5 THEORETICAL AND METHODOLOGICAL FRAMEWORK

The following section suggests theoretical frameworks relevant for this survey. Among those are diffusion and adoption theories and service quality followed by the methodological foundations of the research project.

5.1 Relevance of the Theoretical Framework

The first two sections on adoption and service quality introduce a number of concepts, explain and analyze them briefly focusing on the relevant ones in light of theory development for this research project.

One of the main challenges in marketing research is a lack of common understanding and definition of key concepts. Particularly in the area of consumer behavior focusing on loyalty and satisfaction literature hardly shows common definitions, often the concepts overlap or even contradict each other. Important terms such as satisfaction or relationship are regarded differently in various research traditions. This may result from the fact that marketing research is influenced by traditions of psychology, sociology, behaviorism and economics. Thus, the identification of relevant latent variables is sometimes challenging. The following sections present a choice of theories and constructs for definition and measurement of those relevant concepts. The aim is a precise definition and overview with a focus on those serving as a theoretic basis for the research at hand, guiding model development, and composing parts of the actual research model.

Due to the nature of mobile services an integrative approach, focusing on service quality and diffusion theory seems promising for model development.

Apart from literature review for theory building the methodological framework needs consideration. As Structural Equation Modeling (SEM) or causal modeling as it is also referred to, seems to be the appropriate statistical method to test multiple indicator latent variable models. This method is also explained in the methodological building block.

Electronic service quality in general and mobile service quality in particular have specific requirements regarding theory building. Here
i) A lot of theory in service quality stems from a comparison of expected and actual service performance. This view is not supported in this research as customers often do not know what to expect when it comes to new technology products and the measurement instruments’ complexity is unnecessarily increased.

ii) Traditional service quality literature is built on considerations of human to human interaction. With regard to mobile services this stream of research can serve as a guideline but one has to consider the fact that mobile services primarily involve human computer interaction.

iii) Adoption and diffusion theories bear a different sort of shortcoming not considering behavioral outcomes of system use. Additionally these theories often do not define “use” precisely enough. Testing a system once or trying a new service without repeating it is not the ultimate goal of service providers. In this research repeat use and behavioral consequences of the service use is of interest, thus, recursive models with the endogenous variable attitude towards the system/service use are unsatisfactory. Therefore, model development for this research project goes beyond traditional adoption models integrating those into the extensive body of knowledge from service quality and consumer behavior theory.

vi) Some of the dimensions in adoption and service quality models capture the general domain of IS adoption and service quality fairly well but they need to be reconsidered and evaluated (from an empirical view) if they are distinct enough for mobile service quality assessment and mobile consumer behavior.

The following sections, representing the theoretical building block for this project, present adoption and diffusion theories, the concept of service quality, related Internet service quality models, and, with respect to the empirical work involved in this research project, the underlying assumptions of causal modeling.
5.2 Diffusion and Adoption Theories

This chapter presents and discusses the most important theories concerning adoption with respect to mobile services and their importance for this research project. Uses and Gratifications research will not be discussed as it has generally been criticized for its limited theoretical foundation (Lin, 1996) and low explanatory power (LaRose, Mastro et al., 2001). The following table presents some models and theories of individual acceptance.

Table 6: Models and Theories of Individual Acceptance (See also Venkatesh, Morris, et al. 2003)

<table>
<thead>
<tr>
<th>Model/Theory</th>
<th>Authors</th>
<th>Core Constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Diffusion Theory (IDT)</td>
<td>(Rogers, 1962)</td>
<td>Relative Advantage, Ease of Use, Image, Visibility, Compatibility, Results Demonstrability, Voluntariness of Use</td>
</tr>
<tr>
<td>Theory of Reasoned Action (TRA)</td>
<td>(Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975)</td>
<td>Attitude Toward Behavior, Subjective Norm</td>
</tr>
<tr>
<td>Technology Acceptance Model (TAM)</td>
<td>(Davis, 1989; Davis, Bagozzi et al., 1989; Venkatesh and Davis, 2000)</td>
<td>Perceived Usefulness, Perceived Ease of Use, Subjective Norm (TAM 2)</td>
</tr>
<tr>
<td>Motivational Model (MM)</td>
<td>(Davis, Bagozzi et al., 1992; Vallerand, 1997; Venkatesh and Speier, 1999)</td>
<td>Extrinsic Motivation, Intrinsic Motivation</td>
</tr>
<tr>
<td>Theory of Planned Behavior (TPB)</td>
<td>(Ajzen, 1991; Harrison, Mykytyn et al., 1997; Mathieson, 1991; Taylor and Todd, 1995b)</td>
<td>Attitude Toward Behavior, Subjective Norm, Perceived Behavioral Control</td>
</tr>
<tr>
<td>Task Technology Fit (TTF)</td>
<td>(Goodhue and Thompson, 1995)</td>
<td>Task Characteristics, Performance Impacts, Utilization, Technology Characteristics, Individual Characteristics</td>
</tr>
<tr>
<td>Social Cognitive Theory (SCT)</td>
<td>(Compeau and Higgins, 1995; Compeau, Higgins et al., 1999)</td>
<td>Outcome Expectations - Performance, Outcome Expectations - Personal, Self-efficacy, Affect, Anxiety</td>
</tr>
</tbody>
</table>
5.2.1 Diffusion of Innovations

The diffusion of an innovation traditionally has been defined as the process by which an innovation "is communicated through certain channels over time among the members of a social system." (Rogers, 1983, 5)

The factor of communication channels, mentioned in the definition can be considered as one of the most important. The information about an innovation is communicated to or in a social system via mass media or interpersonal communication. The person’s social system consists of different perceptions on media types and their reliability. Some might rely on mass media and others on interpersonal channels in their information seeking process. Some might rely on word-of-mouth and peer influence whereas others rely on the Internet or newspapers for information.

