Master's Thesis handed in at the University of Bern

«Züri wie neu»
Success of a Citizen Sourcing Application

submitted to

Center of Competence for Public Management

Schanzeneckstrasse 1

CH-3001 Bern

Advisor

Dr. **Matthias Stürmer**

submitted by

Tim Loosli

of Sumiswald, Canton BE

Matriculation Number: 08-114-613

Address

Morillonstrasse 48

3007 Bern

tim.loosli@students.unibe.ch

Bern, 28.08.2016

Acknowledgments

This master's thesis is part of the Master of Arts program in Public Management and Policy at the University of Bern and is handed in to Dr. Matthias Stürmer at the Institute of Information Systems.

I would first like to thank Dr. Matthias Stürmer for advising and supporting me while writing this thesis. In addition, I would like to thank Gabriel Abu-Tayeh for his valuable guidance and Oliver Neumann for his insight and counsel, especially regarding the statistical approach of this thesis.
Working with you on this research project was a great experience and I am looking forward to reading future research papers about "Züri wie neu".

Abstract

More and more services are being offered to citizens through digital communication methods. Governments all around the world increasingly use E-Government and Open Government applications to offer their citizens the possibility to get in touch with them through these digital channels. This fosters the need for research, whether these applications are successful and whether the set targets are met. While E-Government has received a lot of research attention Open Government is still a rather young research object. Especially the success of citizen sourcing applications is yet to be researched more often. This master's thesis provides the first adaptation of the DeLone and McLean Information Systems Success Model to a Swiss Open Government application called "Züri wie neu" (ZWN) to measure its success from a citizen perspective. The research is conducted with citizen based survey data which is drawn from the user base of ZWN, combined with a secondary data file provided by the municipality of Zurich. The survey was sent to 2613 unique users and a total of 759 observations are evaluated in this master's thesis. Structural equation modelling is used for analysing the results. The findings provide insight into the nature of use of a citizen sourcing application and provide valuable implications for further research. It becomes apparent that the actual *Use* of the application has no significant association with any of the quality dimensions or *Net Benefits* constructs, meaning that there must be several other factors that bring the users back to reporting damaged infrastructure elements. This thesis concludes by presenting a short overview of further research and by discussing the implications and limitations of this study.

Table of Contents

Table of Figures

List of Acronyms

C2G	Citizen to Government
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
D&M	DeLone and McLean
df	Degrees of freedom
FIML	Full Information Maximum Likelihood
FMS	Fix my street
G2C	Government to Citizen
G2G	Government to Government
ICT	Information, Communication Technologies
IS	Information Systems
ML	Maximum Likelihood
NPM	New Public Management
OSS	Open Source Software
PSM	Public Service Motivation
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Model
SRMR	Root Mean Square Residual
TLI	Tucker-Lewis Index
ZWN	Züri wie neu

1 Introduction

The digitalisation of public administrations, the utilisation of information and communication technologies (ICT) as well as the use of social media to interact with citizens is certainly not a new but still rather young phenomenon. Governments use these technologies to implement projects that are aimed to deliver services to the citizens as well as to businesses (Wang & Liao, 2008, p. 718). In the wider sense of New Public Management, the ICTs are used to deliver services and information more efficiently and effectively than with traditional non digital methods. Wherever there are new possibilities, new methods and thus new projects that are being used and implemented by businesses or governmental institutions, the question about the success of these methods and projects emerges. Thus E-Government and more recently Open Government projects have become a widely researched topic by scholars all around the world. Most of the conducted research investigates either the relationship between governments and citizens, governments and businesses, or governments and governments. Scholars investigated the implications for these stakeholders by analysing several different applications. The implementation of digitalisation projects not only requires a great deal of expertise and specific knowledge, trained personal and skills but also technologies, infrastructure and thus tax payer money. This leads to tremendous pressure on governmental institutions while implementing and maintaining these projects. As a result, measures of success are needed that indicate whether these projects achieve their desired goals or not (Lee & Kwak, 2012, p. 493).

This master's thesis is part of a research project that wants to assess a particular Swiss Open Government web-application called "Züri wie neu" (ZWN) by measuring the success of the application with the DeLone and McLean Information Systems Success Model, henceforth described as D&M IS Success Model. This topic is highly relevant not only based on the aforementioned introductory words but also since no research has been conducted, to the best of this authors knowledge, about a similar application. The ongoing research about ZWN led several newspapers to writing articles about the application and thus this master's thesis as well. The German newspaper *Süddeutsche Zeitung* for example wrote about Zurich's "Grumbler-App" and described how the application works (Theile, 2016). Zurich's *Tagesanzeiger* wrote about the research that is being conducted about ZWN, and thus also about the present master's thesis. Also the newspaper of Bern *Der Bund* contemplated, whether such an application could be introduced in the Swiss capital or not (Hunkeler, 2016).

This shows that the stakeholders or in other words, the tax payers seem to be interested if such an application is being researched by scholars and thus whether the application can be considered successful or not.

Out of these considerations the following general research question may be derived:

> *Is the Swiss Open Government Application "Züri wie neu" successful or not from a citizen perspective according to the D&M IS Success Model?*

The first chapter of this master's thesis about ZWN has the objectives to give an introduction to the topic, to briefly explain how ZWN works, to offer insight why this research is valuable and to draw an outline of the thesis. The next section, chapter 2, presents the theoretical background which is again divided into multiple parts. The first part of chapter 2 resents the current state of research about IS Success and E-Government. Followed by an overview of the various terminologies that describe E-Government and Open Government initiatives. The three main pillars of Open Government - transparency, participation and collaboration - are explained, before defining a terminology that is used by this thesis to describe ZWN. The second part of chapter 2 explains the DeLone and McLean IS Success Model as well as the relevant dimensions of success, followed by a short overview of the Public Value approach used by Scott et al. (2015). To conclude the theoretical part, the hypotheses are detailed and the research model is proposed. In chapter 3, the methodological approach is presented, starting with a description of the used data-file and sample, as well as an explication of the data collection methods. Next the various measures, their respective sources and control variables are presented. To conclude the presentation of the analytical methods, the data analysis procedures are detailed. Chapter 4 presents the results obtained from the data analysis. Necessary model respecification is explained and together with statistics obtained from the structural equation modelling, the proposed hypotheses are analysed. Chapter 5 interprets and discusses the findings of this research. Furthermore, the limitations of this study are presented and a short overview of further research on this topic is outlined. Lastly, chapter 6 draws a conclusion of all of the above.

1.1 Problem Description

Since this research wants to examine a citizen sourcing platform in Switzerland, the following two sub-chapters compare the original “Fix my street” from the UK with the adapted version of Zurich, “Züri wie neu”.

1.1.1 What is «Fix my street»?

The website “fixmystreet.com” (FMS) allows citizens of the UK “(…) to report, view or discuss local problems such as graffiti, fly tipping, broken paving slabs or street lighting, and to track their resolution by the local government concerned” (King & Brown, 2007, p. 74). The system was created by the charity mySociety and successfully launched in 2007. Since 2007 tens of thousands of reports have been publicly published on the website. Reported issues are categorized and sent to the appropriate municipality for processing, either via E-Mail or are directly pushed into the systems of local governments (Fix my Street, 2016). The user that reported an issue or any other citizen that encountered the same reported problem is able to post an update if the circumstances of the issue have changed, or even if the issue has been resolved. It is important to note that FMS is independent and not tied to a local government. Another important aspect is the fact, that this service is free of charge for the citizens and as well for the local authorities (King & Brown, 2007, p. 74).

1.1.2 What is «Züri wie neu»?

Derived from the UKs original FixMyStreet.com “Züri wie neu” is a web-based service where residents of Zurich are able to report damaged infrastructure and facilities in their neighbourhood, such as garbage, graffiti’s, damaged street lamps and so forth. It is programmed and set up by the same company that is also responsible for FMS, mySociety. The issues are submitted via a web-form on https://www.zueriwieneu.ch/ or with specific smartphone apps for both android and iOS systems. In order to submit damaged infrastructure elements one has to first enter a rough address and secondly pinpoint the damage on a map of Zurich. The possibility to upload pictures while reporting an issue enables the authorities to clearly identify the problem. The local municipality of Zurich moderates the submitted issues and also functions as a triage. The reported issues are then sent to the authority in charge of solving the problem. Submissions, which are not directly related to the municipality such as emergency issues, or issues concerning private properties are anonymised and forwarded to the proper authority via E-Mail. The user of the service is also able to track the progress of the reported issue on the website. In contrast to the original service FMS, ZWN does not allow

updates for the reported issues. Therefore, other citizens that also encountered the same issue are not able to comment or interact with the submitted problem in any way. Further it differs in the fact that the owner of ZWN is in fact a local government institution and not an independent organisation (Internetdienste der Stadt Zürich, 2016).

Platforms such as fixmystreet.com, or in this particular case zueriwieneu.ch, propose a powerful tool for administrative agencies not only to provide certain services to the public but also to interact and react to certain public needs. As mentioned by Wang & Liao (2008, p. 718) it is difficult for governments to assess the success of such a website, since there is only little feedback about the service itself. Even though the website's purpose is to interact with citizens and it uses the help of the residents to fix the streets of Zurich, the participation, e.g. number of reports of certain citizens, cannot be considered as the sole valid success measure. It is therefore vital to adapt a model, such as the D&M IS Success Model to this application in order to fully understand, whether such a system can be considered successful or not. This model will be explained in chapter 2.3.

2 Theory and Hypotheses

The following chapters give an overview on the theoretical background of this thesis and conduct a literature review on the relevant topics. First, the current state of research is presented. Since there are various terminologies, e.g. E-Government, Open Government, that are used in this thesis it is vital to clearly distinguish them from one another. Therefore, chapter 2.2 clarifies this matter before explaining why "Züri wie neu" can be considered as a citizen sourcing application in an Open Government environment. In order to measure the success of "Züri wie Neu" the DeLone and McLean Information Systems Success Model is explained in chapter 2.3. Following the D&M Success Model the hypotheses for this research are presented in chapter 2.3.2.

2.1 Current State of Research

E-Government, as Floropoulos et al. (2010) state, has received a lot of attention by researchers all around the globe. Different theoretical models have been developed to gain a better understanding of this concept. The authors further mention that there is no single definition of E-Government which is also underlined by chapter 2.2. As mentioned above, the objective of this master's thesis is to contribute to E-Government, Open Government and IS Success research by applying the DeLone & McLean Is Success Model to this environment. Therefore, this chapter highlights the different states of research of the mentioned topics.

DeLone and McLean (2004, p. 31) state that although new businesses are emerging and new technologies are developing the underlying role of IS has not changed, "(…) and thus the methodology for measuring the success of information systems (IS) should not change". Information systems have received a lot of research attention in the last few decades and there have been numerous studies that have attempted to apply some, or all, measures of the D&M Success Model to examine and validate its use. Petter et al. (2008) conducted a qualitative literature review to examine 180 papers that dealt with IS success. The authors examined and compared the results of different studies that applied the D&M IS Success Model to give an overview over the various results. They figured out that many studies that used the model often focused on a single dimension of success rather than accounting for the multiple and interrelated relationships among the success dimensions. Five years later, Petter et al. (2013) published a second paper that focused on the independent variables which influence IS success. The two papers by Petter et al. give an excellent overview over the current state of research about IS Success as well as the DeLone and McLean model.

The D&M IS Success Model has been used numerous times to empirically validate IS but only little research has been conducted in the field of E-Government success using the same model (Wang & Liao, 2008, p. 719). This has not changed since Wang and Liao's paper in the year 2008. Also Scott et al. (2015, p. 3) mention, however seven years later, that "(…) insufficient research has been conducted in identifying measures that determine eGovernment success from a citizen perspective". They further mention the analysis of published articles done by Bélanger and Carter (2012) that showed, only a minority of the conducted E-Government research used the D&M IS Success Model or citizen-based survey data.
Scott et al. (2015) developed "Net Benefit" measures together with a public value approach for measuring E-Government success from a citizen based view while also considering new web 2.0 environments such as social media. Several other studies (e.g. Chen, 2010; Floropoulos et al., 2010; Rana, Dwivedi, Williams, & Weerakkody, 2014; Scott & DeLone, 2009; Scott et al., 2015; Teo, Srivastava, & Jiang, 2008; Wang & Liao, 2008) have used some metrics of the D&M Success Model to measure the success of some E-Government applications. Floropoulos et al. (2010) for example conducted a research about the success of the Greek taxation system. Wang and Liao (2008) used the D&M Model to measure two E-Government systems in Taiwan. Chen (2010), similar to Floropoulos, conducted research about an online system for income tax returns, where he discussed taxpayer satisfaction with the taxation system in Taiwan. Teo et al. (2008) analysed trust in the context of E-Government systems. They figured out that higher level of trust in government actions is positively associated with some success dimensions of the D&M Model.

It becomes apparent that the research about E-Government and the research about the success of E-Government applications is wide-ranging, but none of these studies, to the best of this authors knowledge, have attempted to explain platforms such as "fixmystreet.com" or "Züri wie neu" with the D&M model (Scott et al., 2015, p. 3).

Therefore, this brief review shows that insufficient research has been done in not only establishing new measures for E-Government research but also in applying the measures for E-Government success from a citizen perspective.

2.2 E-Government or Open Government?

Governments all around the world significantly increased the use of information and communication technologies (ICT) in the last few decades. These technologies are used with very different objectives: for instance to enhance the service quality of a local authority by displaying relevant information for the citizens, to provide some basic services online or even for promoting participation and collaboration between the citizens and the government (Sandoval-Almazan & Gil-Garcia, 2012, p. 72). Hilgers (2012, pp. 638–639) sees the starting point of this trend in the paradigmatic change from a bureaucratic public management to new public management (NPM). On the one hand, NPM is applying a more market-driven approach to managing public services which is mainly used in private sectors, to the public sector. New public management therefore orientates on providing more efficient and effective services to the public. On the other hand, NPM treats citizens more like customers of public services so that the internal organisational processes are aligned to customer expectations and their needs. The public administrations transform from bureaucratic organisations to service providers that offer noticeable outputs for the citizens, or rather for the customers, by focusing not only on transparency and efficiency but also on responsibility. Alongside with the development of New Public Management and the reorganisation of administrative procedures, the digitalisation of these procedures underlines the higher use of ICTs in the last few decades. These digital services are subsumed by the term E-Government which broadly defines the governmental use of ICT "(…) particularly Web-based Internet applications, to enhance the access to and delivery of government information and service to citizens, business partners, employees, and other agencies and entities" (Wang & Liao, 2008, p. 718). The complexity of E-Government projects originates from the fact that "(…) many e-government projects combine technical features from both the construction and the ICT industries, which increase innovation and uncertainty" (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016, p. 1). For Hilgers (2012, p. 639-640), E-Government is the necessary base for a functional form of citizen participation.

Tools which are provided through the introduction of web 2.0 technologies and the interconnectivity between several platforms such as tablets, smartphones and social media, enable governments to use these ICTs in a new way (Sandoval-Almazan & Gil-Garcia, 2012, p. 72). The web 2.0 interactivity combined with social media not only allows for mass production but also for participation and collaboration. This innovative form of communication alters the ways how E-Government works and especially how citizens or rather the public interacts with the government (Linders, 2012, p. 446). According to Lee and

Kwak (2012, p. 492), social media, which can be defined as a toolset for online social interaction, is penetrating our daily life and is broadly used by the public. This also holds for governments where the implementation of social media can play an important role for interacting with the public. There are two main purposes of social media, which can be classified into two groups: The first group is more individualistic which allows for self-expression by sharing with others over networks such as Facebook, Twitter, YouTube and the like. The second group is more about collaboration and creating something together through the use of social media such as Wikis.

Today, social media platforms offer numerous advantages not only for attracting citizens but also for promoting information. It is much easier to work together and mange lager groups of people and different ideas. Linders (2012) posits that social media and web 2.0 technologies and the related interconnectivity "(…) indeed appear to enhance and expand the viability of and capacity for citizen coproduction (…)" (Linders, 2012, p. 451). On the one hand this implicates that the use of ICT presents a lot of possibilities for governments when it comes to interacting with citizens. On the other hand this means that the use of social media and ICT could significantly alter the way how modern public administrations work and act (Linders, 2012, p. 451).

A second term that narrows the notion of E-Government down is Open Government. Open Government is a result of the just mentioned modernisation processes that took place in the past few decades. Open Government integrates external knowledge into the political-administrative process with the help of new information and communication technologies. The focus lies on the collaboration between citizens and governments where citizens provide this outside knowledge which is then used in the political-administrative processes. According to Hilgers (2012), Open Government is based on three main pillars: transparency, participation and collaboration, whereas transparency and providing the citizens with public data is a basic requirement for participation and collaboration. Transparent administrative actions are closely related with "Open Data" that aims to provide all non-confidential data, e.g. maps, geo data, public budgets and so forth, free of charge to the public. As a citizen one should be able to freely access this data without worrying about copyright issues. Together with open source software one is then able to present even complex datasets such as financials in an easy to understand manner (Hilgers, 2012, pp. 640–641; Stürmer & Ritz, 2014, p. 128).

Lee and Kwak (2012) propose that there are different maturity levels of Open Government and therefore, also different levels of implementation a government can find itself in. With each additional level gained, administrative agencies are able to further strengthen the public value of their Open Government initiatives and the public gets more and more engaged. Lee and Kwak (2012) state that it is, however, important to focus on one level at a time for building the required base and to achieve the needed capacities for Open Government before moving on to the next level, since failure can have serious impacts. Level 1 of the maturity model represents the initial conditions for Open Government. Agencies in level 1 primarily focus on the one-way publication of information with no interactive communication methods. Level 2 focuses on the publication of relevant data in order to increase the transparency of public administrative processes. In order to do so it is vital to clearly identify which data provides the most benefit for the public. Since the public is able to interact with the published data, the basic needs for information can be satisfied. Participation can be found for the first time at level 3 of the maturity model. The governmental agencies may use the public input to enhance policy decisions. In order to gain insight into the ideas and the expertise of the public, at level 3 governmental agencies use web 2.0 technologies and social media, primarily the above already mentioned individualistic and self-expressing groups that allow for informal conversational interactions. Once level 3 is reached, level 4 turns public participation into collaboration. This shows that according to Lee and Kwak, participation happens prior to collaboration. Collaboration distinguishes from participation in the fact that collaboration is more about creating something together in order to achieve a certain outcome in a complex task. Collaboration relies on the second group of social media that focuses on working together. The last level, level 5, improves the previous levels by "(…) expanding the scope and depth of them and fully harnessing the power of social media and related technologies" (Lee & Kwak, 2012, p. 499).

Lee and Kwak (2012, p. 498) additionally mention that some agencies do not distinguish between the two terms collaboration and participation and use them interchangeably. Since not only agencies do not clearly differentiate between the terms, they are used differently among scholars as well. In order to be able to distinguish one from another, the following subsections explain the differences between the two terms in the context of Open Government.

