wien.gv.at/site/

Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J. K., Thaarup, R. K., Liebe, A., Wissner, M., Massink, R., & Kotterink, B. (2014). *Mapping Smart Cities in the EU*.

Morvaj, B., Lugaric, L., & Krajcar, S. (2011). Demonstrating smart buildings and smart grid features in a smart energy city. *IYCE Proceedings of the \ldots*, *5*(3), 49–63.

Rimbach, A. (2013). *Entwicklung und Realisierung eines integrierten betrieblichen Gesundheitsmanagements in Krankenhäusern: Betriebliches Gesundheitsmanagement als Herausforderung für die Organisationsentwicklung*. Rainer Hampp Verlag.

Rüegg-Stürm, J. (2003). *Das neue St. Galler Management-Modell: Grundkategorien einer modernen Managementlehre ; der HSG-Ansatz* (2.). Haupt. https://books.google.de/books?id=P9C6GAAACAAJ

Rüegg-Stürm, J., & Grand, S. (2017). *Das St. Galler Management-Modell* (3.). Haupt.

Rüegg-Stürm, J., & Grand, S. (2018). *Von der 3. Generation zur 4. Generation des St. Galler Management-Modells*. https://www.sgmm.ch/wp-content/uploads/2018/06/sgmm_vergleich_der_3_und_4_generation.pdf

Schäfer, C. (2019). *Strategies for Smart Cities focusing on Environment and Mobility*. RWTH Aachen University.

Schwegler, R. (2003). *Lücken schließen im Umweltmanagement: Theoretischer Bezugsrahmen für ein rationales Management Handeln auf Basis der St. Galler ManagementLehre*. http://www.regina-schwegler.de/Pforzheimer_Forschungsbericht e_Nr1.pdf

United Nations. (2018). *Prospected World Population by 2050*. United Nations. https://population.un.org/wup/Publications/Files/WUP2018-PressRelease.pdf https://population.un.org/wup/Country-Profiles/

Welge, M., Al-Laham, A., & Eulerich, M. (2017). *Strategisches Management: Grundlagen—Prozess—Implementierung* (7.). Springer Fachmedien Wiesbaden. https://books.google.de/books?id=DglhDgAAQBAJ

Winter, R., & Rohner, P. (2010). Business Engineering – betriebswirtschaftliche Konstruktionslehre und ihre Anwendung im Gesundheitswesen. In *Patientenidentifikation und Prozessorientierung: Wesentliche Elemente des vernetzten Krankenhauses und der integrierten Versorgung* (pp. 33–55). Springer. https://doi.org/10.1007/978-3-642-13087-8_3