Past research offers a solid foundation for theory development, one of those foundations is Rogers (1962) work on the diffusion of innovations. This work has stimulated various surveys and has been validated in various areas (Au and Enderwick, 2000).

Rogers (1962) defined five factors influencing consumer’s adoption decisions, relative advantage, compatibility, complexity, communicability, and trialability. All of those are now explained in more detail.

Relative advantage: The degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social-prestige factors, convenience, and satisfaction are also important components. It also matters that there is some relative advantage of completing the transaction via an alternative medium. This was explored by various researchers investigating the advantage of transactions via the Web (Moore and Benbasat, 1991; Rogers, 1995; Seybold, 1998)

Complexity: The degree to which an innovation is perceived as difficult to understand and use is complexity. Some innovations are rapidly understood by most members of a social system; others are more complicated and will be adopted more slowly. New ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understandings.

Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.

Trialability is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible.
**Observability** is the degree to which the results of an innovation are visible to others. Obviously, innovations and their success have a great deal to do with how they are perceived by the potential and actual consumers. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it.

Rogers (1995, p.16) puts forth that "innovations that are perceived by individuals as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations".

In order to be successful the innovation has to be communicated to or in the social system. Communication can be carried out via mass media or via personal communication. Rogers (1962) defines diffusion as an inherently social process. Thus, information can be transmitted via interpersonal channels, with a person adopting an innovation on the basis of the evaluation of an individual like them, or mass media channels, such as newspaper, television, and radio. To analyze the influence of various media one can apply the Bass model for analysis (Bass, 1969). This model assumes that two types of communication channels influence potential adopters; namely, the mass media channel and interpersonal channels.

The social or cultural structure affects the diffusion and adoption of innovation in a system. A social system is defined as "a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (Rogers, 1995, 23). The diffusion of an innovation within a social system, such as an organization, is influenced by norms of the system. Additionally, the opinion leaders within that social system will affect adoption as well as the change agent. Factors influencing the process are: the structure of the social system, norms, the role of opinion leaders and the consequence of the innovation (Rogers, 1995, 23).

Tomatzky and Klein (1982) found that three of Roger's innovation characteristics (perceived advantage, compatibility and complexity) were consistently related to adoption behavior. Davis derived his constructs perceived usefulness of the technology and perceived ease of use of the technology from the diffusion of innovation perspective (Rogers, 1995).

Diffusion models have been used to explain the adoption of mobile tourism services (Corigliano and Baggio, 2004) but only give insights on an aggregate level. An other application of diffusion models with regard to mobile commerce is the survey of Kleijnen et al. (2004) where perceived risk plays a critical role in the adoption process, followed by complexity and compatibility.
5.2.2 Social Cognitive Theory

The Compeau and Higgins’ (1995) paper discusses the role of individual’s beliefs about their abilities to use a computer. The model is based on Bandura’s Social Cognitive Theory (1986). The survey investigates emotional reactions to computers (affect and anxiety), as well as outcome expectations and computer self-efficacy on computer use. Self-efficacy and outcome expectations are positively influenced by encouragement of others and others’ use of computers. Self-efficacy is important in an organizational setting when it comes to successful information system (IS) implementation. This provides implications for organizational support, training, and implementation.

In a later survey the second part of the model (not including encouragement by others, others’ use and support) was tested (Compeau, Higgins et al., 1999).

![Figure 5: Compeau and Higgins SCT Model (1995)](image)

In a later survey performance outcomes were found to influence affect and use with affect significantly related to use (Compeau, Higgins et al., 1999). Overall an individual’s affective and behavioral reactions to information technology both impact self-efficacy an outcome expectations.

5.2.3 Theory of Planned Behavior & Theory of Reasoned Action

The Theory of Planned Behavior (TPB) is an extension of the Theory of Reasoned Action (TRA) and a well-established general theory of social psychology stating that specific beliefs influence given behavioral perceptions and resulting actual behavior (Aijzen, 1991; Ajzen and Fishbein, 1980). The building blocks of the TPB are salient beliefs, which are used to determine attitudes, social norm and behavioral control, consecutively determining intentions and behavior (see Figure 6).
Ajzen (2001) pointed out the ability of TPB to provide a useful theoretical framework for understanding and predicting the acceptance of new information technology. Empirical evidence suggests the explanatory power of TPB in the field of new information technology adoption. This includes a survey on the acceptance of telemedicine technology by physicians (Chau and Hu, 2002), the widespread adoption of virtual banking (Liao, Shao et al., 1999), executives adopting new information technology (Harrison, Mykytyn et al., 1997) and the acceptance of electronic brokerage services (Bahattacherjee, 2000).

5.2.4 The Technology Acceptance Model

A frequently cited adoption model in information systems is Davis’ technology acceptance model (TAM) (Davis, 1989). The TAM adapted the Theory of Planned Behavior by incorporating technology in order to explain computer usage.