2.2.1 Participation in Open Government

Participation in governmental processes is nothing new, rather it is one of the basic understandings of democracy (Stürmer & Ritz, 2014, p. 128). It refers to the demand by the citizens to take part in political-administrative decision-finding processes. In connection with Open Government, participation uses new technologies and platforms that enable citizens to interact with the administration. With these platforms citizens are able to voice their concerns, present their ideas and discuss various concepts that may lead to new policies. The whole notion of participation or being able to participate potentially leads to a higher acceptance of politics, as well as a higher public spirit (Hilgers, 2012, p. 642).

According to Lee and Kwak (2012) the main purpose of Open Government participation is to consider the ideas and inputs given by the citizens for enhancing public services. The process of communicating with the government is rather simple and the main goal of communication is to voice ideas and bring people together. As shown above, the complexity of a task and creating a certain outcome together is a distinguishing feature of participation versus collaboration. For Sandoval-Almazan and Gil-Garcia (2012) citizens participate through several channels with the government. One of these channels may be communicating with public officials or using communication tools such as forums or surveys in order to gain access to certain services. One issue with these tools however is that the feedback from the government side often falls short. But overall participation can create added values and provide additional information for the government and the citizens as well.

It becomes apparent that participation in an Open Government context is to be understood as a tool for public administrations to gather ideas for enhancing or altering public services. The process of communication remains rather simple and the feedback by the government often lacks substance.

2.2.2 Collaboration in Open Government

Collaboration, as above-mentioned, is the third main pillar in Open Government. It describes how citizens and the government use ICT for working together. Prior studies have proposed numerous typologies and approaches to tackle collaboration in Open Government and a lot of different propositions and explanations have come together since. Similarly to the conflation of the terms participation and collaboration, collaboration itself is used and defined differently. This limits scholars in the ability to use the same terminologies and fosters the

creation of new ones (Linders, 2012, p. 447; Stürmer & Ritz, 2014, p. 128). Clearly, this underlines, as at the beginning of this chapter mentioned, the necessity of clearing up which terminologies are being used in the context of "Züri wie neu".

According to Linders and Wilson (2011, p. 268) collaboration mainly differs in two main points from participation in Open Government: As seen above, with participation the government still maintains the full decision-making powers, whereas collaboration requires a much higher amount of power sharing. Additionally, collaboration is linked to organisations rather than to individuals. Governments enable citizens and organisations the possibility to collaborate in designing and delivering a specific service.

Furthermore Lee and Kwak (2012, p. 498) posit that collaboration in the context of Open Government should not only reach the public but also the private sector to grasp all the possibilities that open collaboration enables.

2.2.3 Coproduction in Open Government

Additionally to the differentiation of participation versus collaboration, Linders (2012) uses the concept of coproduction rather than the term collaboration to describe how governments may work with the public and vice versa. He classifies citizen coproduction via social media into "Citizen Sourcing", "Government as a Platform" and "Do it Yourself Government". It is important to note that this classification only considers citizen coproduction, e.g. Citizen-to-Government (C2G) or Government-to-Citizen (G2C). Government to Government (G2G) relationships are not considered. This also makes sense in the context of this master's thesis, since "Züri wie neu" is addressed at the citizens of Zurich and therefore citizen involvement is given.

"Government as a platform" means that the government provides its IT infrastructure and its data to the public. The platform may help citizens to be more informed and to act more socially responsible. For example, such a platform enables citizens to access publicly available ratings of hospitals or schools to support decision making, which school to choose or which hospital to visit.

"Do It Yourself Government" describes the possibilities of citizens to self-organise and potentially take over tasks the government usually takes care of. This is connected to the use of social media that enables the public to easily and effectively organize via the Internet. "Citizen sourcing" is defined through the fact that the government is still responsible for executing the services but greatly relies on the help of its citizens for collecting ideas and inputs of what needs to be done. Citizens may influence the governmental decisions and "(…)

may even help execute government services on a day-to-day basis" (Linders, 2012, p. 447). One form of citizen sourcing is using social media channels not only to interact with the public but also to consult the public in order to get inputs about policy relevant issues. Another form of citizen sourcing is inviting the public to solve problems for the government. This can be a very effective and cost-efficient way of problem solving. It enables the government to use the knowledge, skills and expertise of its citizens to solve certain challenges. The third form of citizen sourcing is citizen reporting that uses the Internet for knowledge sharing with the government. "Such systems can facilitate deep collaboration between citizens and government (…)" (Linders, 2012, p. 448). According to Linders (2012), "Fix my street" belongs to this group of citizen-sourcing.

This shows the thin line between the various terms. As shown above, the collection of ideas and inputs is an important part of participation in Open Government and therefore, according to Lee and Kwak (2012) furthermore Linders and Wilson (2011), this suggests that citizen sourcing counts as participation and not collaboration. In the context of "Züri wie neu" this shows on the one hand that since the resolution of the posted issues is done by the municipality of Zurich, "Züri wie neu" counts as a participation- rather than a collaboration-application (Stürmer & Ritz, 2014, p. 130). This also implicates that the decision-making powers are still with the municipality of Zurich. On the other hand, according to Linders (2012), citizen sourcing is a form of coproduction which is often interchangeably used for the term collaboration (e.g. Sandoval-Almazan, Gil-Garcia, Luna-Reyes, Luna, & Rojas-Romero, 2012). Interestingly, Nam (2012) proposed two frameworks to provide insight into citizen sourcing and defines collaboration within the terminology of citizen sourcing itself.

For Nam (2012) one purpose of citizen sourcing is to engage citizens. He argues that governments that traditionally provide services to the citizens, may become the consumer, where the public provides information with the help of the citizen sourcing application. "Citizen-sourcing, therefore, may change the government's perspective on the public (…)" (Nam, 2012, p. 13). He further argues that citizen sourcing has replaced NPM to a substantial extent. NPM, which as described above, supports a more market-driven approach to public service and supports private partnerships as well as contracts with non-governmental sectors. On the contrary, citizen sourcing or engagement of citizens in general "(…) draws on the collective knowledge of the public" (Nam, 2012, p. 12). Citizen sourcing therefore challenges the new public management paradigm. NPM leaves only little room for the engagement of the

public. Treating citizens as customers does not match with engaging the public for more participation and collaboration (Linders, 2012, p. 451).

Even though Linders (2012) made a valuable effort in classifying citizen coproduction in Open Government, it becomes apparent that the research on Open Government is still in an early stage and a clear typology and classification of terms needs further work. Since Linders (2012) describes "citizen sourcing" with the help of "Fix my street", this master's thesis adopts this terminology for "Züri wie neu" as well. "Züri wie neu" is therefore seen as a citizen sourcing application in an Open Government environment.

The last few decades carved a higher demand by citizens for better services through the Internet (Wang & Liao, 2008, p. 718). Governments are allocating substantial resources for the development, the implementation and maintenance of E-Government and Open Government initiatives. It is expected that governments implement the three main pillars of Open Government (transparency, participation and collaboration) as fast as possible. This can lead to projects that cannot adequately be supported by the agencies. Therefore, failure of these projects can not only lead to monetary loss but also to reduced public trust and damaged reputation (Lee & Kwak, 2012, p. 493). In order to assess these facts evaluation efforts are needed to reduce the potential risks and to find out whether the services can be provided as intended by the government but also as requested by the citizens in the most efficient and effective way possible. As already mentioned, web 2.0 brought up new ways of communication and interaction on websites. Governments adapt to these new ways with specific E-Government systems and Open Government applications that enable the citizens to interact with the authority. This creates the need for a reliable way for measuring and evaluating the success of these governmental websites. As Wang and Liao (2008, p. 718) mention, "(…) eGovernment systems success is a complex concept, and its measurement is expected to be multi-dimensional in nature". Since there is no existing success model with the sole purpose of measuring E-Government applications such a model needs to be derived from the vast selection of IS success measures available.

2.3 DeLone and McLean Model of Information System Success

As mentioned at the beginning of this chapter, the success of IS is widely investigated and studied. Numerous researchers have derived models that try to explain what makes IS successful. One of the most comprehensive, adaptable and influential models reviewing the success of information systems is the DeLone and McLean Information Systems Success Model. DeLone and McLean (1992) propose a taxonomy with six dimensions in a descriptive model for measuring IS success. The original model, published in 1992, is based on IS research that has been conducted by various researchers in the 1970s and 1980s with the purpose of synthesising previous research into a more comprehensible model. The evaluation of information systems "(…) is critical to our understanding of the value and efficacy of IS management actions and IS investments" (DeLone & McLean, 2003, p. 10).

The model's interrelated six dimensions comprise *system quality*, *information quality*, *use*, *user satisfaction*, *individual impact*, and *organizational impact*. These dimensions are based on process and causal relationships. DeLone and McLean (2003, p. 11) describe that a temporal, process model suggests that one stage follows the next one. This implicates that an information system is first created, then used by an individual user, which leads to either satisfaction or dissatisfaction whether they like using the system or not, which influences the individual user in the ability to conduct his work, and ultimately and collectively impacts the organisation as a whole. Causal or variance models on the other hand examine if a causal relationship between success dimensions exists or not. "For example, higher system quality is expected to lead to higher user satisfaction and use, leading to positive impacts on individual productivity, resulting in organizational productivity improvements" (DeLone & McLean, 2003, p. 11). Combining causal or variance models together with temporal or process models therefore allows for a better understanding of IS success. The creation of a system, the system use and the subsequent consequences of this use each propose a necessary, but not sufficient condition for the outcome in a process model. In other words, if no one uses the system, there are no consequences. Conversely, if the system is heavily used there may also be no consequences. This clearly shows that to fully grasp the success of an IS, the process model needs to be combined with the causal model (DeLone & McLean, 2003, p. 16). This framework, as shown in Figure 1, had allowed researchers and practitioners to test the interdependencies between the dimensions and has become a cornerstone for further research on the topic of information system success (Floropoulos et al., 2010).

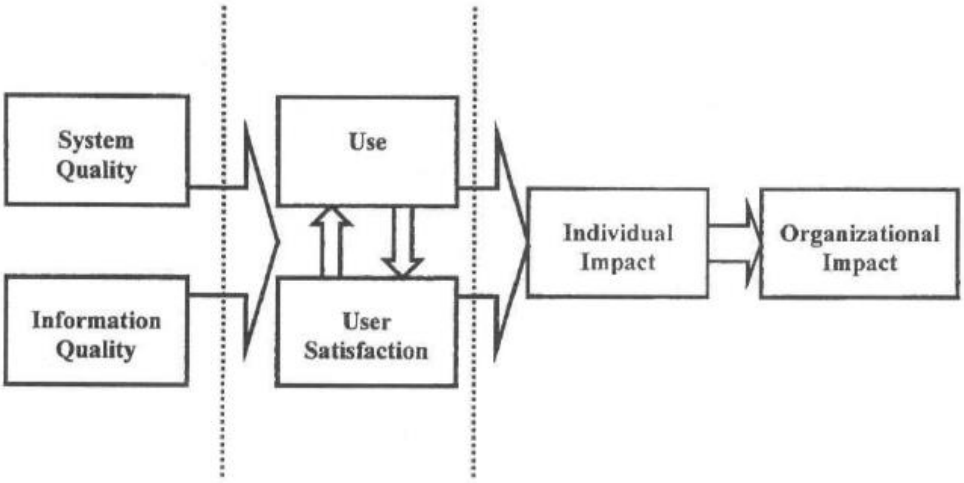

Figure 1 - Original D&M IS Success Model (DeLone & McLean, 1992)

Since 1992 numerous studies have been conducted on the original D&M IS success model. A lot of these studies proposed modifications to the model, answering the call of the authors' for more research on the same topic (Petter et al., 2008, p. 237). Among these studies, Seddon (1997) criticised the model's mix of causal and process relationships and argued that the model is leading to misinterpretations in the use of the framework. Additionally, he argued, that the *Use* construct is too ambiguous. DeLone and McLean (2003) stated, in response to the criticism that combining variance and process models is one of the models strengths, since combining the two makes the model richer than either one itself (Petter et al., 2008, p. 238).

Given the findings of these studies and especially the criticism of Seddon, plus the changes in the practice of IS since 1992, DeLone and McLean (2003) proposed an updated model (see ***Figure 2***) by adding a new dimension *Service Quality* and by combining Individual Impact and Organisational Impact into a single category called *Net Benefits* (Floropoulos et al., 2010). This update "(…) addressed the criticism that an information system can affect levels other than individual and organizational levels" (Petter et al., 2008, p. 238). Petter et al. (2008) state that *Net Benefits* refer to the fact that IS and especially the success or failure of IS can have various impacts not only on individuals but on organisations and even societies as well. Combining Individual Impact and Organisational Impact into *Net Benefits*, thereby accounts for an analysis at multiple levels and enables researchers to apply the model to whatever level is most relevant for the research. The majority of research and most of the measures that have been used to examine *Net Benefits* are "(…) focusing almost exclusively on the impact of IS in the work environment" (Scott et al., 2015, p. 2).

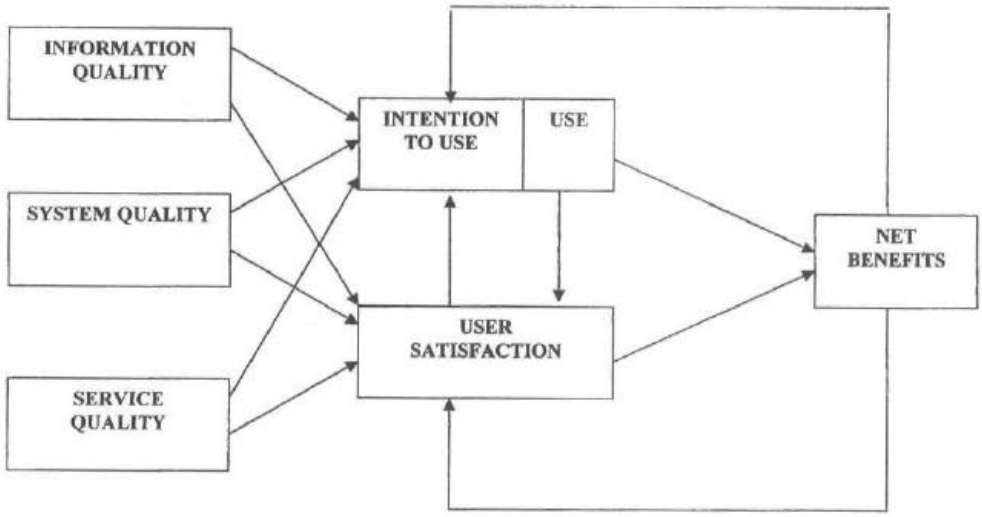

Figure 2 - Updated D&M IS Success Model (DeLone & McLean, 2003)

The updated D&M (2003) IS Success Model, as shown in ***Figure 2***, includes three dimensions of quality which have a causal influence on the intention to use a system and the *User Satisfaction*. Those two dimensions then again influence not only each other but also the *Net Benefits* dimension. Whether all those causal connections are positive or negative is not shown and needs to be "(…) hypothesized within the context of a particular study" (DeLone & McLean, 2003, p. 23). This implicates that for example poor *System Quality*, e.g. bad availability of a system, leads to dissatisfied users and therefore to negative *Net Benefits*. Negative *Net Benefits* subsequently influence *Use* and *User Satisfaction* and are likely to decrease system usage. Interpreting *Use* can be quite difficult as well since there are different forms of system use that again depend on the context surrounding the IS. For example, there is mandatory and voluntary use of an IS which has different meanings and therefore different impacts on *User Satisfaction* as well as on the *Net Benefits* dimensions. If the user is forced to use a system because it is the only way his job can be done, the implications of *Use* are different than in a voluntary context. It becomes apparent that *Use* and *User Satisfaction* are closely interrelated. The *Use* of a system must therefore precede *User Satisfaction* in a procedural way but positive or negative experience with *Use* will influence *User Satisfaction* in a causal sense. "Similarly, increased 'user satisfaction' will lead to increased 'intention to use,' and thus 'use'" (DeLone & McLean, 2003, pp. 23–24).

For a better understanding of the *Net Benefits* dimension the following sub-chapter describes how *Net Benefits* can be measured with a public-value approach.

2.3.1 Public Value Net Benefits

Since measuring success and *Net Benefits* in an E-Government environment is not a trivial task and in order to move away from the utilitarian focus the broadly defined *Net Benefits* originally had, Scott et al. (2015) propose to use the Public Value Theory to broaden the D&M IS Success Model, by creating a 30-item E-Government *Net Benefits* scale based on the said theory. This scale can be used to evaluate E-Government websites. Public Value can be defined as the understood value of governmental services or policies. This concept allows for a new understanding on how government activities are evaluated by combining efficiency and effectiveness dimensions as well as the creation of social value, such as trust in government, participation and engagement. The Public Value movement in contrast to NPM is not solely focused on effectiveness but rather tries to combine the effectiveness and efficiency dimensions to a broader array. Scott et al. (2015) mention that many studies underline the benefits of E-Government initiatives. But only few studies, as also mentioned in chapter 2.1, empirically examine *Net Benefits* from a citizen perspective. The value that is received by a service, the costs that are spent to receive the service and the resources that are needed in order to produce the service, result in net value. This net value compares to the Net Benefit dimension of the D&M IS Success Model. Possible variables that can be measured with the Public Value based Net Benefit dimensions comprise e.g. Time (saved time by using the online application), Communication (efficiency of communication methods), Trust (trust in government), Well-informedness (level of knowledge about governmental services or policies).

The research by Scott et al. therefore empirically validates *Net Benefits* constructs that measure E-Government success. The research shows that "(…) measuring success in eGovernment requires multi-dimensional constructs in order to accurately reflect value perceptions stemming from contemporary internet-based systems" (Scott et al., 2015, p. 15). Hence, success should also reflect the impacts of a system on a personal and societal level. Scott et al. found out that certain citizen value benefits such as trust or the ability to participate higher, than the amount of time saved by using a system. This shows that there are more "(…) sophisticated value perceptions than just efficiency and effectiveness" (Scott et al., 2015, p. 15). This demonstrates that using an E-Government application can result in various *Net Benefits* since not every type of user values benefits the same way.

Generally, the application of the D&M IS Success model must happen with a deep understanding of the researched information system and the organisation using the system. Only then, the researcher is able to identify viable measures for determining the success of the system. The purpose of the system therefore determines which measures are best used to evaluate its success. An e-commerce application for example compared to an E-Government website would have some similar and some different success measures. Both applications would measure up to date information or information accuracy but only the e-commerce application would measure personalisation of information (Petter et al., 2008, p. 239).

Summing up: The literature review on E-Government and Open Government research has shown that evaluation efforts are highly relevant. It has become clear that ZWN is a citizen-sourcing application in the Swiss Open Government environment. This master's thesis has therefore established a deep understanding of the researched topic in order to properly apply the D&M IS Success Model. The following chapter explains which hypotheses can be derived from the D&M model.

2.3.2 IS Success Dimensions and Hypotheses

The theoretical discussion about the IS Success model has provided insight on how the various dimensions relate to each other. DeLone and McLean (2004, pp. 34–38) adapted their own IS Success Model to e-commerce and therefore to the internet environment. The following hypotheses thus also include their association of the success variables to the Internet environment. This study posits that the dimensions of IS Success are related to the citizen's satisfaction which is influenced through *Use* as well. Therefore, it makes sense to derive the hypotheses with reference to the D&M model. Figure 3 shows the research model and the corresponding hypotheses that are being used to assess the success of ZWN.

