A Meta-analysis of Technology Acceptance of Informations and Communication Technology in Residential Areas

Masterarbeit

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1 INTRODUCTION

Technology is becoming a part of many people's daily lives (Mattern 2007, p. 11). Not only in industry, but in the private environment of residential quarters, technology in the field of information and communication technology is becoming increasingly important. Above all, the networking of devices with each other via the Internet is increasing. Trends in research, industry, and business show that providing "ubiquitous ambient intelligence" is the next challenge of information and communication technologies (Ferscha 2007, p. 4). However, technology components, as information and communication technology are referred to in this exam, are accepted differently by users. The scientific community has already found reasons in several studies on this subject. To provide an overview, this exam will analyze the acceptance of three components in residential areas: photovoltaics, smart meter, and electric cars. It will be statistically investigated whether a consistent motivation explanation for the use of the technology components can be found. The suitability of the best-known model for measuring technology acceptance is examined.

Technology acceptance is measured in science with various tools. Two of the most widely used technology acceptance models form the structural basis of the meta-analyses to be conducted. The basic Technology Acceptance Model (TAM) (Davis 1985) and the most important further development, the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) are considered (Venkatesh et at. 2012). The models statistically summarize multiple scientific publications to provide an overview of a research area.

For the meta-analyses the methodological approach must be defined first. In particular, the two most widely used models for meta-analyses are presented: the fixed effects model and the random effects model. For the literature search selection framework rules will be established. Otherwise, the search for suitable literature for the meta-analyses would lead to too many results.

The literature found must meet certain minimum methodological standards to be considered in this meta-analysis. The papers must contain some potential moderator variables for the meta-analyses to be comparable. In the subsequent data collection, the extensive literature research is performed according to the previously defined rules. To increase the quality of the meta-analysis, potential problems must be identified early

and solved if possible. Problems are publication bias, uniformity problem, garbage-in-garbage-out problem, dependent examination results and incomplete data.

With the literature found, several meta-analyses are subsequently performed. First, the variables of the basic TAM are considered, and a meta-analysis is performed for each relationship between the variables. The variables must first be converted into consistent forms by coding variables. Then, comparative values can be calculated from these values to be able to introduce characteristic values into the meta-analyses. The meta-analyses of the basic TAM elements are first performed in the fixed effects model and then in the random effects model. To be able to assess whether the calculated results are statistically significant and whether the data basis used for each meta-analysis is homogeneous, a significance test and a homogeneity test are performed for each meta-analysis. Non-homogeneous data bases suggest additional information in the population. To establish some more information, variables that were not part of the classic TAM are included.

To examine the influence of external variables that affect the use of the technology components, an action concept for sustainable development and a motivation concept are used. The external variables are classified in two dimensions and a meta-analysis is performed for each expression and technology component. The data basis is a regression and path analysis, with variables coded uniformly. The meta-analyses of the external variables are carried out in the fixed and random effects model and checked with significance test and homogeneity test.

Finally, the results will be interpreted for the considered technology components electric cars, photovoltaics, and smart meter. In addition, attention is paid to a presentation that mimics the classic TAM. Additional significance values must be calculated. The exam answers the research questions and draws a conclusion. The research questions to be answered are the following:

Research question Q1: Can the basic TAM be applied to the technology component electric cars?

Research question Q2: Can the basic TAM be applied to the technology component photovoltaics?

Research question Q3: Can the basic TAM be applied to the technology component smart meter?

Research question Q4: Which sustainable action concept predominates in the acceptance of the technology components considered here: economic, environmental, or social?

Research question Q5: Which form of motivation predominates in the acceptance of the technology components considered here: intrinsic or extrinsic motivation?

The implications and outlook for science and manufacturers as well as the limitations due to the methodological approach and literature selection are discussed before a conclusion is drawn.

11 SUMMARY

Technology is an integral part of today's everyday life. It supports and provides convenience. Sustainable technologies are enormously important, especially against the backdrop of climate change. The acceptance of the technology’s electric cars, photovoltaics and smart meters was tested in 64 meta-analyses. The data basis was too heterogeneous for analyses with the fixed effects model. Analyses with the random effects model led to robust results. The TAMs found in the literature search were summarized. Overall, it can be said that the TAM is very suitable at measuring technology acceptance. Almost all overall paths of the basic elements resulted in medium and high correlation effects. The authors of the studies in the data base performed a surprising number of variations in the research model. As a result, not all basic paths could be found and analyzed for electric cars and especially photovoltaics. The research questions Q1, Q2 and Q3 could be answered for the most part, partially and completely with "Yes". Missing parts of the answers leave an answer open. Data contradicting the research questions could not be found. Electric cars, photovoltaics and smart meters must therefore have a high benefit and be easy to use to persuade users to purchase them. The ease refers to the handling and the purchase, as well as maintenance.

The high variations of the research models in the data basis meant that a moderator analysis was not possible. There was only little overlap between the external variables. Instead, the external variables were divided into two dimensions and further meta-analyses were conducted within the dimension expressions. The dimensions considered were a theory of action for sustainability and a theory of motivation.

In sustainable development, the incentive to use an electric car is predominantly economic. Users seem most likely to be persuaded to use an electric car by financial incentives and favorable prices. The photovoltaics and smart meter technologies have a high social sustainability incentive. Correspondingly, the associated advertising could be personalized. Hardly any external variables can be found for the environmental area. Further research should fill the gap. Overall, Q4 can be answered with: "No sustainable action concept dominates the others". Differences are recognizable in the individual technology.

In conjunction with motivation theories, it can be stated that extrinsic motivational factors predominate for the use of electric cars. Accordingly, it seems possible for manufacturers and governments to increase the number of privately owned electric

cars through external incentives. The use of photovoltaics is outweighed by intrinsic motivational factors. Here, personal persuasion and appeal to values and personal norms seems a more promising route. Extrinsic and intrinsic factors are equally pronounced in the use of smart meters. As a result of these different findings, Q5 can be summarized as follows: "No form of motivation dominates the other”. Again, differences in the individual technologies are recognizable.

In summary, the TAM for technology adoption of electric cars, photovoltaics, and smart meters provides consistent results that are aligned with the theory of the model. The external variables provide a differentiated picture. Due to widely varying studies in the data base, further and more in-depth research is desirable. Likewise, further standardization and analysis of the external variables in dimensions can bring knowledge progress to meet the challenges of climate change.