According to Davis et al. (1989, 985), the TAM goal is "to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified."

The TAM has been used to explain the adoption of telecommunication services such as telework (Hu, Chau et al., 1999), mobile telephones (Kwon and Chidambaram, 2000) and mobile commerce services (Pedersen, 2003). These studies suggest that the traditional TAM (Davis, 1989) needs modifications in underlying assumptions of usefulness when explaining the adoption of mobile services. They suggest the inclusion of social influence and behavioral control variables to explain the adoption process.

The TAM has successfully predicted and explained individual’s intention to adopt and actual adoption across a variety of studies. Gefen and Straub (2000) provide a synopsis of TAM studies from 1989-2000. The model has been extended by including gender (Gefen and Straub, 1997; Venkatesh and Morris, 2000), age (Morris and Venkatesh,
2000), social norms (Pedersen and Herbjorn, 2003) and culture (Straub, Keil et al., 1997).

Pedersen et al. (2003) used an extended TAM to test the acceptance of a mobile parking service and found that with the extension (self expressiveness) the model satisfactory measured the adoption behavior.

The following figure depicts the TAM model.

![Figure 7: The Technology Acceptance Model](image)

### 5.2.5 Task Technology Fit Model

User evaluations are attitudes or beliefs about something and have been used to measure different "things". Goodhue's (1995) approach for developing the Task Technology Fit Model (TTF) was that IS literature lacked a specific user evaluation construct with a theoretical perspective that links underlying systems to their relevant impacts. Some authors (Goodhue and Thompson, 1995; Jarvenpaa, 1989; Zirgus and B.K., 1998) integrated concepts from IS and organizational research. They discuss outcomes of matching group support applications with group task requirements on performance and process quality. In the ultimate TTF model Goodhue and Thompson (1995) combine utilization and fit as a technology must be utilized and must be of good fit with the tasks it supports. This concept is shown graphically in the following figure. The results of their study highlight the importance of the fit between technologies and users' tasks in achieving individual performance impacts.
With regard to the m-services industry TTF was applied to investigate the tasks performed via a variety of interaction devices such as wireless phones and PDAs (Wells, Sarker et al., 2002).

### 5.2.6 Motivational Model

Research from the field of psychology supported the general motivation theory as predictor for behavior. The core constructs are extrinsic motivation and intrinsic motivation. Extrinsic motivation could be an improved job performance, pay or promotions whereas intrinsic motivation would be that the user performs the activity per se because he/she wants to (Davis, Bagozzi et al., 1992). This theory has been adapted for the IT context in various studies (Davis, Bagozzi et al., 1992; Venkatesh and Speier, 1999).

### 5.2.7 Unified Theory of Acceptance and Use of Technology

The most recent model development and assessment was carried out by Venkatesh, Morris et al. (2003), leading technology acceptance researchers, with an attempt to evaluate existing models to build a unified model of technology acceptance.

The model was formulated based on conceptual and empirical similarities across eight competing technology acceptance models. These are:

1. Davis’ Technology Acceptance Model (Davis, 1989; Davis, Bagozzi et al., 1989)
2. Roger’s Innovation Diffusion Theory (Rogers, 1995)
3. The Theory of Reasoned Action (Fishbein and Ajzen, 1975)
4. The Motivation Model (Davis, Bagozzi et al., 1992)
5. The Theory of Planned Behavior (Aijzen, 1991)
6. The Combined Technology Acceptance and Theory of Planned Behavior (Taylor and Todd, 1995b)
7. The Model of PC Utilization (Thompson, Higgins et al., 1991; Triandis, 1977)
8. The Social Cognitive Theory (Compeau and Higgins, 1995; Compeau, Higgins et al., 1999)

The unified theory of acceptance and use of technology (UTAUT) comprises four core factors determining intention to use – performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh, Morris et al., 2003). Gender, age, experience, and voluntariness of use moderate the key relationships in the model (Venkatesh, Morris et al., 2003).

The performance expectancy is according to Venkatesh Morris et al. (2003) the degree to which an individual believes that using a system will help to better attain rewards. In previous surveys performance expectancy (usefulness) has consistently been a strong predictor of intention (Davis, Bagozzi et al., 1989; Taylor and Todd, 1995b; Venkatesh and Davis, 2000).

Effort expectancy is the degree of ease associated with the use of systems. Three constructs from existing models capture the concept of effort expectancy: perceived ease of use (TAM), complexity (MPCU), and ease of use (IDT).

Social influence is the degree to which a person perceives that important others believe he/she should use a new technology. Subjective norm, image, and social factors were included in previous models to represent this factor.

Facilitating conditions the degree to which an individual believes that an organizational and technical infrastructure exists to support system usage. Perceived behavioral control (TPB), facilitating conditions (MPCU) and compatibility (IDT) capture this idea in previous research.

Consistent with all previously mentioned behavioral models intention has a significant positive influence on technology usage. UTAUT also includes the moderating variables gender, age, experience, and voluntariness of use.

Now, after describing the components of the model extensively, Figure 9 illustrates the UTAUT model.
5.2.8 Comparative Analysis of Adoption Models

Venkatesh, Morris et al. (2003) provide an overview of model comparisons. The main findings are condensed here. Mathieson (1991) stresses that both TAM and TPB predict intention to use quite well with TAM easier to apply and TPB providing more specific information that can better guide development.