System Quality measures the technological components of a system, such as availability of the system, responsiveness, ease of use. In the Internet environment, a measure such as the response time of the website is among the *System Quality* dimension. As DeLone and McLean (1992, p. 64) describe it "(…) most of these measures are fairly straightforward, reflecting the more engineering-oriented performance characteristics of the systems in question". Teo et al. (2008, p. 108) mention that a technical well established E-Government website should provide an easy, prompt and reliable access to information. For ZWN this means that the application should be online at all times and easy to navigate in order to report

a found issue. The integrated GPS should place the user, or rather locate the damaged infrastructure, at the desired point on the map of Zurich. This quality perception influences whether a user is going to use the application again or not. If the system is not reachable when a damaged infrastructure element is found, the user is most likely not going to postpone submitting the issue. This not only leads to a loss of information, because the municipality is not aware of the new issue, but also influences the user whether to use ZWN again or not. The following hypotheses can be derived.

> *Hypothesis 1a: The System Quality of "Züri wie neu" is positively associated with the Use of the platform.*

In the context of *User Satisfaction*, a similar approach can be used to derive the hypothesis. If the user of ZWN has experienced troubles whilst using the application, he is likely going to be dissatisfied. If the upload of the picture fails because of a technical error, if there are problems in navigation or if the system is not reachable, the satisfaction will most likely turn into frustration.

> *Hypothesis 1b: The System Quality of "Züri wie neu" is positively associated with the User Satisfaction of the platform.*

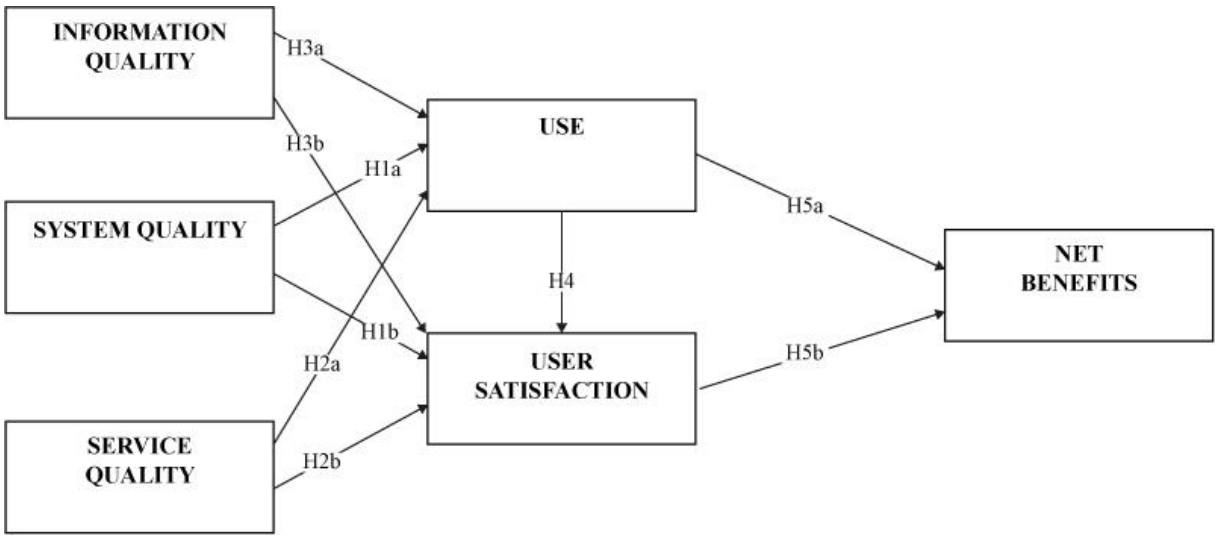

Figure 3 - Research model, adapted from DeLone & McLean, 2003

Service Quality as mentioned above is not part of the original model and is added due to the changes in the role of IS. It captures the quality of the delivered service by the service provider or the quality of the service the user receives, e.g. customer support, personalised responses, accuracy and empathy of the personnel. Teo et al. (2008, p. 108) mention that E-Government and especially an E-Government Websites "(…) can be analogically compared to a service agency with an IT interface that delivers services online". As described at the beginning of this chapter, there are many different uses of E-Government and also many different services the modern citizen can access via the Internet. Services like ZWN enable interactions with the government but also engagement from the user. Thus the employees of the municipality are more involved in delivering the service to the citizens, including the timely responding to a posted issue, the updating of information and the general overseeing of the application (Teo et al., 2008, p. 108). DeLone and McLean (2004) also mention the importance of service quality in an e-commerce environment, especially the support provided for the customers. For ZWN the support or the service in general describes the answers given by the authority to a posted issue. If there is no answer by the municipality after posting a found issue, the user is most likely going to think that the application is a farce and no one cares about the issue. Vice versa, a personalised response can stimulate and motivate the user to use the application again. Derived from these arguments the following hypotheses are proposed.

> *Hypothesis 2a: The Service Quality of "Züri wie neu" is positively associated with the Use of the platform.*

The same holds for *User Satisfaction*. If the answer given by the municipality is personalised and corresponds to the posted issue, the *User Satisfaction* is most likely going to be higher. The time it takes for the municipality to answer to an issue also might affect the satisfaction of a user.

> *Hypothesis 2b: The Service Quality of "Züri wie neu" is positively associated with the User Satisfaction of the platform.*

Information Quality comprises all the desirable outputs a system produces, e.g. content provided on the website, completeness of the displayed information, correctness, understandability. On the one hand, Teo et al. (2008, p. 107) describe the search of information as one of the most common reasons why citizens visit E-Government websites and thus, E-Government websites are being used for satisfying informational needs. This would suggest that *Information Quality* could literally be understood as the quality of the provided information. But this cannot hold up for ZWN, since the application's core idea is not to provide information but rather to collect information about infrastructure issues. Therefore, *Information Quality* needs to be looked at differently. DeLone and McLean (2004) on the other hand, also characterise *Information Quality* as the ease of understanding the content that is displayed on the website. If the user is not able to understand what the website is all about or how the application functions, he most likely will not visit again. In the context of ZWN, this definition of *Information Quality* makes more sense. Therefore, the following hypothesis can be derived.

> *Hypothesis 3a: The Information Quality of "Züri wie neu" is positively associated with the Use of the platform.*

Also the *User Satisfaction* is influenced by the *Information Quality* of an IS. Since with ZWN the found issues are all displayed on a map it is vital that this map is showing the city of Zurich in its latest urban development. If the user is not able to pinpoint the issue at the location the issue is found because the map is not up-to-date, not only the purpose of reporting an issue is defeated but also the satisfaction of the user is most likely going to be lower.

> *Hypothesis 3b: The Information Quality of "Züri wie neu" is positively associated with the User Satisfaction of the platform.*

System Use refers to "(…) the degree and manner in which staff and customers utilize the capabilities of an information system" (Petter et al., 2008, p. 239). In other words, Use refers to the way how the system is used, e.g. on what device a homepage is visited from, how often the system is used, or even the purpose of the use in the first place. 10 years after publishing the original IS Success Model, DeLone and McLean (2003, pp. 16–17) argue that "(…)

system usage is an appropriate measure of success in most cases." However, they specify that more system *Use* will not necessarily yield more benefits. This implies that simply measuring how often an IS is used cannot determine whether this IS can be considered successful or not. DeLone and McLean (2004) describe system *Use* in the e-commerce environment as one of the most influential measures of IS success because not only the nature of the usage but also the amount of times a system is used - especially when the usage is voluntary - are important indicators of success. Since the use of ZWN is entirely voluntary and the citizens of Zurich are also able to report damaged infrastructure via other media, this study presumes that the amount of times ZWN is used, is positively associated with the *User Satisfaction*. The following hypotheses are derived.

> *Hypothesis 4: The actual Use of "Züri wie neu" is positively associated with the overall User Satisfaction of the platform.*

The *Use* of an application like ZWN should therefore also affect the *Net Benefits* the user is experiencing. This means that through usage of the application a certain benefit will occur.

> *Hypothesis 5a: The actual Use of "Züri wie neu" is positively associated with Net Benefits.*

User Satisfaction measures the positive and negative factors that describe the users experience with an IS. According to Teo et al. (2008, p. 109) the success of an E-Government website and the intention to use or visit this website more than once greatly depends on the user's satisfaction with the website. The authors further state that the intention of a user to continue using an E-Government website may be compared to visits or revisits of a website's user. The user must first visit the website in order to decide whether he wants to visit again. This evaluation process will determine if a user is going to revisit a website or not. For ZWN this implicates that, if a user is satisfied with the application he is most likely going to use the application again, if he wants to report damaged infrastructure elements to the municipality. Since measuring both the influence of *Use* on *User Satisfaction* and the inverted relationship from *User Satisfaction* to *Use* is very complex, this assumption is not included in this thesis. Therefore, this thesis only measures the positive or negative associations *User Satisfaction* might have on the various *Net Benefits*. The following hypothesis is derived:

Hypothesis 5b: The User Satisfaction of "Züri wie neu" is positively associated with Net Benefits.

Net Benefits subsume all the positive and negative impacts of a system not only on the user, but also on the organisation providing the service, on markets, and so forth. *Net Benefits* measures how the success is affected by IS, e.g. times saved by using the system, money saved by using the system. "Net benefits success measures are clearly important, but they cannot be analysed and understood without system, information, and service-quality measurements" (DeLone & McLean, 2004, p. 35). As Scott et al. (2015) mention, DeLone and McLean define *Net Benefits* in a very broad manner. This led to a lot of *Net Benefits* measurements that exclusively focus on the work environment, predominantly taking a utilitarian focus. Therefore, as also mentioned in chapter 2.3.1, Scott et al. (2015) measure the success of E-Government systems and the corresponding *Net Benefits* by utilising the Public Value theory approach. For ZWN a possible Net Benefit a citizen may perceive is the time saved by reporting via the application instead of the traditional way. For simplicity, only the notation *Net Benefits* is used, when talking about the Public Value *Net Benefits* by Scott et al.

The feedback-loops from *Net Benefits* back on *User Satisfaction* and *Use* respectively, plus the feedback-loop from *User Satisfaction* back on *Use*, are not part of this master's thesis due to complexity reduction. More information about model specification and more reasons why the feedback-loops are excluded are detailed in chapter 4.3.1.

The following chapter explains how the nine hypothesised relationships between the three quality dimensions, *Use*, *User Satisfaction* as well as *Net Benefits* are to be measured in the context of "Züri wie neu".

3 Research Design and Method

This master's thesis adopts the DeLone and McLean IS Success Model (2003) and the public value based *Net Benefits* dimensions by Scott et al. (2015), by adapting them to an application called "Züri wie neu" in order to measure its success. The aforementioned theoretical backgrounds about E-Government and Open Government were not directly used to measure the success of this application, but proposed a way for analysing the results from different angles and were important for a better understanding of the overall topic. The initial

theoretical model by D&M was not changed for this master's thesis and all of the originally proposed relationships remained, but the feedback-loops (e.g. from *Net Benefits* back to *Use*; from *Use* to *User Satisfaction* and vice versa) were omitted due to complexity reasons in this thesis. In order to measure the hypothesised relationships a web-based survey was used to gather the necessary data. Combined with an already existing secondary dataset, all of the relationships could be measured appropriately.

This section explains the methodological framework of this thesis. At first, the sample is described and the data collection explained. Secondly, the various measurements and variables are discussed. Thirdly, the data analysis procedure is presented.

3.1 Data Collection and Sample

The data used to test the hypotheses formulated in the previous chapter consisted of secondary data that was provided by the municipality of Zurich, combined with a conducted survey that has been sent to all of the users of ZWN that posted a found issue on the platform. A meeting with representatives of the municipality of Zurich has shown that some of the data, collected by the system itself, may only be used and interpreted with caution. Nevertheless, the secondary data provided numerous useful information mostly about the usage dimension of the researched model. For example, how many times a unique user has used the platform for reporting about a damaged infrastructure element. As shown in Table 2 the dimension of *Use* is not part of the questionnaire. This was due to the fact that the secondary dataset already provided the relevant data concerning *Use* and therefore, collecting additional data was not necessary. The data file allowed to combining actual usage data and self-reported data obtained via the questionnaire. Using two different sources for the data collection, the questionnaire and the actual usage data, also helped to minimise or to eliminate common method biases as explained by Podsakoff et al. (2003). Method biases pose a problem to research because they are the main sources of measurement error and can have serious impacts on findings. They are "(…) likely to be particularly powerful in studies in which the data for both the predictor and criterion variable are obtained from the same person in the same measurement context using the same item context and similar item characteristics" (Podsakoff et al., 2003, p. 885). Thus using different sources for data collection minimises the risk of having such method variances.

During literature review, the parallel development of the web-based survey took place. The literature review helped identifying previously already used and validated scales that could be adapted to the Open Government environment and thus to the application ZWN. Since this master's thesis is part of a larger research project, the complete survey consisted of more questions than this master's thesis is considering. The survey comprised a total of 77 questions including control variables. 50 of these questions were of importance for this thesis.[1] A seven-point Likert scale was used for measuring the items ranging from "stimme überhaupt nicht zu" (strongly disagree) to "stimme voll und ganz zu" (strongly agree) (Wang & Liao, 2008). Since ZWN is a Swiss application and Zurich is based in the German-speaking part of Switzerland all of the questions in the survey have been translated into German. Several rounds of evaluation helped redefining and modifying the initial survey. The modified version was then pilot tested with members of *the Institute of Information Systems* and members of the *Center of Competence for Public Management and Policy* at the University of Bern. The comments made during the pilot study were implemented and the final version of the survey created.

The survey was then sent on the 07.07.2016 to 2613 unique users that have used the application since 01.06.2013. This date was chosen because of operational reasons by the representatives of the municipality of Zurich. Reported issues submitted before this cut-off date are mostly test reports from government employees, journalists or users that wanted to test the application when it was just released. Thus it makes sense to exclude, as far as possible, the just mentioned users and the respective reports from the final sample. While reporting an issue on ZWN a unique user ID based on the entered email-address is created. Hence, each individual user theoretically should have a unique user ID. However, it is acknowledged that there is still a risk of duplicates entering the dataset as a result of users not entering the same email-address while posting at a later date. This behaviour leads to the creation of a new user ID which effectively is for an already existing user. Unfortunately, there is no way that helps preventing this issue. Out of these 2613 users that the questionnaire was initially sent to, 209 emails hard bounced or returned due to out of office messages and therefore, reduced the actual sample size to 2404. Roughly 2 weeks after sending out the questionnaire a reminder e-mail was sent to all of the users that have not yet participated in the survey. Overall 974 users started the survey and 705 completely finished the

[1] As shown in section 5.3 the additional 30 items are used to measure public service motivation (PSM) and motivation in an open-source context for further research on this topic.

questionnaire. Since this research also includes partially completed questionnaires a total of 759 observations were considered during data evaluation. ***Table 1*** below summarises various characteristics of the respondents, e.g. *age*, *gender*, *education*. Since the provided secondary data file did not include the email-addresses of all the relevant users due to privacy reasons, the users had to be contacted directly by the municipality. Thus, the responsibility for distributing the survey was with the municipality of Zurich (Geographical-Informationsystem Centre, GIS) with guidance from the University of Bern. In order to be able to link the secondary data with the data obtained from the survey, unique answering hyperlinks had to be created before sending out the survey. This was important for accurately determining the users and matching the answers from the questionnaire with the secondary data file. The tool used for creating and conducting the survey was Qualtrics.

Table 1
Characteristics of Respondents

Characteristic	Count	Percentage
Gender		
Male	575	76
Female	184	24
Age		
<20	58	8
21-30	178	24
31-40	194	26
41-50	178	24
>51	146	19
Education		
Obligatory Education	12	2
Vocational Education	177	23
Professional Maturity	19	3
High-School	36	5
College of prof. Education and Training	149	20
Graduate	300	40
Doctorate	59	8
Others	6	1
Industry		
Private Sector	295	41
Public Sector	258	35
Non-Profit Sector	30	4
Self-Employed	90	12
Others	54	7

3.2 Measures and Operationalisation

This subsection explains the measures used in this research. Many scholars have used many different scales to measure the different IS Success dimensions (Petter et al., 2008, p. 141). To ensure that the measurements and scales of this study were valid, the selected items for measuring the hypotheses were mainly adapted from prior studies. As mentioned in chapter 2 the three quality dimensions of the D&M Success Model need to be controlled for separately, "(…) because singularly or jointly, they will affect subsequent 'use' and 'user satisfaction'" (DeLone & McLean, 2003, p. 23).

System Quality was operationalised with five items *(SQ1 – SQ5)*, concerning the more technical aspects of ZWN: e.g. "Züri wie neu is easy to use" *(SQ1)* or "Züri wie neu works as expected" *(SQ3).*

Information Quality was also assessed through five items *(IQ1 – IQ5)*. One such item was "Züri wie neu provides all necessary information that is needed to report an issue" *(IQ3).*

Service Quality was assessed through five items as well *(SvQ1 – SvQ5)*, measuring how the service is perceived by the users of ZWN: e.g. "The answers given to a reported issue, respond directly to it" *(SvQ1)* or "The staff quickly responds to my posted issue" *(SvQ2).*

User satisfaction was measured using five items *(US1 – US5)* that capture whether the user is satisfied with the application or not. One such item was "Züri wie neu measures up to my expectations" *(US1).*

Use, as mentioned above, was not measured with the questionnaire. Variables concerning this dimension are all taken from the secondary dataset. As Petter et al. (2008, p. 241) mention, there are different ways and measures that try to capture IS use. "These different measures could potentially lead to mixed results between use and other constructs in the D&M model" (Petter et al., 2008, p. 241). They further comment on the fact that self-reported use is significantly different from actual use. In other words, "(…) heavy users tend to underestimate use, while light users tended to overestimate use" (Petter et al., 2008, p. 241). This suggests that self-reported use could lead to results that may be misinterpreted. However, they further discuss the suggestion of Doll & Torkzadeh (1998) that more *Use* not always leads to better results and therefore, the *frequency of use* might not be the best measure of IS

use overall. This clearly confirms the approach of this research of using two separate data files for measuring IS Success. *Use* was operationalised with the item *Number of Reports per User* which describes how often a unique user ID is being used for reporting an issue. This therefore measured how often a user effectively used the system.

Net Benefits were assessed through six sub-dimensions according to Scott et al. (2015): Time, Convenience, Communication, Well-informedness, Participate in decision-making as well as Trust. These sub-dimensions are assessed with a total of 21 items *(NB1 – NB21)*. Therefore, nine items of the original research by Scott et al. were not taken into account. The sub-dimension *cost, ease of information retrieval* and *personalisation* could not be adapted to ZWN, or would not make sense in this given context (e.g. there is no personalisation on the website of ZWN, measuring personalisation would be obsolete) and are therefore excluded.

In addition to the above-mentioned measures the proposed model also included several control variables, e.g. Gender, Age, Postcode, Highest obtained education, Employment status. The variable postcode was measured in absolute numbers and recoded into 1 if the code matched a corresponding postcode of the municipality of Zurich and 0 if not.