Taylor and Todd (1995b) conducted a survey testing the predictive quality of TAM and TPB. In their survey they found that a decomposed model consisting of TAM and TPB items provided a fuller understanding of behavioral intention.

While there have been some tests of models in an organizational setting, Plouffe, Hulland et al. (2001) are the only ones comparing models in that setting. All other comparison studies have been surveys among students.

The most extensive model comparison so far, carried out by Venkatesh, Morris et al. (2003) first tests eight models, among those are Theory of Reasoned Action, Technology Acceptance Model, Motivational Model, Theory of Planned Behavior, Combined TAM and TPB, Model of PC Utilization, Innovation Diffusion Theory and Social Cognitive Theory.

In the Venkatesh, Morris et al. (2003) survey all models are compared on all participants, which is a major advantage compared to previous studies. Most model comparisons were conducted in voluntary usage contexts. Thus, one has to be cautious generalizing these findings to mandatory usage scenarios. The Venkatesh et al. (2003) survey
acknowledges this fact by examining both, voluntary and mandatory implementation contexts.

Table 7: Review of Model Comparisons (See also Venkatesh et al. 2003)

<table>
<thead>
<tr>
<th>Model Comparisons</th>
<th>Models</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathieson (1991)</td>
<td>TAM, TPB</td>
<td>The variance in intention explained by TAM 70%, TPB 62%.</td>
</tr>
<tr>
<td>Davis et al. (1989)</td>
<td>TRA, TAM</td>
<td>The variance in intention and use explained by TRA was 32% and 26%, and TAM was 47% and 51% respectively.</td>
</tr>
<tr>
<td>Taylor and Todd (1995b)</td>
<td>TAM, TPB, Decomposed TPB</td>
<td>The variance in intention explained by TAM was 52%, TPB was 57% and DTPB was 60%.</td>
</tr>
<tr>
<td>Venkatesh et al. (2003)</td>
<td>TRA, SCT, TAM/TAM2, TPB/DTPB, MM, UTAUT, C-TAM/TTPB, MPCU, IDT</td>
<td>UTAUT outperformed the other eight models which explained between 17% and 53% of variance in user intentions to use information technology while UTAUT was confirmed with 70% of explained variance in user intentions.</td>
</tr>
<tr>
<td>Plouffe et al. (2001)</td>
<td>TAM, IDT</td>
<td>The variance in intention explained by TAM was 33% and IDT was 45%.</td>
</tr>
</tbody>
</table>

5.3 Service Quality

Service quality and satisfaction are two of the most complex constructs in marketing theory, which is reflected by a massive amount of publications on this subject. Particularly the measurement of service quality has attracted the attention of academics and practitioners (Roest and Pieters, 1995). The definition of service quality is a complex and difficult task and marketing literature offers myriad options.

Service quality resulting from the use of mobile services is of interest for this book. Furthermore, the behavioral outcomes resulting from service quality are explored. Quality has been focused on products and the technical perspectives of them resulting in Total Quality Management in the 90s. In this research the consumer’s judgment of a service is the center of interest. According to Parasuraman, Zeithaml and Berry a consumer oriented definition is perceived quality as: "... the consumer’s judgment about an entity’s overall excellence or superiority..." Zeithaml in: (Parasuraman, Zeithaml et al., 1985, 43)

The following table helps identify the distinctions of the various constructs and highlight some differences.
The following subchapters introduce the most important concepts of service quality and highlight the different assumptions on causal relationships between the constructs. The presentation of the models follows a chronological order as some build on findings of others.

### 5.3.1 Donabedian’s Model

One of the eldest models dealing with service quality is Donabedian’s (1987) model. Coming from the health care industry Donabedian identifies three dimensions for the quality of medical services:

1. **Structure**
2. **Process**
3. **Outcome** (Donabedian, 1987; Donabedian, 1991)

*Structure* refers to the capabilities necessary to make the service. This is the technical and organizational ability of the service provider and the potential to use regarding the consumer.

*Process* comprises all activities involved in the completion of the service.

The result of the process is referred to as *Outcome*. In the health care industry this would be an improved condition of the patient.

Donabedian suggests linearity and sequential steps among these three components. The main achievement of Donabedian’s view is still valid; service quality does not lie in the outcome but also in the process of completing the service. This model serves as a basis for subsequent attempts to model service quality.

In his more recent book on quality assurance Donabedian (2003) breaks quality improvement into two component parts: *systems design and resources* and *performance monitoring and adjustment*. These two components feed into each other.
5.3.2 Grönroos’ Model

Grönroos’ (1978; 1982; 1984) work on the deconstruction of service quality concludes that service quality’s principal components are technical quality, functional quality and corporate image. He applies a target/actual comparison of expectation with the service in the way he did with the Confirmation/Disconfirmation-Paradigm in satisfaction theory. The following figure illustrates how technical quality and functional quality are included from a customer’s point of view.

![Diagram](image)

**Figure 10: Grönroos’ (1984) Service Quality Model**

The technical quality dimension focuses on the *what* while the functional quality dimension focuses on the *how*. *What* the customer receives is a result of his interactions with a firm. This can be measured by the customer objectively. The *how* of receiving the service is also important to the customers but they cannot measure it as objectively. The technical quality includes know how, technical solutions, machines, and computerized systems. The functional quality includes internal relations, behavior, service mindedness, appearance, accessibility, customer contacts and attitudes. Grönroos is explicit with respect to the contrasting hard and soft aspects of the service output.

All partial evaluations are influenced by the existing image of a service provider. Corporate and/or local image is particularly important for most services (Grönroos, 1988). It has an impact on the perception of quality and can even be considered as a filter. Finally, good perceived quality is achieved when the experienced quality meets the expectations of the customer. If expectations are not realistic the perceived quality will be low no matter if the quality – objectively measured – was good (Grönroos, 1988). Grönroos defines six criteria of good perceived service quality that can be accounted to the dimensions:

- Professionalism and skills
- Attitudes and behavior
• Accessibility and flexibility
• Reliability and trustworthiness
• Recovery
• Reputation and credibility

Marketing activities include advertising, public relations and sales campaigns that can be controlled by the firm. In contrast word-of-mouth and image factors are only indirectly controlled by the firm.

Later, considering developments in the service quality research with respect to the constructs satisfaction and service quality, Grönroos suggests to rename his model “Perceived Service Features” to stress the focus on the attributes of a service (Grönroos, 2001). Some authors criticize the model due to insufficient empirical tests and neglecting the external factor. However, it gives valuable insights into the quality dimensions.

5.3.3 Parasuraman, Zeithaml, Berry

The model developed by Parasuraman, Zeithaml and Berry (1985) was based on an explorative study of experts’ evaluations and focus groups in four service businesses. The model’s basic idea is the existence of gaps between customers’ expectations and perceived performance. Some findings were industry specific but the majority were common across industries and, thus, encourage the formulation of a general model. This was the basis for the subsequent development of a measurement instrument called SERVQUAL (Parasuraman, Berry et al., 1991; Parasuraman, Zeithaml et al., 1988). The model is described in Figure 11.
Gap 1: Consumer expectation – management perception gap. This gap implies a difference between customer expectations and executive perceptions about them. Discrepancies between those two exist.

Gap 2: Management perception – service quality specification gap. This is the discrepancy of management perceptions of consumer expectation and the firm’s service quality specifications that influences the customers’ service quality perceptions.

Gap 3: Service quality specifications – service delivery gap. Even with the existence of guidelines performing services may not be a certainty. A firm’s employees have a strong influence on the service quality perceived by the customers. This is the gap between service quality specifications and actual service delivery.

Gap 4: Service delivery – external communications gap. This gap occurs when a company promises more in its marketing communications than the services can deliver in reality.

Gap 5: Expected service – perceived service gap. The explorative results showed that the key to good service quality is meeting or exceeding what consumers expect from a service. The gap is the extent to which the expected service is not met by the perceived service (Parasuraman, Zeithaml et al., 1985).
From a customer’s perspective gap five is the most important one. For companies gaps 1-4 are most important and their direction (positive or negative) has an impact on gap 5.

In a later survey they stress the relationship between service quality and customers’ intentions concerning information systems (Berry and Parasuraman, 1997). These statements of intentions comprise “Loyalty to Company”, “Propensity to Switch”, “Willingness to Pay More”, “External Response to Problem” and “Internal Response to Problem”. The information quality measures if the information is relevant, precise useful in context, credible, understandable, and timely.

5.3.4 Measurement of Service Quality

5.3.4.1 SERVQUAL

There are several measurement instruments for service quality. This chapter presents SERVQUAL measuring GAP number five from the previously explained GAP model (Parasuraman, Zeithaml et al., 1988).

Parasuraman, Zeithaml and Berry (1988) described a model of five dimensions of service quality: tangibles, reliability, responsiveness, assurance, and empathy.

- Tangibles: Tangibles are the physical facilities, equipment and appearance of personnel for instance.
- Reliability: Reliability refers to the ability to perform the desired service dependably, accurately, and consistently.
- Responsiveness: Responsiveness is the willingness to provide prompt service and support customers.
- Assurance: This concept includes employees’ knowledge, courtesy, and the ability to convey trust and confidence.
- Empathy: Provision of caring and individualized attention to consumers is understood as empathy. (Berry, Parasuraman et al., 1988; Parasuraman, Berry et al., 1991; Parasuraman, Zeithaml et al., 1988).

Although the model was originally constructed for the traditional service sector it can be adapted to the new technology sector. In this setting tangibles would be the user interface, reliability can be the error probability of the system itself e.g. an unstable phone connection would influence the reliability negatively. Responsiveness can relate to the fact that mobile services should be highly interactive but yet, at the same time, should be unobtrusive. Assurance is another aspect named by Berry, Parasuraman and Zeithaml (1988), which can translate into the extent to which the service provides trustworthy information and the user can have confidence in the services. Finally, empathy with
regard to mobile services refers to the degree of personalization of the service provided, which is not yet fully applicable in this setting as services are yet predominantly pulled not pushed. Once push services increase the degree of individualism and personalization will become even more important.

SERVQUAL consists of 22 items for customers’ expectations and perceptions of service quality, using a seven point Likert scale for measurement.

Criticism regarding SERVQUAL falls mainly into two areas: i) the rather vague formulation of the items and ii) asking the consumer about expectations.

The first criticism involved the fact that the SERVQUAL items are formulated in a general manner to allow application in as many industries as possible. Thus, in some cases the items are too generic and need to be adapted to the specific setting. As a result the advantage of SERVQUAL, being standardized for an application in various areas often is not applicable (Ostrowski, O'Brien et al., 1993).