The sources for the adapted measures concerning the dimensions of the D&M model are shown and summarised in Table 2, ***Table 3*** and ***Table 4***. As described in the previous chapter, all of the items that had been used in the survey asked the participants to indicate whether they agree with a statement or not on a seven-point Likert scale.

Table 2
Measures and Sources

		System Quality	
SQ1	"Züri wie neu"	ist leicht zu bedienen	(Floropoulos et al., 2010; Prybutok, Zhang, & Ryan, 2008; Rana et al., 2014; Teo et al., 2008; Wang & Liao, 2008)
SQ2	"Züri wie neu"	ist benutzerfreundlich	
SQ3	"Züri wie neu"	funktioniert so, wie ich es erwarte	
SQ4	"Züri wie neu"	erlaubt es mir, einfach eine Meldung abzugeben	
SQ5	"Züri wie neu"	verfügt über die notwendigen Funktionen	
		Information Quality	
IQ1		Die Kategorien bei "Züri wie neu" sind zutreffend	(Floropoulos et al., 2010; Prybutok et al., 2008; Rana et al., 2014; Teo et al., 2008; Wang & Liao, 2008)
IQ2		Das Kartenmaterial von "Züri wie neu" ist aktuell	
IQ3		Züri wie neu stellt mir alle notwendigen Informationen für eine Meldung zur Verfügung	
IQ4		Die Informationen zur Anwendung von "Züri wie neu" sind fehlerfrei	
IQ5		Die bereitgestellten Informationen auf "Züri wie neu" sind zuverlässig	
		Service Quality	
SvQ1		Die Antworten, die ich von "Züri wie neu" erhalte, gehen auf meine Bedürfnisse ein	(Floropoulos et al., 2010; Prybutok et al., 2008; Rana et al., 2014; Teo et al., 2008; Wang & Liao, 2008)
SvQ2		Die Antworten auf "Züri wie neu" erfolgen rasch	
SvQ3		Die Stadt Zürich nimmt meine Meldungen auf "Züri wie neu" ernst	
SvQ4		"Züri wie neu" ist im Sinne der Bürgerinnen und Bürger entwickelt worden	
SvQ5		Meine Meldungen auf "Züri wie neu" werden passend beantwortet	
		User Satisfaction	
US1		"Züri wie neu" erfüllt meine Erwartungen	(Floropoulos et al., 2010; Prybutok et al., 2008; Rana et al., 2014; Teo et al., 2008; Wang & Liao, 2008)
US2		Dank "Züri wie neu" wird mein Anliegen effizient bearbeitet	
US3		Dank "Züri wie neu" kann ich einfach den zuständigen Behörden eine Meldung abgeben	
US4		Meine Meldungen auf "Züri wie neu" wurden zu meiner Zufriedenheit behandelt	
US5		Ich würde "Züri wie neu" wiederverwenden	

Table 3
Measures and Sources (continued)

		Net Benefits - Time	
NB1		"Züri wie neu" spart mir Zeit	(Scott et al., 2015)
NB2		Mit "Züri wie neu" erhalte ich schneller Antwort als über herkömmliche Meldeverfahren	
NB3		Mit "Züri wie neu" bekomme ich Dinge schneller geregelt	
NB4		Dank "Züri wie neu" kann ich den direkten Kontakt mit der Verwaltung vermeiden	
		Net Benefits - Convenience	
NB5		Es ist mir wichtig, dass die Benutzung von "Züri wie neu" jeder Zeit möglich ist	(Scott et al., 2015)
NB6		Es ist mir wichtig, dass der Zugriff auf "Züri wie neu" von überall möglich ist	
NB7		"Züri wie neu" ist so flexibel, dass ich nicht von anderen Tätigkeiten abgehalten werde.	
		Net Benefits - Communication	
NB8	"Züri wie neu"	ermöglicht eine effiziente Kommunikation mit der Stadt Zürich	(Scott et al., 2015)
NB9	"Züri wie neu"	ist eine gute Möglichkeit mit der Stadt Zürich zu kommunizieren	
NB10	"Züri wie neu"	ist eine zielgerichtete Weise um mit der Stadt Zürich zu kommunizieren	
		Net Benefits - Well-informedness	
NB11	"Züri wie neu"	verbessert mein Verständnis für die Dienstleistungen der Stadt Zürich	(Scott et al., 2015)
NB12	"Züri wie neu"	erhöht mein Wissen zu Themen, die mir wichtig sind	
NB13	"Züri wie neu"	erlaubt mir auf verschiedene Bedürfnisse Antworten zu erhalten	
		Net Benefits - Participate in decision-making	
NB14	"Züri wie neu"	erlaubt mir Einfluss zu nehmen auf Dinge, die mir wichtig sind	(Scott et al., 2015)
NB15	"Züri wie neu"	verstärkt mein Gefühl, Teil einer aktiven Demokratie zu sein	
NB16	"Züri wie neu"	gibt mir das Gefühl, dass Entscheidungsträger mich anhören	
NB17	"Züri wie neu"	gibt mir das Gefühl, dass ich bei wichtigen Angelegenheiten gefragt werde	
		Net Benefits - Trust	
NB18		"Züri wie neu" dient dem Interesse der Bevölkerung	(Scott et al., 2015)
NB19		"Züri wie neu" benutze ich gerne, weil meine Anfragen effizient bearbeitet werden	
NB20		Ich kann mich immer auf "Züri wie neu" verlassen	
NB21		Ich verlasse mich darauf, dass "Züri wie neu" seinen Zweck erfüllt	

Table 4
Measures and Sources (continued)

	Demographics / Control variables	
D1	Bitte geben Sie Ihr Geschlecht an	Male / Female
D2	Bitte gebe Sie Ihr Alter an	In years
D3	Bitte geben Sie die Postleitzahl Ihrer Haupt-Wohnadresse an	Postcode
D4	Bitte geben Sie Ihren höchsten Bildungsabschluss an	e.g. School / University
D5	Welches ist Ihre Muttersprache?	German, French, Rhaeto-Romanic, Italian
D6	Sind Sie berufstätig?	Yes / No
D7	Wie hoch ist Ihr Arbeitspensum in Prozent?	1-100%
D8	In welchem Sektor Arbeiten Sie?	e.g. Non-profit, public-, private-sector
D9	Ich habe mit mehreren Mailadressen an "Züri wie neu" teilgenommen	Yes / No

3.3 Data Analysis Procedures

This research wants to test a large number of hypotheses with different indirect and direct associations on each other all combined with a large number of variables and items which creates a relatively complex research model. Therefore, a clear and well established tool for data analysis is needed (Neumann, 2014). According to Kline (2011, p. 121) a method that supports the above mentioned criteria for complex research models are path analysis in a structural equation model (SEM) framework. This structural model allows for testing "(…) spurious associations and direct or indirect effects among observed variables" (Kline, 2011, p. 121). With structural equation modelling there are two "(…) classes of variables (…), observed and latent" (Kline, 2011, p. 8). Generally, latent variables explain factors that are not directly observable. With ZWN an example of a latent variable was the construct of *Service Quality*. This construct can be measured very differently and researchers use different types of methods to assess the quality of such a service (e.g. Papadomichelaki & Mentzas, 2012). This shows that there is not one single type of measure, that captures said construct (Kline, 2011, p. 9). The observed variable on the other hand is, as the name states, directly observable. In this research such an observable variable was the construct of *Use* which was directly measured with the usage data obtained from ZWN. Furthermore, SEM requires a large sample, preferably with a sample size over 400, which was given with this master's thesis (Lei & Wu, 2007, p. 36).

As Kline (2011, p. 154ff) states the estimation method maximum likelihood (ML) is most common used with SEM. Therefore, also this research adapted this method. ML describes the estimates as "(…) the ones that maximize the likelihood (…) that the data (…) were drawn from this population" (Kline, 2011, p. 154). Furthermore, ML is a full-information method, that calculates all model parameters at once, thus being very efficient. Additionally, to handle the missing values in the data file, the full information maximum likelihood (FIML) method was used. "FIML maximizes a modified log-likelihood function that makes use of all available individual observations" (Lei & Wu, 2012, p. 167). Lei and Wu (2012, p. 167) further state that FIML handles data very well, since no observations are being left out. Thus a more complete picture can be drawn. Also Kline (2011, p. 59) notes that this method generally outperforms other estimation methods. The ability to include missing data (N/A) into the calculation is very important, since the data file used in this research contained numerous missing values as above-mentioned.

The software used for the SEM in this research was the latest version of the open-source package *lavaan* (0.5-20) which is based on *R*. “lavaan is an acronym for latent variable analysis, and its name reveals the long-term goal: to provide a collection of tools that can be used to explore, estimate, and understand a wide family of latent variable models, including factor analysis, structural equation, longitudinal, multilevel, latent class, item response, and missing data models” (Rosseel, 2012, p. 1).

4 Results and Analysis

In this chapter, the proposed research question and the hypotheses will be analysed with the obtained data from the questionnaire and the results presented. The first subsection provides descriptive statistics of all the different variables. The second part of this chapter assesses the structural equation modelling (SEM) together with the analysis of model fit and necessary model respecification. Then the hypotheses will be tested with the respecified model and the results presented.

4.1 Descriptive Statistics

Table 5 and Table 6 give an overview of various descriptive statistics taken from the standard *summary()* function in *R*. Combined with the *stat.desc()* function of the *pastecs* package an overview of the following relevant parameters is given: The total number of observations (n) per variable, the missing values (N/A), minimum and maximum values (Min, Max), first and third quartiles (1^{st} Qu., 3^{rd} Qu.), median and mean of the given answers per variable and the standard deviations (SD). These metrics allow for a complete and comprehensive overview of the obtained data.

Table 5
Descriptive Statistics

Variable	n	N/A	Min	Max	1st Qu.	3rd Qu.	Median	Mean	SD
NrOfReportsUser	759	0	1.00	167.00	1.00	3.00	2.00	3.82	9.44
SQ1	752	7	1.00	7.00	5.00	7.00	6.00	5.90	1.05
SQ2	752	7	1.00	7.00	5.00	7.00	6.00	5.84	1.09
SQ3	754	5	1.00	7.00	5.00	7.00	6.00	5.80	1.18
SQ4	758	1	1.00	7.00	6.00	7.00	6.00	6.11	1.03
SQ5	753	6	1.00	7.00	5.00	6.00	6.00	5.81	1.06
IQ1	738	21	1.00	7.00	5.00	6.00	6.00	5.44	1.13
IQ2	738	21	1.00	7.00	5.00	7.00	6.00	5.86	1.01
IQ3	747	12	1.00	7.00	5.00	6.00	6.00	5.72	1.10
IQ4	738	21	1.00	7.00	5.00	6.00	6.00	5.60	1.13
IQ5	738	21	1.00	7.00	5.00	6.00	6.00	5.71	1.03
SvQ1	741	18	1.00	7.00	5.00	6.00	6.00	5.44	1.51
SvQ2	744	15	1.00	7.00	5.00	7.00	6.00	5.79	1.25
SvQ3	744	15	1.00	7.00	5.00	7.00	6.00	5.77	1.45
SvQ4	740	19	1.00	7.00	6.00	7.00	6.00	6.00	1.13
SvQ5	741	18	1.00	7.00	5.00	7.00	6.00	5.57	1.48
US1	743	16	1.00	7.00	5.00	7.00	6.00	5.68	1.46
US2	740	19	1.00	7.00	5.00	7.00	6.00	5.63	1.47
US3	744	15	1.00	7.00	6.00	7.00	6.00	6.20	1.05
US4	743	16	1.00	7.00	5.00	7.00	6.00	5.60	1.58
US5	745	14	1.00	7.00	6.00	7.00	7.00	6.23	1.29
Net Benefits									
NB1	708	51	1.00	7.00	4.00	7.00	6.00	5.44	1.45
NB2	704	55	1.00	7.00	5.00	7.00	6.00	5.53	1.33
NB3	707	52	1.00	7.00	5.00	7.00	6.00	5.37	1.35
NB4	704	55	1.00	7.00	4.00	6.00	5.00	4.81	1.53

Table 6
Descriptive Statistics (continued)

Variable	n	N/A	Min	Max	1st Qu.	3rd Qu.	Median	Mean	SD
NB5	710	49	1.00	7.00	5.00	7.00	6.00	5.94	1.15
NB6	707	52	1.00	7.00	5.00	7.00	6.00	5.79	1.24
NB7	695	64	1.00	7.00	4.00	6.00	5.00	5.08	1.26
NB8	698	61	1.00	7.00	5.00	6.00	6.00	5.57	1.27
NB9	698	61	1.00	7.00	5.00	6.00	6.00	5.59	1.26
NB10	696	63	1.00	7.00	5.00	6.00	6.00	5.66	1.22
NB11	697	62	1.00	7.00	4.00	6.00	5.00	4.74	1.47
NB12	692	67	1.00	7.00	3.00	5.00	4.00	4.04	1.50
NB13	695	64	1.00	7.00	4.00	6.00	5.00	4.85	1.42
NB14	688	71	1.00	7.00	4.00	6.00	5.00	5.16	1.44
NB15	690	69	1.00	7.00	4.00	6.00	5.00	4.77	1.64
NB16	685	74	1.00	7.00	4.00	6.00	5.00	4.70	1.52
NB17	687	72	1.00	7.00	3.00	5.00	4.00	4.19	1.65
NB18	709	50	1.00	7.00	6.00	7.00	6.00	6.03	1.08
NB19	707	52	1.00	7.00	5.00	6.00	6.00	5.57	1.32
NB20	703	56	1.00	7.00	4.00	6.00	5.00	5.18	1.36
NB21	708	51	1.00	7.00	5.00	7.00	6.00	5.79	1.195
Control Variables									
D1	758	1	1.00	2.00	1.00	1.00	1.00	1.24	0.43
D2	754	5	7.00	91.00	29.00	47.00	37.00	38.31	13.27
D3	759	0	0.00	1.00	1.00	1.00	1.00	0.81	0.40
D4	758	1	1.00	8.00	3.00	6.00	5.00	4.71	1.79
D5	758	1	1.00	6.00	1.00	1.00	1.00	1.22	0.92
D6	759	0	1.00	2.00	1.00	1.00	1.00	1.16	0.36
D7	728	31	1.00	21.00	15.00	21.00	21.00	16.65	6.72
D8	727	32	1.00	5.00	1.00	2.00	2.00	2.11	1.27
D9	759	0	1.00	2.00	2.00	2.00	2.00	1.91	0.29

4.2 Correlations

This section examines the various correlations between the different variables as a preparation for the SEM analysis. As Kline (2011, p. 51) postulates, it is necessary to examine the data with a correlation matrix before analysing the SEM. Furthermore, the correlation matrix allows to present first results concerning the hypotheses. The results of the correlation matrix indicate the dependences between the different variables. Since this research examines a wide range of different variables Table 7 presents the correlations grouped together according to the D&M IS Success Model. The correlation coefficients are shown together with the respective p-values. A correlation matrix containing all of the variables can be found in the appendix of this thesis.

The Pearson's correlations coefficients were calculated using the *rcorr* function of the Harrell Miscellaneous (Hmisc) package for *R*. *rcorr* calculates the correlations and the respective P-values all at once, allowing to test for statistical significance (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$).

Table 7
Correlations (grouped)

Variables	1	2	3	4	5	6
1 Nr. Of Reports per User	1.00					
2 User Satisfaction	0.02	1.00				
3 System Quality	-0.01	0.57 ***	1.00			
4 Information Quality	-0.06	0.57 ***	0.70 ***	1.00		
5 Service Quality	0.02	0.90 ***	0.54 ***	0.57 ***	1.00	
6 Net Benefits	0.05	0.70 ***	0.46 ***	0.53 ***	0.67 ***	1.00

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Hypothesis 1a, postulating that the *System Quality* of "Züri wie neu" is positively associated with the *Use* of the platform, was not supported by the correlation matrix. Interestingly, even a marginally negative, although not significant correlation was reported ($r = -0.01$; not significant). On the other hand, for hypothesis 1b that stated the same for the relationship between *User Satisfaction* and *System Quality*, highly significant support could be found ($r = 0.57$; $p < 0.001$).

Hypothesis 2a stated that the *Service Quality* of "Züri wie neu" is positively associated with the *Use* of the platform, found no significant support ($r = 0.02$; not significant). The relationship between *User Satisfaction* and *Service Quality*, which is postulated by hypothesis 2b, was highly correlated and also highly significantly supported ($r = 0.90$; $p < 0.001$). A correlation this high could be a sign of collinearity that occurs when "(…) separate variables actually measure the same thing" (Kline, 2011, p. 51), which will again be discussed in the following chapter.

Regarding hypothesis 3a, also no significant support could be found for the assumed positively associated relationship between the *Information Quality* of "Züri wie neu" and the *Use* of the platform ($r = -0.06$; not significant). Hypothesis 3b, stated the same for the relationship of *Information Quality* and *User Satisfaction*. This correlation was again highly significant ($r = 0.57$; $p < 0.001$).

With regard to Hypothesis 4, which postulated a positively associated relationship between *Use* & *User Satisfaction*, only a marginally positive correlation was reported. Moreover, the correlation was not statistically significant ($r = 0.02$; not significant).

Hypothesis 6a, which stated that the *Use* of "Züri wie neu" is positively associated with the perceived *Net Benefits*, also found no support in the correlation matrix ($r = 0.05$; not significant). Hypothesis 6b, postulated that the *User Satisfaction* of "Züri wie neu" is positively associated with the perceived *Net Benefits* on the other hand, found highly significant support ($r = 0.70$; $p < 0.001$).

The findings of the correlation matrix show, that all of the relationships involving *User Satisfaction* were highly significant, but all of the relationships concerning the actual *Use* of the platform were not. Thus, also the relationship between *User Satisfaction* and *Use* was not significantly correlated.

4.3 Structural Equation Modelling

As Kline (2011, pp. 91–95) suggests, one should follow six basic steps for analysing SEM, including measure selection and data collection which has already been done and is explained in the chapter about Research Design and Method. The following sub-chapters therefore describe the approach to structural equation modelling according to the remaining steps proposed by Kline. First some general descriptions about SEM including model specification and identification are detailed for a better understanding of this approach. Then the model fit and necessary respecifications are presented before finally turning to hypotheses testing with the SEM.

4.3.1 Specification and Identification

The first step according to Kline (2011, p. 91) is the specification of the initial model. As shown in Figure 4 the model parameters are defined similarly to the D&M IS Success Model. This initial model, model 1, represents the hypotheses in the form of a structural equation model. The graphical representation consists of all the latent variables (e.g. *Service Quality*, *System Quality*) and the observable variable (e.g. *Use*). Lei and Wu (2007, p. 35) specify that a "(…) sound model is theory based. Theory is based on findings in the literature, knowledge in the field, or one's educated guesses, from which causes and effects among variables within the theory are specified". Thus, Figure 4 shows the structural equation model which is derived from theory. The feedback-loops, as described in the original D&M IS Success Model are not part of this initial model. Models with feedback-loops are specified with variables that influence each other simultaneously. However, the variables in this research are only measured once and moreover at the same time. Hence, measuring the feedback-loops would lead to complex model specifications (Kline, 2012, pp. 111–125). As described by Kline (2011, p. 98ff.) this is a result of directionality. Since this study only measures at one given point in time, it is not easily possible to determine whether e.g. *Use* influences *User Satisfaction* or whether *User Satisfaction* influences *Use*. It would be however possible to show an association but not in which direction. Therefore, and since the scope of this master's thesis is also rather limited, the originally proposed feedback-loops were being removed from the SEM in order to reduce model complexity. It was further assumed that the proposed research paths only show the influence of one variable on another, e.g. *Use* influences *User Satisfaction* and not vice versa.