Secondly, measuring expectations has been criticized as in practice expectations are often mixed with performance evaluation when not asked prior to consuming the service. Quality is the subjective perception of an individual customer and often is not fulfilled. In fact, the customer can perceive high quality even if the (admittedly) unrealistic expectations were not quite met.

5.3.4.2 SERVPERF

Cronin et al. (1992; 1994) criticise SERVQUAL and also provide an alternative instrument called SERVPERF. Other authors also support the argument that simple performance based measures of service quality are satisfying and outperforming the expectations-performance approach (Bolton and Drew, 1991; Woodruff, Cadotte et al., 1983).

Their reasoning aligns with defining service quality as an attitude developed over time and that satisfaction is a transaction-specific measure. Oliver (1980) for instance suggests that attitude is initially a function of expectations and subsequently a function of the prior attitude toward the present level of satisfaction.

Reflecting on criticism on SERVQUAL Parasuraman, Zeithaml and Berry (1994a; 1994b) suggest a three column format which generates separate ratings of desired, adequate, and perceived service with three identical side-by-side scales. This format is longer, though, and might lead to respondents’ resistance to fully complete the questionnaire.

With regard to the development of the SERVQUAL instrument Cronin and Taylor (1992) raise concerns related to the empirical evidence which suggests that the five components are not consistent. However, the validity of the 22 items appears to be well supported by the proce-
dures used to develop them and their subsequent use as reported in literature. Therefore, Cronin and Taylor (1992) stick with the basic 22 items. In summary they found that the only performance oriented SERVPERF measure explains more variance than the SERVQUAL instrument.

Parasuraman et al. (1994b) compare four alternative measures including SERVQUAL and SERVPERF. They conclude that both, SERVPERF and a summary disconfirmation measure outperform SERVQUAL. However, they recommend the continued use of their measure which is quite surprising.

5.3.5 Internet Quality

There are research attempts that focus on the development of a model for Web site quality, also known as WebQual. The next section introduces such models, two of them named WebQual one developed by Barnes and Vidgen (2002), the other one by Loiacono, Watson and Goodhue (2002). One called Sitequal by Yoo and Donthu (2001), eTailQ by Wolfinbarger and Gilly (2003), EC-SERVQUAL by Wang and Tang (2003), DeLone and McLean's (1992) IS success, E-S-Qual (Parasuraman, Zeithaml et al., 2005), and attitude towards the site (Chen, Clifford et al., 2002).

The models discussed earlier focus on human interaction. This setting is not fully applicable as mobile phones are electronic devices. Thus, drawing on concepts developed for the Internet may yield insights for the mobile medium and support model development in course of this research project.

5.3.5.1 E-S-Quality

Recent (Parasuraman, Zeithaml et al., 2005) studies looked into what constitutes e-service quality and Zeithaml, Parasuraman and Malhotra (2000) state "e-service quality (e-SQ) is the extent to which a website facilitates efficient and effective shopping, purchasing, and delivery."

Researchers agree that SERVQUAL is a good predictor of overall service quality and adequate for measuring IS service quality (Kettinger and Lee, 1994; Pitt, Watson et al., 1995; Watson, Pitt et al., 1998).

The process of developing e-SQ involved six steps i) a literature and qualitative study ii) a preliminary scale containing 121 items representing 11 e-service quality dimensions iii) an online survey iv) development of a parsimonious scale through an iterative process v) a confirmatory factor analysis and validity test on the final scale vi) a confirmation of reliability and validity (Parasuraman, Zeithaml et al., 2005). The following table explains the dimensions included in the model and what these dimensions are anteceding.
Table 9: Dimensions of e-SQ (Adapted from Zeithaml (2000), Parasuraman (2005))

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Explanation</th>
<th>Anteceding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Involves the correct functioning of the site and the accuracy of service promises, billing, and product information.</td>
<td>Perceived Control</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Means quick response and the ability to get help if there is a problem or question.</td>
<td>Perceived e-Service Quality</td>
</tr>
<tr>
<td>Access</td>
<td>Is the ability to get on the site quickly and to reach the company when needed.</td>
<td>Perceived Convenience</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Involves choice of ways to pay, ship, buy, search for, and return items.</td>
<td>Perceived Convenience/Control</td>
</tr>
<tr>
<td>Ease of navigation</td>
<td>Means that a site contains functions that help customers find what they need easily, possesses a good search engine, and allows the customer to move easily and quickly through the pages.</td>
<td>Perceived Convenience</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Means that a site is simple to use, structured properly, and requires a minimum of information to be input by the consumer.</td>
<td>Perceived Convenience</td>
</tr>
<tr>
<td>Assurance/Trust</td>
<td>Involves the confidence the customer feels in dealing with the site and is due to reputation of site and products/services as well as clear and truthful information.</td>
<td>Perceived e-Service Quality</td>
</tr>
<tr>
<td>Security/Privacy</td>
<td>Involves the degree to which the customer believes the site is safe from intrusion and personal information is protected.</td>
<td>Perceived Control</td>
</tr>
<tr>
<td>Price Knowledge</td>
<td>Is the extent to which the customer can determine shipping price, total price, and comparative prices during the shopping process.</td>
<td>Perceived e-Service Quality</td>
</tr>
<tr>
<td>Site Aesthetics</td>
<td>Relates to the appearance of the site.</td>
<td>Perceived e-Service Quality</td>
</tr>
<tr>
<td>Customization/Personalization</td>
<td>Is how much and how easily the site can be tailored to individual customer’s preferences, histories, and ways of shopping.</td>
<td>Perceived Control</td>
</tr>
</tbody>
</table>

The table shows factors anteceding perceived control and perceived convenience, which in turn are antecedents of perceived e-service quality. Perceived price antecedes perceived value, which is influenced by the e-service quality. The whole causal chain ends in purchase/repurchase. Both, experienced and less experienced respondents mentioned similar attributes to evaluate e-SQ, thus, according to the authors (Zeithaml, Parasuraman et al., 2000) it should be possible to develop a general scale. Expectations play an important role in perceived service quality. However, participants of the e-SQ expressed that it is hard for them to articulate their e-SQ expectations.

In a later publication Parasuraman Zeithaml and Malhotra (2005) again worked on a multiple-item scale for measuring service quality delivered by Web sites for online shopping. In this research they stress...
the importance of value as an additional overall assessment such as e-SQ, which in turn influence behavioral intentions and actual behavior. Their final e-SQ scale includes efficiency, fulfillment, system availability and privacy. The second outcome was an e-recovery service quality scale (e-RecS-Qual) including responsiveness, compensation and contact (Parasuraman, Zeithaml et al., 2005).

5.3.5.2 EC-SERVQUAL

Wang and Tang (2003) used the SERVQUAL model as starting point and developed an EC-SERVQUAL model containing four dimensions: reliability, responsiveness, assurance and empathy. This study adopted the two column format of SERVQUAL to develop the EC-SERVQUAL. The measurement instrument was modified to apply to the e-commerce context. The instrument was originally developed for a human to human interaction setting, thus, questions with regard to a sales person had to be rephrased to ask about the screen design etc. After adaptations each item was turned into an expectation and perception measurement. The final instrument with good reliability and validity provides researchers with 16 measurements for explaining differences across results (Wang and Tang, 2003).

5.3.5.3 WebQual by Barnes and Vidgen

Barnes and Vidgen (2001a) developed a web quality assessment instrument, improved and changed it based on newer findings. The instrument, based on Bossert’s (1991) theory of quality function deployment, can be found in four versions, WebQual 1.0 to WebQual 4.0. WebQual version 2.0 included 10 dimensions (aesthetics, understanding the individual, communication, access, security, credibility, navigation, competence, responsiveness, and reliability). An analysis of the WebQual 3.0 data lead to three dimensions of e-commerce Web site quality: information quality, service interaction quality, and usability. Their latest WebQual version 4.0 (Barnes and Vidgen, 2003) is reduced to a quite parsimonious model of four dimensions: usability, design, information, and service. Site quality has been replaced by usability as it emphasizes the user and the users’ perceptions rather than the designer. The usability dimension draws on literature from the field of human computer interaction (Davis, 1989). Usability is concerned with users’ interaction and perception of a Web site.

Applications of WebQual include UK business school websites (Barnes and Vidgen, 2000), Internet bookshops (Barnes and Vidgen, 2001d), small companies (Barnes and Vidgen, 2001b), and online auction houses (Barnes and Vidgen, 2001c).
5.3.5.4 WebQual by Loiacono, Watson and Goodhue

As opposed to their colleagues Loiacono, Watson and Goodhue (2000) focus on TAM and TRA as starting points to develop their measure for Web site quality. According to the authors those theories provide a strong conceptual basis for a link between beliefs and behavior that can be applied in the web context.

The authors criticize Barnes and Vidgen’s model for a lack of content validity and a too small sample size in the first three versions inapt to provide reliable factor scores.

Loiacono et al.’s (2000; 2002; 2000) proposed WebQual instrument measures 12 core dimensions with 4 umbrella terms: usefulness (informational fit-to-task, tailored communications, trust, response time), ease of use (ease of understanding, intuitive operations), entertainment (visual appeal, innovativeness, emotional appeal) and finally, complimentary relationship (consistent image, on-line completeness, relative advantage). The application of the Loiacono et al. (2002) WebQual instrument in combination with Hofstede’s cultural dimensions showed that masculinity and long-term orientation are associated with higher Web site quality expectations (Tsikriktsis, 2002). Another application of this instrument showed that only three dimensions, informational fit-to-task, transaction capability and response time, were significant predictors of shopper satisfaction (Kim and Stoel, 2004).

5.3.5.5 DeLone and McLean’s Model of IS Success

DeLone and McLean (1992) conducted an extensive survey on the success factors of information systems. According to them, IS success can be represented by the quality characteristics of the IS itself. These are the system quality, the quality of the output of the IS, and the information quality. The consumption or use of the IS relates to the users’ response to or satisfaction with the IS. The effect of the system on the behavior of the user is the individual impact and the effect on the organizational performance is the organizational impact.

![DeLone and McLean's (1992) Model of IS Success](image)
5.3.5.6 Sitequal

The items of Sitequal were generated mainly on consumers descriptions as it focuses on individual perceptions of quality (Yoo and Donthu, 2001). The aim was to develop a reliable, valid, multidimensional, and parsimonious instrument.

In the first phase of developing the measurement instrument 92 site characteristics were identified and trimmed to 54 descriptions after excluding redundancies. Then the 54 characteristics were included in a questionnaire with 50 items remaining after the first analysis. Further model re-specification and refinement of the measurement instrument lead to four factors made up of nine items. These are ease of use, aesthetic design, processing speed, and security.