Nevertheless, the chosen approach of this thesis, to specify and derive the SEM model based on existing theory, is concluded and thus the first step according to Kline is accomplished.

Since the proposed model 1 is a recursive model, identification, according to Kline (Kline, 2011, pp. 148–149), is rather simple. The degrees of freedom need to be at least zero, the latent variables need interpretable scales and the factors at least two indicators which is given with the proposed model. Lei and Wu (2007, p. 35) clarify that since model specification is very flexible, different models can be derived from theory but not all specified models can be properly identified and estimated. They further note that identification of a model means every model parameter can be estimated.

4.3.2 Model Fit and Respecification

The next step was to conduct a first analysis using *lavaan* to assess the model fit. Before the parameters can be interpreted to make a statement about the hypotheses, it was essential to test whether the proposed model fits the data or not. There is a variety of indices measuring different aspects of model fit. Since on the one hand it is not realistic to include every fit-test the summary() function of the *lavaan-package* outputs, but on the other hand more than one test should be reported, it is necessary to describe which fit indices are reported and why they are deemed appropriate for this research. According to the recommendations of Hooper et al. (2008, p. 56), the following indices were being used in this thesis.

One test that always should be reported according to Kline (2011, p. 209) is the Model Chi-Square ($\chi 2$) test. $\chi 2$ – test "(…) assess the magnitude of discrepancy between the sample and fitted covariance matrices (…)" (Hu & Bentler, 1999, p. 2). This means according to Hooper et al. (2008, p. 53f) that a good model fit should provide an insignificant result at $p > 0.05$. Thus, $\chi 2$-test actually measures the badness of model fit. It is important to note that $\chi 2$-test is very sensitive to sample size, since it basically is a significance test that potentially leads to low p-values. Almost always models with a large sample size get rejected ($p < 0.05$) by Chi-Square statistics. Thus, the ratio of the degrees of freedom (df) to the $\chi 2$ needs to be taken into account as well. Since "(…) there is no consensus regarding an acceptable ratio for this statistic (…)" (Hooper et al., 2008, p. 53), a ratio of 3.0 was used in this thesis.

The second fit statistic that was reported is the Root Mean Square Error Of Approximation (RMSEA), which "(…) tells us how well the model, with unknown but optimally chosen parameter estimates would fit the populations covariance matrix" (Hooper et al., 2008, p. 54). This badness-of-fit indicator calls for values close to 0.06 for good model fit. Meaning that a value of 0 would indicate perfect model fit and values close to 1.00 would indicate bad model fit (Hu & Bentler, 1999, p. 27).

Thirdly the values of the Standardised Root Mean Square Residual (SRMR) range from 0.00 to 1.00, with lower values indicating good model fit. Since the values of SRMR are standardised, the SRMR is easily interpretable. The threshold of SRMR as suggested by Hu and Bentler (1999, p. 27) is a value lower than 0.08 for good model fit. As Hooper et al. (2008, p. 55) point out, well-fitting models achieve values lower than 0.05, therefore this more strict cut-off value was used.
And lastly the values of the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) ranging from 0.00 to 1.00 with values closer to 1.00 indicating good model fit were reported. A cut-off value of 0.95 is recommended by Hu and Bentler (1999, p. 27). Meaning that a good model fit should obtain a value > 0.95.
Summarising, the following indices were being reported: $\chi 2$ – Test (together with the degrees of freedom and the respective p-value), RMSEA, SRMR, CFI and TLI.

The first *sem* in *lavaan* was conducted with the specified initial model, model 1, which is illustrated below in Figure 4. The corresponding regression paths were all based on the D&M IS Success Model and for example described the relationship of *Use* as a depending variable that is associated with several independent variables (e.g. *User Satisfaction*, *System Quality*). The first model run correctly through the lavaan functions. The summary() command yielded the following model fit indices: $\chi 2$ 3559.237 (degrees of freedom 1153, p-value 0.000), RMSEA 0.052 (90 Percent Confidence Interval 0.050 and 0.054), SRMR 0.063, CFI 0.901, TLI 0.894.
The model fit values for model 1 were partially below their respective cut-off values that have been presented above, therefore model fit of model 1 seemed in need of improvement. It was therefore necessary to respecify this model. As Lei and Wu (2007, p. 38) put it: “When the hypothesized model is rejected based on goodness-of-fit statistics, SEM researchers are often interested in finding an alternative model that fits the data”. Kline (2011, p. 94) argues that a model respecification should not only be based on statistical demands but rather on theory and rational. Thus, the changes that are made to a specified model should be supported by theories, otherwise post hoc modifications are rather arbitrary and may lead to false interpretation (Lei & Wu, 2007, p. 39).

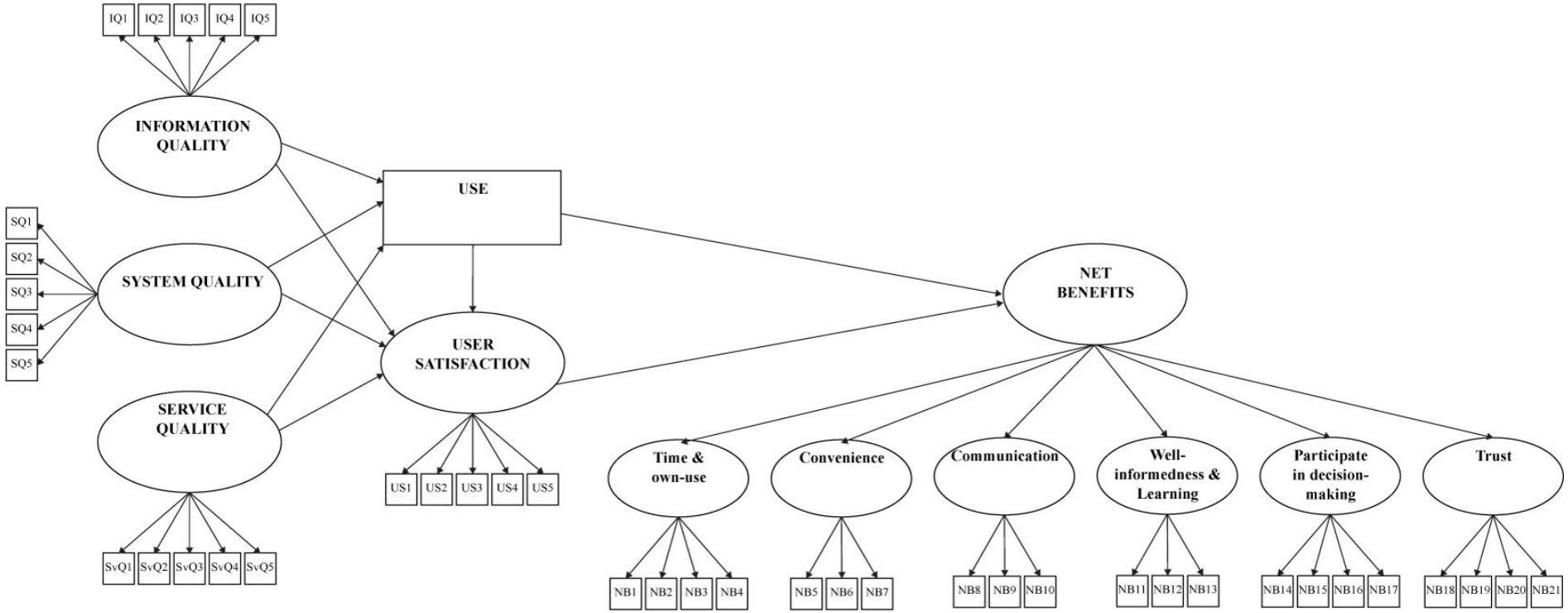

Figure 4 - Structural Equation Model 1.

Observed variables are represented with rectangles (e.g. □) whereas latent variables are represented with ellipses (e.g. ○).

Hypothesised effects of one variable on another are represented with an arrow (e.g. →) (Kline, 2011, p. 95)

With regard to the respecified model, model 2, several parts of the original model were changed and some factors were omitted. As it turned out, *User Satisfaction* and *Service Quality* strongly correlated in model 1. Thus, multicollinearity occurred causing estimation problems with the initial SEM. This finding was already briefly discussed in the previous chapter. Kline (2011, p. 362) remarks that analysing highly correlated (i.e. the reported *r* is > than 0.85) variables will lead to unstable solutions. Therefore, it seemed necessary to either omit *Service Quality* or *User Satisfaction*. Since the whole *Net Benefits* construct, as described by Scott et al. (2015), is also hypothesised with *User Satisfaction* and *User Satisfaction* yielded overall better results, *Service Quality* was taken out of the respecified model in order to stabilise the reported statistical results. Furthermore, as it turned out, the construct of *Net Benefits* which comprised the various public value sub-constructs did not yield satisfactory results. Therefore, since taking out the whole *Net Benefits* construct would somehow defeat the purpose of this research and would be completely contradictory to theory, it has been split up into the proposed subcategories. In other words, *Use* and *User Satisfaction* were no longer tested on *Net Benefits*, but rather on *Time*, *Convenience*, *Communication*, *Well-Informedness*, *Participation in Decision-Making* as well as on *Trust*. This specification yielded much better and satisfactory results. Additionally, it became apparent that paths from *System Quality* as well as from *Information Quality* to the various public value *Net Benefits* may be added to the model, since according to Scott et al. (2015, p. 12) the quality dimensions "(…) participate in a combined significant relationship (…) with the Net Benefits scale". Therefore, it was decided to add those regression paths as well, also to compensate for the loss of the hypothesised interactions of *Service Quality*. This potentially leads to post-hoc findings that were not hypothesised to begin with but that are still theoretically plausible. The illustrated, respecified model, model 2, is shown below in Figure 5.

The summary() command of lavaan returned the following fit-indices for model 2: $\chi 2$ 1499.715 (degrees of freedom 675, p-value 0.000), RMSEA 0.040 (90 Percent Confidence Interval 0.037 and 0.043), SRMR 0.35, CFI 0.953, TLI 0.943. Compared to model 1, the indices have improved and are closer to the recommended cut-off values. The $\chi 2$-test indicated a significant p-value and hence suggested bad model fit, which was most likely due to the large sample size of this research, as already mentioned above. Therefore, model fit has improved and is deemed satisfactory for interpreting the results. Thus, the following sub-section tests the proposed hypotheses with this secondary, revised model.

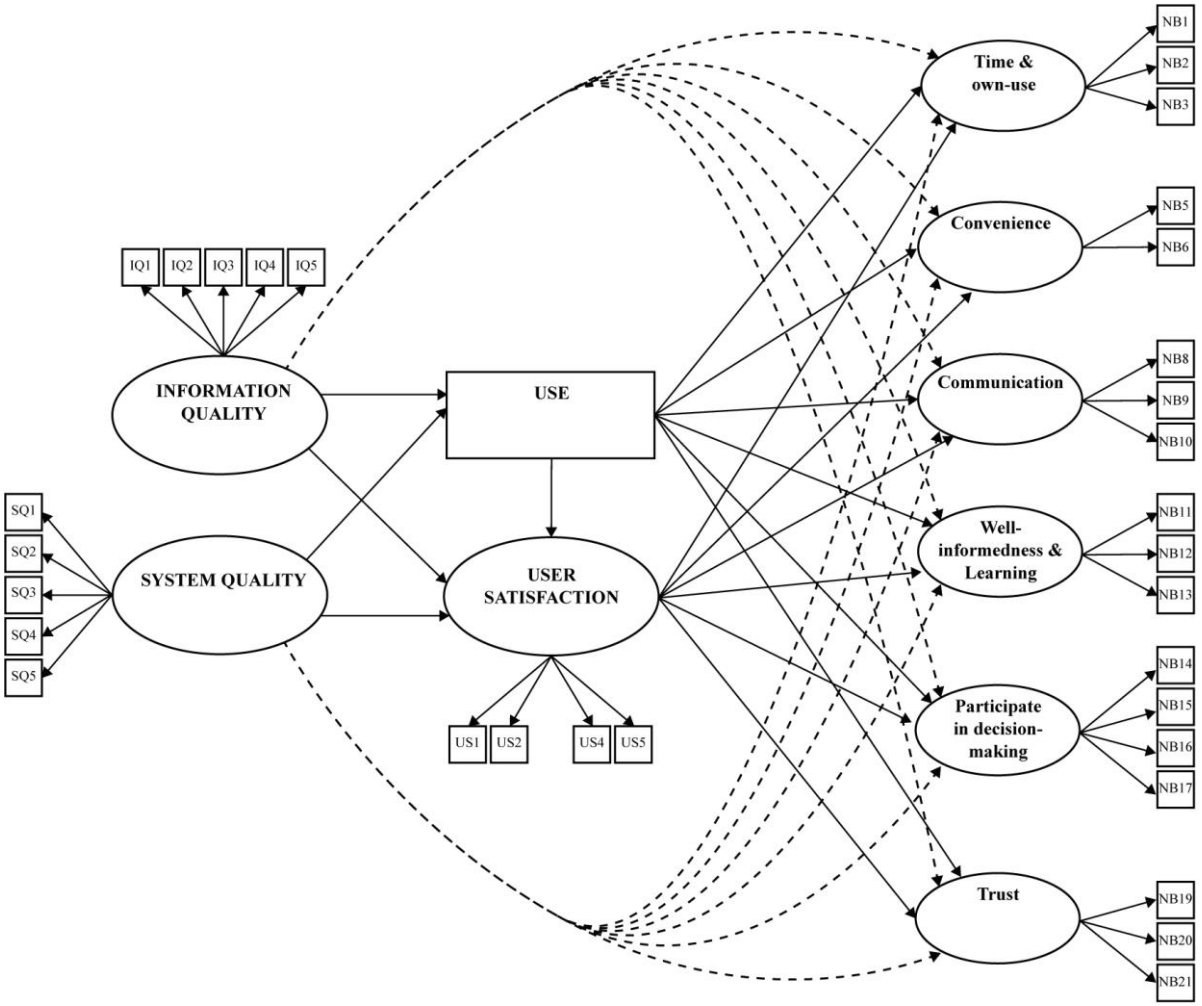

Figure 5 – Structural Equation Model 2

Non-hypothesised associations i.e. *Information Quality* and *System Quality* to the public value *Net Benefits* are illustrated with a dotted line

4.4 Testing the Hypotheses

Similarly to chapter 4.2, this section presents the results from the structural equation modelling and the proposed hypotheses are discussed. This is in line with the last basic step proposed by Kline (2011, p. 94) which demands "(…) to accurately and completely describe the analysis in written reports". A summary of the results, together with standardised estimates (standardised latent and observed variables), as well as significant p-values can be found in Table 8. Please note that *Use* is described with *Number of Reports Per User*. A table containing all of the relationships is presented in the appendix of this thesis.

Hypothesis 1a, stated that the *System Quality* of "Züri wie neu" is positively associated with the *Use* of the platform. Even though the coefficient was positive, no significant support could be found for this hypothesis (β = 0.102; p = 0.175). Therefore, Hypothesis 1a was not supported. With regard to hypothesis 1b, which postulated that there is a positive association between *User Satisfaction* and *System Quality*, significant support was reported (β = 0.213; p = 0.001), resulting in support for hypothesis 1b.

Regarding hypothesis 2a, which postulated that the *Service Quality* of "Züri wie neu" is positively associated with the *Use* of the platform, as well as hypothesis 2b, that postulated the same association for *User Satisfaction*, no support could be found, as the paths from *Service Quality* to *Use* and to *User Satisfaction* were omitted as described in the previous chapter. While analysing the correlations, it was already noted that the correlation between *Service Quality* and *User Satisfaction* was very high. Due to this occurring collinearity, it was no longer possible to make any statements regarding hypotheses 2a and 2b.

Hypothesis 3a, postulated a positively associated relationship between the *Information Quality* of "Züri wie neu" and the *Use* of the platform, while hypothesis 3b stated the same relationship for *User Satisfaction*. Interestingly, a negative but insignificant coefficient was reported for 3a (β = -0.138; p = 0. 068) thus hypothesis 3a was not supported. For 3b on the other hand a highly significant association was found (β = 0.451; p = 0. 0000) supporting hypothesis 3b.

Hypothesis 4, which stated a positively associated relationship between *Use* and *User Satisfaction*, a slightly positive association was reported (β = 0.073; p = 0. 016). Meaning, hypothesis 4 was marginally supported.

Hypothesis 5a, stated that the *Use* of "Züri wie neu" is positively associated with the perceived *Net Benefits*. Hypothesis 5b stated the same for *User Satisfaction*. Since the various public value *Net Benefits* of Scott et al. (2015) are used in this research, it makes sense to look at these dimensions individually. Additionally, the sub-dimensions have been separated in model 2, as described in the previous chapter and are also regressed with the *Information* and *System Quality* dimensions.

The actual *Use* of the platform only had a marginally positive but insignificant association with Time (β = 0.028; p = 0.358). *User Satisfaction* on the other hand, was highly statistically significant (β = 0.594; p = 0.000). Additionally, a highly significant relationship was found with *Information Quality* (β = 0.261; p = 0.000). The path from *System Quality* however, did not yield any significant results (β = -0.023; p = 0.721).

Second, regarding the sub-dimension Convenience, *Use* showed a positive but insignificant relationship (β = 0.068; p = 0.066) with this dimension. The association with *User Satisfaction* was found to be highly significant (β = 0.252; p = 0.000). Regarding the two quality dimensions no support was found for *System Quality* (β = 0.111; p = 0.166) and neither for *Information Quality* (β = 0.120; p = 0.153).

Thirdly, the association between *Use* and Communication yielded no significant support (β = 0.017; p = 0.596). Whereas *User Satisfaction* was found to be highly significantly associated with Communication (β = 0.455; p = 0.000). In addition, *System Quality* returned a positively significant result (β = 0.185; p = 0.007) whereas the *Information Quality* dimension did not (β = 0.067; p = 0.349).

Fourthly, Well-informedness surprisingly had a negative association with *Use*, but the association was again not statistically significant (β = -0.010; p = 0.778). Highly significant support could be found for *User Satisfaction* and Well-informedness (β = 0.361; p = 0.000). *System Quality* did not yield any significant results (β = -0.121; p = 0.126) but a negative association. *Information Quality* on the other hand reported a significant result (β = 0.281; p = 0.001).

Fifthly, *Use* was again not significantly related to Participation in decision-making (β = 0.035; p = 0.292). The relationship between Participation in decision-making and *User Satisfaction* on the other hand was highly significant (β = 0.460; p = 0.000). *System Quality* (β = -0.030; p = 0.683) as well as *Information Quality* (β = 0.142; p = 0.066) did not yield any statistically significant support.

Lastly, the relationship between Trust and *Use* was again reported as statistically insignificant (β = 0.018; p = 0.404), whereas the association of Trust and *User Satisfaction* again was highly significant (β = 0.847; p = 0.000). The regression analysis did not significantly support the association of Trust and *System Quality* (β = -0.027; p = 0.564) but supported the relationship between Trust and *Information Quality* (β = 0.111; p = 0.023).

Summarising, it became apparent that hypothesis 5a was not supported whilst hypothesis 5b was fully supported and highly statistically significant for all of the public value *Net Benefits*. Additionally, the post-hoc paths that were added due to model respecification in the previous chapter, also returned some significant results. Those findings will also be discussed in the following chapter.

Regarding the various control variables, some interesting results were found as well.
Apparently, the gender was negatively related to how often a user reports a damaged infrastructure element (β = -0.097; p = 0.010). Thus, women reported less than men.
With regard to Satisfaction, Age seemed to be negatively associated with *User Satisfaction* (β = -0.078; p = 0.022). Meaning, older people were generally less satisfied with the application, than younger people.
The Communication dimension of the *Net Benefits* construct was negatively associated with the work quota, e.g. if someone works 100% or a part-time job it had different effects on the communication dimension. Meaning, a higher work quota was negatively associated with the Communication dimension (β = -0.129; p = 0.039).
The gender has had a positive influence with Well-informedness, meaning women reported on a higher scale regarding this question (β = 0.078; p = 0.046). Interestingly, the level of education was negatively associated with this dimension. Meaning, the higher the education, the lower the value (β = -0.112; p = 0.003).
With regard to the dimension of Participation, the work quota has had a negative association. Meaning, the higher the workload, the lower the reported values (β = -0.149; p = 0.024).
Lastly the sub-dimension of Trust was negatively associated with the level of education (β = -0.046; p = 0.041) and also negatively associated with the sector of labour (β = -0.067; p = 0.012), meaning e.g. self-employed users reported lower values. Additionally, whether the users had a job or were unemployed had a positive association with trust (β = 0.092; p = 0.026).

Table 8 - SEM Results based on Model 2

Regressions:	Estimate (std.)		Std.Err	Z-value	P(>|z|)
NumberOfReportsPerUser ~					
Systemqual	0.102		0.725	1.356	0.175
infoqual	-0.138		0.783	-1.825	0.068
D1	-0.097	*	0.831	-2.562	0.010
satisfaction ~					
NmbrOfRprtsPrU	0.073	*	0.005	2.406	0.016
systemqual	0.213	**	0.093	3.314	0.001
infoqual	0.451	***	0.103	6.784	0.000
D2	-0.078	*	0.004	-2.293	0.022
time ~					
NmbrOfRprtsPrU	0.028		0.004	0.920	0.358
satisfaction	0.594	***	0.037	12.847	0.000
systemqual	-0.023		0.076	-0.357	0.721
infoqual	0.261	***	0.086	3.796	0.000
convenience ~					
NmbrOfRprtsPrU	0.068		0.004	1.837	0.066
satisfaction	0.252	***	0.039	4.724	0.000
systemqual	0.111		0.084	1.384	0.166
infoqual	0.120		0.094	1.428	0.153
communication ~					
NmbrOfRprtsPrU	0.017		0.004	0.530	0.596
satisfaction	0.455	***	0.037	9.747	0.000
systemqual	0.185	**	0.077	2.711	0.007
infoqual	0.067		0.087	0.937	0.349
D7	-0.129	*	0.010	-2.067	0.039
informedness ~					
NmbrOfRprtsPrU	-0.010		0.004	-0.282	0.778
satisfaction	0.361	***	0.043	6.750	0.000
systemqual	-0.121		0.092	-1.528	0.126
infoqual	0.281	**	0.105	3.344	0.001
D1	0.078	*	0.104	1.999	0.046
D4	-0.112	**	0.024	-2.943	0.003
participation ~					
NmbrOfRprtsPrU	0.035		0.005	1.053	0.292
satisfaction	0.460	***	0.048	9.104	0.000
systemqual	-0.030		0.100	-0.409	0.683
infoqual	0.142		0.113	1.839	0.066
D7	-0.149	*	0.012	-2.259	0.024
trust ~					
NmbrOfRprtsPrU	0.018		0.003	0.834	0.404
satisfaction	0.847	***	0.031	23.351	0.000
systemqual	-0.027		0.057	-0.577	0.564
infoqual	0.111	*	0.064	2.279	0.023
D4	-0.046	*	0.015	-2.039	0.041
D6	0.092	*	0.136	2.227	0.026
D8	-0.067	*	0.025	-2.519	0.012

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

The values shown are standardised (β); *Use* is represented with *Number of Reports Per User*; Only significant associations with control variables (D1 – D9) are shown.

5 Discussion

In this chapter, the results and the findings from the structural equation model will be discussed. Additionally, the limitations of this thesis as well as possible implications for the municipality of Zurich will be explicated and further research on the topic of "Züri wie Neu" will be presented.

The results by Wang and Liao (2008, p. 729) state that the effect of *System Quality* on *Use* is not significant. This result is also supported by this research, since neither the effect of *System Quality* nor the effect of *Information Quality* was significantly associated with the *Use* of the platform. This may indicate that there are some other factors that lead to the usage of the application, and thus the quality of the system or the quality of information are not the critical factors that lead to reporting damaged infrastructure elements via this application. Interestingly, the gender seems to play a significant role. It was found that women report less than men. In order to analyse why this is the case, further research is needed.

User Satisfaction was highly significantly influenced by *System Quality* and even more so by *Information Quality*. This empirical result shows that e.g. the ease of use has an influence on how satisfied the users are with the application. These two results are also supported, especially at the individual level, by several other studies (Petter et al., 2008, pp. 243–245). Additionally, the same holds for the dimension of *Information Quality*, meaning that e.g. reliable information about how to use the application leaves the user more satisfied. Satisfaction apparently is further also influenced by the age of the user. This research found, that the older the users, the less satisfied they are with the application. This is possibly due to the fact that younger people are more acquainted with similar applications and possess a higher computer self-efficacy or more internet experience. Furthermore, it is worth noting, that *Use* marginally affected *User Satisfaction*. This suggests that more *Use* leads to higher satisfied users. This might be due to learning effects, or due to previously posted issues getting fixed. To get a clear answer, why *Use* leads to higher *User Satisfaction*, more research is needed.

Whilst conducting the SEM *Service Quality* was omitted due to collinearity with the *User Satisfaction* dimension. Therefore, the hypotheses concerning the success dimension of *Service Quality* could no longer be answered and therefore, no conclusion can be drawn whether the *Service Quality* had some positive or negative influence on the users of ZWN.

With regard to the various public value *Net Benefits* by Scott et al. (2015), this research found some interesting results. While Wang and Liao (2008, p. 729) state that system *Use* has the biggest influence on perceived *Net Benefits*, this study found quite the contrary. System *Use* was not significantly associated with any of the public value *Net Benefits* dimensions. It was rather *User Satisfaction* again that was highly significantly associated with all of the dimensions. This very interesting result is probably due to the citizen sourcing nature of the application and thus linked to the application's purpose to collect information about damaged infrastructure elements. The satisfaction of the users in this environment is strongly related with *how* and *if* the posted issues are getting resolved. A question like "ZWN resolves my problem efficiently" also naturally assess the issue-solving and not only the report itself. Thus, it seems more important that the reported issues are getting fixed in the first place, which then leads to satisfied users but not necessarily to more *Use*. Which makes sense, because if the reported issue gets resolved, there is no need for immediately reporting again, unless of course there is a lot to report. Therefore, it makes sense that with citizen sourcing applications like ZWN not *Use* is the driving force but rather *User Satisfaction*. This underlines the difference in the nature of *Use* for traditional E-Government websites that e.g. 'just' provide information for the citizens, compared to the nature of *Use* of citizen sourcing applications. This result clearly differs from the findings by DeLone and McLean (2004, p. 38) which stated that especially voluntary use is an important measure of success. Hence it has to be noted that more *Use* in the context of damage reporting is not necessarily a good sign. Quite the contrary since more *Use* would point to more damaged infrastructure elements as well, since without the damage, there would be no report and thus no *Use*. This finding also points out that the success of ZWN is much closer related to *User Satisfaction* and *Net Benefits*, rather than *Use* itself.

The different sub-dimensions also yielded interesting results. Similarly to the results of Scott et al. (2015, pp. 15–16) also this research found that the users perceive some values higher than others and that the "(…) different uses of an eGovernment website necessarily contribute to varying value perceptions in citizens (…)". *User Satisfaction* was highly significantly associated with *Trust*, meaning that the more satisfied the users are the higher the value of trust was returned. This dimension was found to have the strongest effect. This implicates that *User Satisfaction* has a positive influence on how trustworthy the application and also the process of fixing the reported issues appear. Therefore, this value also represents the trust in the municipality that the reported issues actually will get fixed, or at least will get commented

on. Teo et al. (2008, p. 126) mention that the users' quality perception of the website "(…) largely depend on his or her trusting beliefs (…)". Governments therefore need to take this into account. Additionally, the added post-hoc path from *Information Quality* also returned a significant result, meaning, that the provided information on the platform as well as e.g. the map of Zurich are valid determinates of *Trust*. This also shows that *Information Quality* appears to be more important for gaining the citizens trust than the other quality dimensions.

Another value that is strongly effected by *User Satisfaction* is *Time* which refers to the time used for an online interaction. If the association would be e.g. negative it would take more time to report an issue using the application than it would with traditional communication methods. A positive and highly significant association with *User Satisfaction* therefore implies that the users are generally satisfied with the amount of time spent for reporting an issue. Again, also *Information Quality* had a significant influence on this dimension, meaning that well-presented, concise information leads to saved time. This shows that ZWN is not only used because there is no other way to report an issue, but also because it seems to be faster and more efficient than traditional communication methods. Compared to the results by Scott et al. (2015) this research found, that *Time* is an important value for this kind of application and thus underlines the fact that there are different value perceptions and needs among the citizens and users of different applications and websites. Saving in time hence appears to be important for this kind of application.

Moreover, the *Communication* dimension that measures the efficiency of the communication methods, also returned positive results. The significant association with *User Satisfaction* means that the users are satisfied with the means and the efficiency of communicating with the municipality of Zurich. *System Quality* also has a significant association with *Communication*, which makes sense, since without a good functioning application there would be no communication at all. Furthermore, the amount of work-load (e.g. part-time or full-time) negatively affects this dimension. Thus, the more a user works, the more efficient the communication needs to be since there is less time a user is able to spend. Together with the *Time* dimension, these results indicate that ZWN not only provides efficient ways of communicating with the municipality, but also saves time while reporting an issue.

As described in previous chapters, participation is a core component of citizen sourcing applications like ZWN. Therefore, it is not surprising that *User Satisfaction* is also

significantly associated with the public value *Net Benefits* Dimension *Participate in Decision-Making.* Since the whole idea of the application is using citizen input for issue-solving, it makes sense that satisfied users perceive this value as high. Therefore, ZWN is contributing towards a more interactive government that enables its citizens to participate in decision-making activities.

Even though the association of *User Satisfaction* and *Well-Informedness* is also significant, the correlation coefficient is lower than with the other dimensions. This means that this dimension does not appear to be as important as e.g. *Trust*. This result makes sense, since the main purpose of ZWN is not to foster the knowledge about services provided by the municipality but rather to gain information through the use of citizen sourcing. This is further underlined by the negatively associated control variable *Level of Education*, which suggests that users with a high level of education don't gain much additional understanding about the services provided by a municipality, just by using the application. Along with the just mentioned results, this research also found that *Information Quality* is positively associated with this sub-dimension. It seems plausible, that *Information Quality* is linked to *Well-Informedness*. These results show that ZWN clearly can be considered a citizen sourcing application as described in previous chapters, since the citizens of Zurich do not seem to use ZWN as a source for information gathering.

Lastly, the sub-dimension *Convenience* appears to be the least important one, considering the association with *User Satisfaction*. This suggests that even though the results are positively and significantly associated, it is not too important whether the application is e.g. available always and everywhere. This might also be caused by the idea of the application, since damaged infrastructure elements are aggravating but not usually emergencies. Therefore, it seems to be of no importance whether a report gets sent immediately or some hours later.

Summarising, it becomes apparent that there are various impacts not only among the quality dimensions but also among the public value *Net Benefits*. This clearly shows that the users of ZWN "(…) view intangible benefits or outcomes as equally important as tangible gains, such as efficiency improvements" (Scott et al., 2015, p. 18). Interestingly, there appears to be another driving force that brings users back to the platform which cannot be clearly identified by this thesis. One plausible response to this fact might be the nature of the application which differs from traditional E-Government websites. If a user finds an issue, he may report it using

ZWN. But what if there is nothing to report? This shows that recurring visits and uses of an application like ZWN are not only bound by quality constraints but rather by external factors as well. Thus, this thesis found that *Use* in the context of ZWN is not dependable on the quality dimensions of the D&M IS Success Model. This means and suggests that e.g. the *System Quality* does not influence the user in his decision to post a found issue (again). Hence, ZWN achieves a certain value in society, which cannot be measured by raw usage data.

5.1 Limitations

There are probably more flaws and limitations to this research, than the following list provides, but these limitations seem to be the most relevant ones to discuss in this chapter.
Since the online questionnaire consisted of more questions than needed for this master's thesis, some of the respondents neglected to fully answering all of the questions. This led to missing values that probably could have been reduced with a smaller survey size. Additionally, some of the participants even complained about the length of the survey. Due to this fact, some participants argued in the comment box at the end of the survey that they didn't fully answer all of the questions. Few respondents claimed that some of the questions for further research (e.g. "*Mit anderen über Politik zu diskutieren, gefällt mir sehr*") are not relevant in this context, since posting an issue about a defective street lamp has nothing to do with politics. Therefore, it becomes apparent that some of the respondents did not fully understand the questionnaire and therefore neglected to fully answer all of the questions. Nevertheless, the 759 observations used in this master's thesis provide an adequate overview over the relevant topics.

Secondly, regarding the research model a few points need to be addressed. The existence of collinearity between *User Satisfaction* and *Service Quality*, limits the results this research could have obtained and is far from ideal. It shows that *Service Quality* needs to be reassessed in the context of citizen sourcing applications. Apparently, either the questions about *User Satisfaction* and *Service Quality* are too similar, or the respondents perceived those questions as too alike. The fact that not the whole proposed model is properly represented raises some concern. Especially since this study had to remove a variable which plays an important part in the DeLone and McLean IS Success Model. Thus, caution needs to be taken when interpreting or adapting the results of this study.

Thirdly, another important limitation concerns the structural equation modelling. Omitting *Service Quality* from the research model is not optimal. Even though model fit returned good values it has to be admitted that respecifying the SEM probably also could have been done otherwise. Additionally, removing the feedback-loops from the model to reduce model complexity may be eligible for a master's thesis but thus also a lot of valuable information is lost. It is therefore important to note that further research should also include these loops e.g. from the public value *Net Benefits* back to *Use* or *User Satisfaction*.

5.2 Implications for "Züri wie neu" and the Municipality of Zurich

The presented findings can help the municipality of Zurich to improve the offered service and can also help to improve the application ZWN overall.

Due to the fact that the survey caused several participants to come forward with interesting improvements for the application, the survey itself already proved useful. Asking the users directly what they expect from a service like ZWN and as well as giving the user a platform where they are able to voice their ideas yielded a lot of interesting inputs. Since those inputs are not related to this master's thesis they are not further discussed.

Based on the findings regarding the quality dimensions of the D&M IS Success Model this study shows that there is no driving force connected to this research model that brings the users back to the application. Therefore, there needs to be some other motivational factors that drive users to reporting found infrastructure issues that are not directly related to the application itself. *System Quality* for example does not seem to have a significant influence on whether users report found issues using the application or not. This does not by any means suggest that those quality dimensions can be neglected while maintaining ZWN but it shows that there are more important factors to take into account. The results clearly show associations with the *User Satisfaction* dimension, which again is highly significantly associated with all of the *Net Benefits* scales. Therefore, improving dimensions related to *User Satisfaction*, as described above, will subsequently improve the *Net Benefits* dimensions. Since participation in Open Government, as described earlier in this thesis, is based on a relationship with governmental institutions and the citizens, it seems plausible that e.g. building trust is a valuable cornerstone for achieving a certain outcome together. "From this perspective, it is important to develop a trust benefit that relates to feelings of trust in government as an institutional partner and co-producer of value" (Scott et al., 2015, p. 6).

Consequential, there are some points that surely can be improved, such as making the application more user-friendly for older people, or increasing the *Information Quality* in order to satisfy the users and subsequently increase the informedness as well. This thesis shows that the values measured with *Net Benefits* are highly influenced by *User Satisfaction.* Therefore, it seems plausible that in order to improve the application, the user satisfaction needs to be increased.

5.3 Further Research

As briefly mentioned above this master's thesis is part of a research project by Dr. Matthias Stürmer at the Institute of Information Systems at the University of Bern.

While preparing the survey and writing this master's thesis, it became apparent that the unique opportunity of contacting users of a Swiss E-Government application with a questionnaire should be capitalised to its fullest potential. As seen by the results of this master's thesis, additional research is not only needed but also recommended. Together with Dr. Matthias Stürmer, Gabriel Abu-Tayeh and Oliver Neumann additional research is conducted at the University of Bern on the topic of "Züri wie neu". This master's thesis therefore provides a valuable first step for analysing the success of a Swiss Open Government application and clears the path for further research.

While conceptualising the questionnaire additional 10 survey items were added to measure Public Service Motivation (PSM), which is a very popular research topic for public management scholars (Giauque, Ritz, Varone, Anderfuhren-Biget, & Waldner, 2011, p. 2). The concept behind PSM is to measure the motivation and the specific work ethos public employees presumably have, "(…) specifically that their motives are founded in the will to promote public values in a disinterested way" (Giauque et al., 2011, p. 4). Ritz et al. (2016, p. 19) point out that most "(…) scholars assume that public service motivation is a form of work motivation that leads to increased commitment, engagement, and performance". But even-handedly it can also have negative effects on the organisation as well as on the individual itself. The authors further mention the enormously increased research or more specifically the increased research output in the last few years (Ritz et al., 2016, p. 19,24). For measuring PSM the following five sub-dimensions with each two items were added to the questionnaire: Attraction to politics and policy (PSM 1 & PSM 2); Commitment to the public interest/civic duty (PSM 3 & PSM 4); Compassion (PSM 5 & PSM 6); Self-Sacrifice (PSM 7 & PSM 8);

Swiss Democratic Governance (PSM 9 & PSM 10). The measures were taken from the previous study by Giauque et al. (2011) and were therefore already validated.

In addition, 20 survey items were used to measure the motivation users might have to participate in Open Government projects. In order to measure the motives citizens have for engaging in these projects, several items are taken from a similar study by Wijnhoven et al. (2015). The goal of Wijnhoven et al. was on the one hand to figure out the motivational factors for participation and on the other hand to compare the different amounts of willingnesses to each other. Their study revealed that there are different motivations for the different stages of Open Government (e.g. Collaboration) and furthermore that socio-economic factors do not influence citizens whether to participate in these projects or not. The research by Wijnhoven et al. therefore suits the research about ZWN very well, since the unit of analysis is based in a similar setting. The following sub-dimensions with each three items were added to the questionnaire: Own-Use (MO1 – MO3), Ideology (MO4 – MO6), Altruism (MO7 – MO9), Fun (MO10 – MO12), Reciprocity (MO13 – MO15), Curiosity (MO16 & MO17) as well as Learning (NB-11 – NB13), which is measured with the same items as the public value *Net Benefits* dimension Well-Informedness.

The two further related research topics show that ZWN and citizen sourcing applications in general are valuable topics for scholars. It is important to further develop measurements and to test existing ones to be able to make meaningful and significant statements about how users interact with such applications but also on how governments implement and maintain these applications. In addition, the feedback-loops should be measured appropriately in order to be able to present findings about the interrelated relationships. To make a statement whether the application is truly successful, ZWN should also be analysed from a governmental point of view, which underlines the just mentioned need for more research. All of the above-mentioned topics taken together, would draw a complete picture of the application.

6 Conclusion

This master's thesis wanted to figure out, whether the Citizen Sourcing application ZWN was successful or not from a citizen's perspective with the adaptation of the D&M IS Success Model. This answers the call for more research conducted from a citizen's perspective. Since the purpose of the citizen sourcing application ZWN is not primarily the provision of information but rather collecting reports, the survey questions and the research in general had to be adapted accordingly. With regard to the hypotheses, support was not found for all of them, nevertheless this research provides results that indicate the appropriateness and validity of several used success measures and contributes in identifying possible new ones.

The second chapter of this thesis showed that there are various terminologies used by scholars all around the world that try to capture how governments and citizens interact with each other. It became apparent that not collaboration but participation and especially citizen sourcing are the most appropriate definitions of an application like ZWN. Only with a deep understanding about the researched application it was then possible to adapt the D&M IS Success Model accordingly. In order to measure the nine hypothesised relationships, an online-survey with a total of 77 questions has been set up, which yielded 759 observations that are being used for the analysis in this master's thesis. Therefore, citizen based survey data was collected and analysed. Together with an already existing dataset, provided by the municipality of Zurich, it was possible to make statements about specific users of the platform and how they perceive certain values. The analysis was conducted with a structural equation model that hypothesised several relationships. The initial model was not specified properly thus respecifications were needed. Nine hypotheses were derived from the literature review. Due to collinearity two of these nine hypotheses had to be omitted, leaving seven hypotheses to answer. Four out of these seven were supported. The SEM shows that there are interrelated relationships that have not been tested before, e.g. from *Information Quality* directly to the *Net Benefits* sub-dimensions and thus interesting results are obtained that give more insight into the citizen sourcing application.

As chapter 2.2.1 has shown, the goal in this setting, to give citizens a place where they are able to voice their ideas and concerns is achieved by ZWN. Overall, the results of this master's thesis show that the users of ZWN are satisfied with the application but no statements about why they report more than once, or only once respectively can be made. This indicates that there needs to be some other motivational background, why the citizens of

Zurich report damaged infrastructure elements and it further underlines the fact that raw usage data is probably not the best measure for IS success in this context. As the results of this research show, there are various factors that influence whether a user reports an element or not. One of them was not considered specifically in this research: If there is nothing to report in the vicinity of the user, there will simply be no report.

Whether the application can be considered successful or not also from an organisational perspective cannot be answered by this thesis and thus needs further investigation and research. It therefore remains unclear, whether the municipality of Zurich also sees the application as a valuable asset for communicating with citizens, for gaining information and for allocating resources in an efficient and effective way to fix the posted issues. Drawing the comprehensive conclusion that ZWN is successful would therefore be false, since this thesis only looked at the perspective and the benefits that citizens gain from using the application.

7 References

Anthopoulos, L., Reddick, C. G., Giannakidou, I., & Mavridis, N. (2016). Why e-government projects fail? An analysis of the Healthcare.gov website. *Government Information Quarterly*, *33*, 161–173.

Belanger, F., & Carter, L. (2012). Digitizing Government Interactions with Constituents: An Historical Review of E-Government Research in Information Systems. *Journal of the Association for Information Systems*, *13*. Retrieved from http://aisel.aisnet.org/jais/vol13/iss5/1

Chen, C.-W. (2010). Impact of quality antecedents on taxpayer satisfaction with online tax-filing systems—An empirical study. *Information & Management*, *47*, 308–315.

DeLone, W. H., & McLean, E. R. (1992). Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, *3*, 60–95.

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *J. of Management Information Systems*, *19*, 9–30.

DeLone, W. H., & McLean, E. R. (2004). Measuring e-Commerce Success: Applying the DeLone & McLean Information Systems Success Model. *International Journal of Electronic Commerce*, *9*, 31–47.

Doll, W. J., & Torkzadeh, G. (1998). Developing a multidimensional measure of system-use in an organizational context. *Information & Management*, *33*, 171–185.

Fix my Street. (2016, April 18). Frequently Asked Questions: FixMyStreet. Retrieved 18 April 2016, from https://www.fixmystreet.com/faq

Floropoulos, J., Spathis, C., Halvatzis, D., & Tsipouridou, M. (2010). Measuring the success of the Greek Taxation Information System. *International Journal of Information Management*, *30*, 47–56.

Giauque, D., Ritz, A., Varone, F., Anderfuhren-Biget, S., & Waldner, C. (2011). Putting public service motivation into context: a balance between universalism and particularism. *International Review of Administrative Sciences*, *77*, 227–253.

Hilgers, D. (2012). Open Government: Theoretische Bezüge und konzeptionelle Grundlagen einer neuen Entwicklung in Staat und öffentlichen Verwaltungen. *Zeitschrift für Betriebswirtschaft*, *82*, 631–660.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *Electronic Journal of Business Research Methods*, *6*, 53–59.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1–55.

Hunkeler, M. (2016, April 8). Die App gegen Sprayereien und Schlaglöcher. *derbund.ch/*. Retrieved from http://www.derbund.ch/bern/kanton/die-app-gegen-sprayereien-und-schlagloecher/story/30717106

Internetdienste der Stadt Zürich. (2016, March 17). Hilfe zu 'Züri wie neu' [FAQ]. Retrieved 17 March 2016, from https://www.zueriwieneu.ch/faq

King, S. F., & Brown, P. (2007). Fix My Street or else: Using the Internet to Voice Local Public Service Concerns. In *Proceedings of the 1st International Conference on Theory and Practice of Electronic Governance* (pp. 72–80). New York, NY, USA: ACM.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed). New York: Guilford Press.

Kline, R. B. (2012). Assumptions in Structural Equation Modeling. In R. H. Hoyle (Ed.), *Handbook of Structural Equation Modeling* (pp. 111–125). New York: Guilford Press.

Lee, G., & Kwak, Y. H. (2012). An Open Government Maturity Model for social media-based public engagement. *Government Information Quarterly*, *29*, 492–503.

Lei, P.-W., & Wu, Q. (2007). Introduction to Structural Equation Modeling: Issues and Practical Considerations. *Educational Measurement: Issues and Practice*, *26*, 33–43.

Lei, P.-W., & Wu, Q. (2012). Estimation in structural equation modeling. In R. H. Hoyle (Ed.), *Handbook of Structural Equation Modeling* (pp. 164–179). New York: Guilford Press.

Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly*, *29*, 446–454.

Linders, D., & Wilson, S. C. (2011). What is Open Government? One Year After the Directive. In *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times* (pp. 262–271). New York, NY, USA: ACM.

Nam, T. (2012). Suggesting frameworks of citizen-sourcing via Government 2.0. *Government Information Quarterly*, *29*, 12–20.

Neumann, O. (2014). Politico-Economic Attitudes and Public Service Motivation Revisited Considering Multidimensionality – Testing a Structural Equation Model on Data from Germany. Presented at the European Group for Public Administration (EGPA) Annual Conference, Speyer, Germany.

Papadomichelaki, X., & Mentzas, G. (2012). e-GovQual: A multiple-item scale for assessing e-government service quality. *Government Information Quarterly*, *29*, 98–109.

Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European Journal of Information Systems*, *17*, 236–263.

Petter, S., DeLone, W., & McLean, E. R. (2013). Information Systems Success: The Quest for the Independent Variables. *Journal of Management Information Systems*, *29*, 7–62.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*, 879–903.

Prybutok, V. R., Zhang, X., & Ryan, S. D. (2008). Evaluating leadership, IT quality, and net benefits in an e-government environment. *Information & Management*, *45*, 143–152.

Rana, N. P., Dwivedi, Y. K., Williams, M. D., & Weerakkody, V. (2014). Investigating success of an e-government initiative: Validation of an integrated IS success model. *Information Systems Frontiers*, *17*, 127–142.

Ritz, A., Brewer, G. A., & Neumann, O. (2016). Public Service Motivation: A Systematic Literature Review and Outlook. *Public Administration Review*, *76*, 414–426.

Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, *48*. Retrieved from http://econpapers.repec.org/article/jssjstsof/v_3a048_3ai02.htm

Sandoval-Almazan, R., & Gil-Garcia, J. R. (2012). Are government internet portals evolving towards more interaction, participation, and collaboration? Revisiting the rhetoric of e-government among municipalities. *Government Information Quarterly*, *29, Supplement 1*, S72–S81.

Sandoval-Almazan, R., Gil-Garcia, J. R., Luna-Reyes, L. F., Luna, D. E., & Rojas-Romero, Y. (2012). Open Government 2.0: Citizen Empowerment Through Open Data, Web and Mobile Apps. In *Proceedings of the 6th International Conference on Theory and Practice of Electronic Governance* (pp. 30–33). New York, NY, USA: ACM.

Scott, M., & DeLone, W. (2009). Understanding net benefits: a citizen-based perspective on e-government success. Retrieved from https://aran.library.nuigalway.ie/handle/10379/1560

Scott, M., DeLone, W., & Golden, W. (2015). Measuring eGovernment success: a public value approach. *European Journal of Information Systems*. doi:10.1057/ejis.2015.11

Seddon, P. B. (1997). A Respecification and Extension of the DeLone and McLean Model of IS Success. *Information Systems Research*, *8*, 240–253.

Stürmer, M., & Ritz, A. (2014). Public Governance durch Open Government: Zwei sich ergänzende Ansätze für die staatliche Aufgabenerfüllung der Zukunft. *Jahrbuch Der Schweizerischen Verwaltungswissenschaften 2014*, 125–138.

Teo, T. S. H., Srivastava, S. C., & Jiang, L. (2008). Trust and Electronic Government Success: An Empirical Study. *Journal of Management Information Systems*, *25*, 99–131.

Theile, C. (2016, July 28). 'Züri wie neu': Zürich hat seine eigene 'Nörgler-App'. *sueddeutsche.de*. Retrieved from http://www.sueddeutsche.de/panorama/zueri-wie-neu-zuerich-hat-seine-eigene-noergler-app-1.3098593

Wang, Y.-S., & Liao, Y.-W. (2008). Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success. *Government Information Quarterly*, *25*, 717–733.

Wijnhoven, F., Ehrenhard, M., & Kuhn, J. (2015). Open government objectives and participation motivations. *Government Information Quarterly*, *32*, 30–42.

8 Appendix

This appendix contains the already mentioned tables for a full overview over the variables.

The used R-File for this *R*esearch as well as the data file are provided upon request.

8.1 Table 9 - Full SEM Results based on model 2

Regressions	Estimate (std.)		Std.Err	Z-value	P(>|z|)
NmbrOfRprtsPrU ~					
systemqual	0.10		0.73	1.36	0.18
infoqual	-0.14		0.78	-1.83	0.07
D1	-0.10	*	0.83	-2.56	0.01
D2	0.05		0.03	1.30	0.19
D3	0.07		0.87	1.79	0.07
D4	0.00		0.19	0.09	0.93
D5	0.04		0.37	1.22	0.22
D6	-0.09		1.77	-1.33	0.19
D7	-0.07		0.09	-0.99	0.32
D8	-0.04		0.31	-0.96	0.34
D9	0.00		1.20	-0.01	1.00
satisfaction ~					
NmbrOfRprtsPrU	0.07	*	0.01	2.41	0.02
systemqual	0.21	**	0.09	3.31	0.00
infoqual	0.45	***	0.10	6.78	0.00
D1	0.04		0.11	1.21	0.23
D2	-0.08	*	0.00	-2.29	0.02
D3	0.02		0.11	0.75	0.46
D4	-0.04		0.02	-1.16	0.25
D5	-0.03		0.05	-1.09	0.28
D6	0.01		0.23	0.08	0.93
D7	-0.07		0.01	-1.13	0.26
D8	0.02		0.04	0.57	0.57
D9	0.03		0.15	0.87	0.39
time ~					
NmbrOfRprtsPrU	0.03		0.00	0.92	0.36
satisfaction	0.59	***	0.04	12.85	0.00
systemqual	-0.02		0.08	-0.36	0.72
infoqual	0.26	***	0.09	3.80	0.00
D1	0.01		0.09	0.32	0.75
D2	0.01		0.00	0.33	0.74
D3	0.03		0.09	0.90	0.37
D4	0.03		0.02	0.92	0.36
D5	0.00		0.04	0.09	0.93
D6	0.10		0.18	1.77	0.08
D7	0.05		0.01	0.82	0.41
D8	-0.01		0.03	-0.31	0.76

Regressions	Estimate (std.)		Std.Err	Z-value	P(>|z|)
D9	-0.03		0.13	-1.02	0.31
convenience ~					
NmbrOfRprtsPrU	0.07		0.00	1.84	0.07
satisfaction	0.25	***	0.04	4.72	0.00
systemqual	0.11		0.08	1.38	0.17
infoqual	0.12		0.09	1.43	0.15
D1	0.03		0.09	0.63	0.53
D2	-0.04		0.00	-0.96	0.34
D3	0.05		0.10	1.27	0.21
D4	-0.01		0.02	-0.34	0.74
D5	0.03		0.04	0.88	0.38
D6	0.01		0.20	0.12	0.91
D7	0.01		0.01	0.14	0.89
D8	-0.03		0.04	-0.72	0.48
D9	-0.04		0.14	-0.96	0.34
communication ~					
NmbrOfRprtsPrU	0.02		0.00	0.53	0.60
satisfaction	0.46	***	0.04	9.75	0.00
systemqual	0.19	**	0.08	2.71	0.01
infoqual	0.07		0.09	0.94	0.35
D1	-0.01		0.09	-0.35	0.72
D2	-0.05		0.00	-1.38	0.17
D3	0.01		0.09	0.30	0.77
D4	0.03		0.02	1.01	0.32
D5	-0.04		0.04	-1.32	0.19
D6	-0.08		0.19	-1.35	0.18
D7	-0.13	*	0.01	-2.07	0.04
D8	-0.03		0.03	-0.78	0.44
D9	-0.02		0.13	-0.67	0.51
informedness ~					
NmbrOfRprtsPrU	-0.01		0.00	-0.28	0.78
satisfaction	0.36	***	0.04	6.75	0.00
systemqual	-0.12		0.09	-1.53	0.13
infoqual	0.28	**	0.11	3.34	0.00
D1	0.08	*	0.10	2.00	0.05
D2	0.07		0.00	1.58	0.12
D3	-0.01		0.11	-0.12	0.91
D4	-0.11	**	0.02	-2.94	0.00
D5	0.02		0.05	0.62	0.54
D6	0.06		0.22	0.88	0.38
D7	-0.04		0.01	-0.50	0.62
D8	-0.02		0.04	-0.45	0.66
D9	-0.07		0.15	-1.84	0.07
participation ~					
NmbrOfRprtsPrU	0.04		0.01	1.05	0.29
satisfaction	0.46	***	0.05	9.10	0.00

Regressions	Estimate (std.)		Std.Err	Z-value	P(>|z|)
systemqual	-0.03		0.10	-0.41	0.68
infoqual	0.14		0.11	1.84	0.07
D1	0.03		0.11	0.92	0.36
D2	0.05		0.00	1.23	0.22
D3	0.05		0.12	1.50	0.14
D4	-0.03		0.03	-0.77	0.44
D5	0.04		0.05	1.20	0.23
D6	-0.05		0.24	-0.74	0.46
D7	-0.15	*	0.01	-2.26	0.02
D8	-0.04		0.04	-0.82	0.41
D9	-0.03		0.16	-0.96	0.34
trust ~					
NmbrOfRprtsPrU	0.02		0.00	0.83	0.40
satisfaction	0.85	***	0.03	23.35	0.00
systemqual	-0.03		0.06	-0.58	0.56
infoqual	0.11	*	0.06	2.28	0.02
D1	-0.01		0.06	-0.22	0.83
D2	-0.01		0.00	-0.38	0.70
D3	0.04		0.07	1.82	0.07
D4	-0.05	*	0.02	-2.04	0.04
D5	0.00		0.03	0.12	0.91
D6	0.09	*	0.14	2.23	0.03
D7	0.02		0.01	0.36	0.72
D8	-0.07	*	0.03	-2.52	0.01
D9	-0.04		0.09	-1.83	0.07

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

8.2 Table 10 - Full correlation table

	NrOfReportsUser		SQ1		SQ2		SQ3		SQ4		SQ5		IQ1		IQ2		IQ3		IQ4		IQ5	
NrOfReportsUser	1.00																					
SQ1	0.00		1.00																			
SQ2	-0.02		0.78	***	1.00																	
SQ3	-0.01		0.65	***	0.70	***	1.00															
SQ4	0.00		0.68	***	0.70	***	0.64	***	1.00													
SQ5	-0.01		0.65	***	0.69	***	0.69	***	0.64	***	1.00											
IQ1	-0.09	*	0.48	***	0.49	***	0.51	***	0.42	***	0.51	***	1.00									
IQ2	0.00		0.46	***	0.42	***	0.48	***	0.39	***	0.45	***	0.55	***	1.00							
IQ3	-0.08	*	0.53	***	0.55	***	0.59	***	0.52	***	0.60	***	0.62	***	0.55	***	1.00					
IQ4	-0.02		0.51	***	0.52	***	0.55	***	0.50	***	0.57	***	0.56	***	0.57	***	0.64	***	1.00			
IQ5	-0.04		0.53	***	0.54	***	0.57	***	0.51	***	0.59	***	0.62	***	0.62	***	0.66	***	0.73	***	1.00	
SvQ1	0.00		0.33	***	0.42	***	0.49	***	0.36	***	0.43	***	0.43	***	0.34	***	0.45	***	0.41	***	0.51	***
SvQ2	0.04		0.35	***	0.38	***	0.45	***	0.36	***	0.40	***	0.37	***	0.36	***	0.47	***	0.44	***	0.46	***
SvQ3	0.02		0.27	***	0.37	***	0.45	***	0.35	***	0.41	***	0.37	***	0.30	***	0.41	***	0.37	***	0.48	***
SvQ4	0.08	*	0.41	***	0.46	***	0.48	***	0.42	***	0.47	***	0.46	***	0.42	***	0.49	***	0.47	***	0.56	***
SvQ5	-0.03		0.32	***	0.40	***	0.50	***	0.37	***	0.43	***	0.40	***	0.32	***	0.44	***	0.40	***	0.48	***
US1	0.03		0.39	***	0.46	***	0.58	***	0.44	***	0.48	***	0.48	***	0.37	***	0.52	***	0.45	***	0.55	***
US2	0.05		0.30	***	0.40	***	0.48	***	0.38	***	0.41	***	0.41	***	0.34	***	0.46	***	0.43	***	0.51	***
US3	0.02		0.45	***	0.50	***	0.53	***	0.52	***	0.52	***	0.46	***	0.38	***	0.52	***	0.47	***	0.51	***
US4	-0.01		0.29	***	0.38	***	0.46	***	0.35	***	0.40	***	0.39	***	0.32	***	0.42	***	0.39	***	0.49	***
US5	0.06		0.32	***	0.40	***	0.47	***	0.40	***	0.41	***	0.34	***	0.29	***	0.38	***	0.37	***	0.44	***
NB1	0.00		0.30	***	0.34	***	0.34	***	0.32	***	0.36	***	0.35	***	0.29	***	0.35	***	0.33	***	0.39	***
NB2	0.07		0.22	***	0.28	***	0.30	***	0.27	***	0.30	***	0.30	***	0.28	***	0.39	***	0.36	***	0.43	***
NB3	0.02		0.29	***	0.39	***	0.40	***	0.32	***	0.38	***	0.35	***	0.30	***	0.43	***	0.39	***	0.47	***
NB4	0.05		0.16	***	0.20	***	0.16	***	0.16	***	0.19	***	0.19	***	0.16	***	0.21	***	0.17	***	0.23	***
NB5	0.08	*	0.22	***	0.25	***	0.25	***	0.22	***	0.30	***	0.19	***	0.23	***	0.22	***	0.24	***	0.30	***
NB6	0.03		0.22	***	0.23	***	0.20	***	0.20	***	0.26	***	0.21	***	0.21	***	0.22	***	0.28	***	0.31	***
NB7	-0.07		0.29	***	0.32	***	0.31	***	0.27	***	0.29	***	0.34	***	0.31	***	0.40	***	0.38	***	0.37	***

	NrOfReportsUser		SQ1		SQ2		SQ3		SQ4		SQ5		IQ1		IQ2		IQ3		IQ4		IQ5	
NB8	0.03		0.28	***	0.38	***	0.41	***	0.33	***	0.37	***	0.32	***	0.27	***	0.39	***	0.36	***	0.45	***
NB9	0.03		0.28	***	0.36	***	0.38	***	0.32	***	0.33	***	0.26	***	0.19	***	0.35	***	0.30	***	0.38	***
NB10	0.01		0.32	***	0.39	***	0.40	***	0.32	***	0.38	***	0.28	***	0.26	***	0.38	***	0.33	***	0.43	***
NB11	-0.03		0.19	***	0.25	***	0.25	***	0.19	***	0.22	***	0.27	***	0.19	***	0.27	***	0.26	***	0.30	***
NB12	-0.01		0.15	***	0.23	***	0.18	***	0.12	**	0.17	***	0.25	***	0.14	***	0.22	***	0.21	***	0.25	***
NB13	0.00		0.17	***	0.24	***	0.23	***	0.15	***	0.21	***	0.30	***	0.19	***	0.28	***	0.23	***	0.30	***
NB14	0.06		0.22	***	0.27	***	0.35	***	0.26	***	0.24	***	0.26	***	0.22	***	0.26	***	0.23	***	0.33	***
NB15	0.04		0.16	***	0.22	***	0.27	***	0.17	***	0.20	***	0.23	***	0.17	***	0.26	***	0.20	***	0.30	***
NB16	0.05		0.21	***	0.27	***	0.34	***	0.24	***	0.24	***	0.29	***	0.22	***	0.28	***	0.27	***	0.34	***
NB17	0.03		0.16	***	0.22	***	0.23	***	0.16	***	0.16	***	0.27	***	0.15	***	0.21	***	0.19	***	0.29	***
NB18	0.07		0.31	***	0.35	***	0.41	***	0.30	***	0.33	***	0.28	***	0.33	***	0.39	***	0.35	***	0.48	***
NB19	0.06		0.33	***	0.40	***	0.44	***	0.37	***	0.41	***	0.37	***	0.33	***	0.43	***	0.43	***	0.51	***
NB20	0.00		0.31	***	0.38	***	0.49	***	0.33	***	0.39	***	0.41	***	0.36	***	0.47	***	0.42	***	0.51	***
NB21	0.04		0.25	***	0.30	***	0.34	***	0.28	***	0.30	***	0.29	***	0.26	***	0.32	***	0.29	***	0.39	***
D1	-0.07	*	0.01		0.05		0.01		-0.02		0.00		0.00		-0.09	*	0.00		-0.04		-0.07	
D2	0.04		-0.02		0.03		0.00		-0.04		0.03		-0.03		-0.09	*	0.00		-0.03		-0.08	*
D3	0.07		-0.05		-0.04		0.00		0.02		0.00		-0.04		-0.05		-0.03		-0.03		-0.06	
D4	0.02		-0.01		-0.04		-0.05		-0.02		0.00		-0.08	*	-0.07	*	-0.05		-0.03		-0.04	
D5	0.04		-0.02		-0.03		-0.01		-0.01		-0.03		-0.01		-0.05		-0.02		-0.04		-0.02	
D6	-0.02		-0.01		0.03		0.00		0.04		0.00		0.03		-0.10	**	-0.01		-0.05		-0.04	
D7	0.00		0.04		-0.03		0.01		-0.02		0.02		0.02		0.15	***	0.03		0.04		0.05	
D8	-0.04		-0.01		-0.02		-0.04		0.01		-0.03		0.00		-0.07		-0.02		-0.04		-0.04	
D9	0.00		0.00		-0.01		0.06		-0.02		0.02		-0.05		0.03		0.03		0.00		-0.05	

	SvQ1		SvQ2		SvQ3		SvQ4		SvQ5		US1		US2		US3		US4		US5		NB1	
SvQ1	1.00																					
SvQ2	0.67	***	1.00																			
SvQ3	0.84	***	0.65	***	1.00																	
SvQ4	0.62	***	0.55	***	0.62	***	1.00															
SvQ5	0.89	***	0.68	***	0.84	***	0.60	***	1.00													
US1	0.77	***	0.59	***	0.78	***	0.64	***	0.77	***	1.00											
US2	0.79	***	0.66	***	0.81	***	0.61	***	0.79	***	0.80	***	1.00									
US3	0.58	***	0.49	***	0.57	***	0.62	***	0.58	***	0.61	***	0.62	***	1.00							
US4	0.81	***	0.60	***	0.84	***	0.56	***	0.81	***	0.80	***	0.84	***	0.59	***	1.00					
US5	0.68	***	0.52	***	0.73	***	0.62	***	0.70	***	0.72	***	0.71	***	0.61	***	0.70	***	1.00			
NB1	0.40	***	0.32	***	0.39	***	0.49	***	0.38	***	0.42	***	0.42	***	0.46	***	0.40	***	0.42	***	1.00	
NB2	0.49	***	0.48	***	0.46	***	0.46	***	0.48	***	0.45	***	0.51	***	0.44	***	0.45	***	0.46	***	0.51	***
NB3	0.57	***	0.44	***	0.56	***	0.53	***	0.55	***	0.56	***	0.61	***	0.49	***	0.61	***	0.56	***	0.61	***
NB4	0.25	***	0.18	***	0.26	***	0.25	***	0.26	***	0.26	***	0.24	***	0.27	***	0.26	***	0.17	***	0.39	***
NB5	0.30	***	0.24	***	0.31	***	0.38	***	0.27	***	0.32	***	0.32	***	0.33	***	0.28	***	0.36	***	0.46	***
NB6	0.26	***	0.22	***	0.28	***	0.33	***	0.24	***	0.29	***	0.29	***	0.32	***	0.27	***	0.29	***	0.42	***
NB7	0.29	***	0.26	***	0.27	***	0.33	***	0.30	***	0.34	***	0.32	***	0.32	***	0.31	***	0.27	***	0.43	***
NB8	0.50	***	0.39	***	0.50	***	0.52	***	0.51	***	0.53	***	0.56	***	0.54	***	0.49	***	0.50	***	0.48	***
NB9	0.41	***	0.33	***	0.42	***	0.51	***	0.42	***	0.45	***	0.46	***	0.49	***	0.38	***	0.45	***	0.42	***
NB10	0.44	***	0.31	***	0.44	***	0.52	***	0.45	***	0.47	***	0.49	***	0.52	***	0.43	***	0.47	***	0.44	***
NB11	0.35	***	0.23	***	0.35	***	0.38	***	0.34	***	0.39	***	0.41	***	0.35	***	0.36	***	0.31	***	0.41	***
NB12	0.25	***	0.13	***	0.23	***	0.25	***	0.24	***	0.25	***	0.25	***	0.19	***	0.24	***	0.20	***	0.37	***
NB13	0.35	***	0.24	***	0.34	***	0.32	***	0.36	***	0.37	***	0.39	***	0.33	***	0.32	***	0.34	***	0.40	***
NB14	0.40	***	0.27	***	0.42	***	0.41	***	0.42	***	0.42	***	0.44	***	0.34	***	0.39	***	0.45	***	0.34	***
NB15	0.33	***	0.26	***	0.35	***	0.36	***	0.33	***	0.35	***	0.35	***	0.30	***	0.33	***	0.34	***	0.33	***
NB16	0.44	***	0.34	***	0.44	***	0.41	***	0.44	***	0.46	***	0.47	***	0.38	***	0.44	***	0.45	***	0.38	***
NB17	0.33	***	0.22	***	0.35	***	0.33	***	0.33	***	0.34	***	0.33	***	0.24	***	0.33	***	0.31	***	0.34	***
NB18	0.51	***	0.38	***	0.54	***	0.64	***	0.48	***	0.52	***	0.56	***	0.58	***	0.50	***	0.57	***	0.45	***
NB19	0.71	***	0.54	***	0.72	***	0.60	***	0.72	***	0.71	***	0.77	***	0.59	***	0.73	***	0.68	***	0.53	***
NB20	0.68	***	0.53	***	0.69	***	0.55	***	0.67	***	0.68	***	0.71	***	0.51	***	0.67	***	0.61	***	0.53	***

	SvQ1		SvQ2		SvQ3		SvQ4		SvQ5		US1		US2		US3		US4		US5		NB1	
NB21	0.59	***	0.41	***	0.60	***	0.54	***	0.58	***	0.60	***	0.62	***	0.52	***	0.57	***	0.60	***	0.50	***
D1	0.00		0.01		0.00		-0.02		0.03		0.05		0.01		0.00		0.00		0.04		-0.03	
D2	-0.02		-0.04		-0.02		-0.04		-0.02		-0.04		-0.08	*	-0.07	*	-0.02		-0.04		-0.04	
D3	0.00		0.00		0.02		-0.01		0.02		-0.03		0.02		0.00		0.02		0.04		0.01	
D4	-0.06		0.00		-0.08	*	-0.01		-0.07		-0.05		-0.04		-0.06		-0.09	*	-0.04		-0.08	*
D5	-0.03		-0.03		-0.05		-0.06		-0.03		-0.02		-0.03		-0.07		-0.05		-0.06		0.01	
D6	0.04		-0.04		0.03		-0.02		0.02		0.03		0.02		0.01		0.04		0.01		0.05	
D7	-0.04		0.02		-0.03		0.02		-0.02		-0.05		-0.02		0.01		-0.03		-0.06		0.02	
D8	0.00		-0.02		0.04		0.01		-0.01		0.02		0.00		-0.02		0.03		0.00		0.01	
D9	0.02		0.06		0.03		0.02		0.05		0.04		0.01		0.01		0.03		0.02		-0.05	

	NB2		NB3		NB4		NB5		NB6		NB7		NB8		NB9		NB10		NB11		NB12	
NB2	1.00																					
NB3	0.59	***	1.00																			
NB4	0.33	***	0.34	***	1.00																	
NB5	0.37	***	0.47	***	0.20	***	1.00															
NB6	0.35	***	0.41	***	0.23	***	0.73	***	1.00													
NB7	0.38	***	0.38	***	0.29	***	0.36	***	0.36	***	1.00											
NB8	0.52	***	0.59	***	0.32	***	0.37	***	0.32	***	0.34	***	1.00									
NB9	0.46	***	0.54	***	0.32	***	0.36	***	0.27	***	0.32	***	0.77	***	1.00							
NB10	0.45	***	0.53	***	0.36	***	0.37	***	0.32	***	0.34	***	0.75	***	0.79	***	1.00					
NB11	0.37	***	0.44	***	0.35	***	0.26	***	0.25	***	0.34	***	0.50	***	0.53	***	0.52	***	1.00			
NB12	0.28	***	0.38	***	0.33	***	0.22	***	0.24	***	0.31	***	0.36	***	0.38	***	0.38	***	0.62	***	1.00	
NB13	0.41	***	0.44	***	0.31	***	0.24	***	0.23	***	0.32	***	0.51	***	0.52	***	0.50	***	0.56	***	0.61	***
NB14	0.36	***	0.51	***	0.30	***	0.36	***	0.31	***	0.31	***	0.48	***	0.49	***	0.48	***	0.48	***	0.42	***
NB15	0.40	***	0.46	***	0.27	***	0.32	***	0.33	***	0.32	***	0.45	***	0.44	***	0.44	***	0.51	***	0.50	***
NB16	0.42	***	0.48	***	0.35	***	0.28	***	0.26	***	0.31	***	0.49	***	0.48	***	0.48	***	0.53	***	0.48	***
NB17	0.32	***	0.36	***	0.34	***	0.21	***	0.22	***	0.31	***	0.39	***	0.44	***	0.42	***	0.52	***	0.57	***
NB18	0.42	***	0.58	***	0.27	***	0.45	***	0.40	***	0.34	***	0.57	***	0.56	***	0.59	***	0.42	***	0.29	***

	NB2		NB3		NB4		NB5		NB6		NB7		NB8		NB9		NB10		NB11		NB12	
NB19	0.58	***	0.69	***	0.35	***	0.42	***	0.39	***	0.37	***	0.64	***	0.54	***	0.57	***	0.46	***	0.33	***
NB20	0.51	***	0.64	***	0.33	***	0.40	***	0.38	***	0.42	***	0.57	***	0.45	***	0.48	***	0.47	***	0.37	***
NB21	0.44	***	0.58	***	0.31	***	0.48	***	0.45	***	0.29	***	0.55	***	0.47	***	0.50	***	0.39	***	0.29	***
D1	-0.03		0.03		0.03		0.03		-0.01		0.01		0.00		0.03		0.01		0.04		0.01	
D2	-0.01		0.00		0.00		-0.04		-0.09	*	0.03		-0.07	*	-0.02		-0.08	*	0.01		0.11	**
D3	0.04		0.02		0.05		0.04		0.03		0.00		0.04		-0.01		0.01		0.01		0.00	
D4	0.03		-0.01		-0.14	***	0.00		-0.04		-0.05		0.02		0.01		-0.02		-0.08	*	-0.14	***
D5	-0.03		-0.03		0.06		0.03		0.00		0.01		-0.09	*	-0.01		-0.05		0.01		0.00	
D6	0.03		0.08	*	0.09	*	-0.02		0.00		-0.01		0.01		-0.01		0.00		0.08	*	0.11	**
D7	-0.01		-0.05		-0.04		0.02		0.02		0.01		-0.02		-0.05		-0.07		-0.08	*	-0.11	**
D8	-0.02		0.01		-0.01		-0.05		-0.05		-0.06		-0.05		-0.03		-0.01		0.01		0.03	
D9	0.02		-0.02		0.01		-0.01		-0.06		-0.02		0.02		-0.03		-0.02		-0.05		-0.07	*

	NB13		NB14		NB15		NB16		NB17		NB18		NB19		NB20		NB21		D1		D2	
NB13	1.00																					
NB14	0.45	***	1.00																			
NB15	0.48	***	0.65	***	1.00																	
NB16	0.53	***	0.67	***	0.70	***	1.00															
NB17	0.54	***	0.62	***	0.67	***	0.71	***	1.00													
NB18	0.38	***	0.50	***	0.46	***	0.47	***	0.36	***	1.00											
NB19	0.47	***	0.48	***	0.42	***	0.50	***	0.39	***	0.63	***	1.00									
NB20	0.47	***	0.51	***	0.47	***	0.52	***	0.42	***	0.58	***	0.76	***	1.00							
NB21	0.40	***	0.50	***	0.40	***	0.46	***	0.36	***	0.65	***	0.70	***	0.66	***	1.00					
D1	0.13	***	0.05		0.05		0.08	*	0.02		-0.02		-0.01		-0.02		0.05		1.00			
D2	0.05		0.00		0.07		0.03		0.07		-0.07		-0.06		-0.02		-0.01		0.04		1.00	
D3	0.00		0.06		0.07		0.09	*	0.02		0.01		0.03		0.03		0.01		0.05		0.09	*
D4	-0.15	***	-0.04		-0.02		-0.08	*	-0.08	*	-0.01		-0.08	*	-0.13	***	-0.09	*	0.04		-0.08	*
D5	-0.01		0.01		0.01		0.03		0.02		-0.06		-0.05		-0.01		-0.05		0.08	*	-0.05	
D6	0.12	**	0.04		0.08	*	0.09	*	0.09	*	0.01		0.06		0.07		0.06		0.01		0.40	***

	NB13		NB14		NB15		NB16		NB17		NB18	NB19	NB20	NB21	D1		D2	
D7	-0.10	*	-0.06		-0.10	**	-0.15	***	-0.10	**	0.00	-0.05	-0.02	-0.07	-0.16	***	-0.40	***
D8	0.05		-0.03		-0.03		0.02		0.06		-0.04	-0.01	-0.05	-0.03	0.03		0.27	***
D9	-0.04		0.01		-0.05		-0.01		-0.04		-0.05	-0.03	-0.01	-0.03	0.08	*	0.00	

	D3		D4		D5		D6		D7		D8	D9
D3	1.00											
D4	0.06		1.00									
D5	0.06		0.09	*	1.00							
D6	0.14	***	-0.15	***	0.00		1.00					
D7	-0.17	***	0.06		-0.01		-0.81	***	1.00			
D8	0.04		-0.08	*	0.00		0.49	***	-0.45	***	1.00	
D9	0.03		0.01		-0.04		-0.04		0.04		-0.04	1.00

The following applies for the whole table above: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

8.3 Selbstständigkeitserklärung für die Masterarbeit

Ich erkläre hiermit, dass ich diese Arbeit selbstständig verfasst und keine anderen als die angegebenen Hilfsmittel benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche kenntlich gemacht. Mir ist bekannt, dass andernfalls der Senat gemäss dem Gesetz über die Universität zum Entzug des auf Grund dieser Arbeit verliehenen Titels berechtigt ist.

Bern, 28.08.2016 Tim Loosli

8.4 Einverständniserklärung zur Veröffentlichung der Masterarbeit

Ich erkläre hiermit, dass ich der Veröffentlichung der von mir verfassten Masterarbeit im Falle einer Benotung von 5.0 oder höher auf der Homepage des KPM zustimme. Die Arbeit ist öffentlich zugänglich.

Bern, 28.08.2016 Tim Loosli