5.3.5.7 eTailQ

Wolfinbarger and Gilly (2003) developed eTailQ, a model explaining and predicting quality of online shopping. They argue that online consumers are aware of their need for privacy and security and above that writers and scholars have stressed the unique capabilities of the online medium to provide interactivity, personalized experiences, community, content, increased product selection, and information. This suggests that traditional concepts of service and retailing quality may be inadequate in an online context (Wolfinbarger and Gilly, 2003).

It is of interest what attributes of quality, satisfaction, and loyalty are important to online users. The measurement scale was developed based on online and offline focus groups, a sorting task, and an online survey of a customer panel with the aim to go beyond a sole website assessment to an e-tail service quality instrument. Figure 13: eTailQ shows the model with the final four factors extracted.

The four factors are:

- **Fulfillment/reliability**: it is the accurate display of a product and the customers receive what they expect in the time frame promised.
- **Website design**: it includes all elements of a consumer’s experience on the Web site.
- **Customer service**: refers to a willing service provider that responds to the customer quickly.
- **Security/privacy**: takes credit card payments and privacy of shared information into account.
5.3.5.8 Attitude Toward the Site – \( A_{ST} \)

In the beginning of the Internet, marketers thought the Internet would be quite measurable (Gibson, 1997) but soon realized that this is not easy at all. Previous research on Attitude toward the Ad (\( A_{AD} \)) has shown that the attitude is an indicator of advertising effectiveness. Haley and Baldinger (1991) found that how well viewers liked an ad was the best predictor of sales.

Analogous to that Chen and Wells (1999) assume that attitude toward the site is an equally useful indicator of site value. After collecting items from related surveys and conducting a quantitative survey the authors found that three factors influenced the attitude toward the site. These factors were: entertainment, informativeness, and organization (Chen, Clifford et al., 2002). The following figure shows the proposed model.

![Figure 14: Attitude Toward the Site](image)

**Figure 14: Attitude Toward the Site**
5.4 Behavioral Consequences of Perceived Service Quality

Since most service quality and adoption models end with service quality or technology use further relevant constructs and theories are explored. The concept of loyalty is important since this research project does not focus on trial or one-time usage but on repeat usage. Furthermore, value is explored since often perceived value is the main driver of repeat usage.

5.4.1 Loyalty

Loyalty is a construct in social science and the term is often used in everyday life. Jacoby and Chestnut (1978) cited 53 definitions in their review on loyalty. Yet, there is no consent on a single definition. Oliver, one of the most cited scientists in loyalty research defines loyalty as a "...deeply held commitment to rebuy or repatronize a preferred product or service consistently in the future, despite situational influences and marketing efforts having the potential to cause switching behavior. (Oliver, 1997, 392)"

The modeling of loyalty has a long history in marketing literature dating back to the early 1920s (Copeland, 1923). The majority of early studies conceptualized loyalty behaviorally. Some authors focused on the sequence in which brands were purchased; others measured loyalty through the proportion of purchases of a specific brand. A third group focused on stochastic measures like probability of purchase. Some combined behavioral criteria for empirical studies.

To give insights into loyalty research the following chapters present the important loyalty concepts.

5.4.1.1 Day’s Two-Dimensional Loyalty Concept

Day (1969) viewed brand loyalty as repeated purchases prompted by a strong internal disposition. He proposed loyalty indexes based on attitudinal and behavioral measures and criticized the use of only behavior based loyalty measures. The main idea is that these do not distinguish between true loyalty and spurious loyalty. He argues that: "The key point is that these spuriously loyal buyers lack any attachment to brand attributes and they can be immediately captured by another brand that offers a better deal..." (Day, 1969, 30)

Thus, he adds a two-dimensional conceptualization of loyalty adding an attitudinal dimension to the behavioral component.
5.4.1.2 Loyalty According to Jacoby, Chestnut and Kyrner

Jacoby and Chestnut (1978) criticized the behavioral measures as lacking conceptional basis and capturing only the static outcome of a dynamic process. In line with Day, Jacoby and Kyrner (1973, 2) also propose a two dimensional loyalty definition

- "...brand loyalty is
- the biased (i.e. nonrandom)
- behavioral response
- expressed over time
- by some decision making unit,
- with respect to one or more alternative brands, and
- is a function of psychological (decision-making, evaluative) processes..."

Jacoby and Chestnut's analysis concludes that consistent purchasing as indicator of loyalty could be invalid.

This research project supports the reasoning to not only consider one factor, e.g. buyer behavior or a positive attitude, as the determinant of loyalty. In line with this reasoning it is proposed to include two components in the loyalty construct, thus, this survey will use a two dimensional loyalty construct.

5.4.1.3 The Dick and Basu Loyalty Approach

As mentioned earlier Day originated the two dimensional loyalty definition. In addition to this two dimensionality, Day distinguished true/intentional loyalty and spurious loyalty. Purchases guided by situational aspects such as special offers reflect spurious loyalty. The traditional definitions do not attempt to understand the factors underlying repeat purchase. High repeat purchase may reflect situational factors whereas low repeat purchase may simply indicate different usage situations like variety seeking, or lack of brand preferences. Thus, behavioral definitions are insufficient to explain brand loyalty.

As a consequence Dick and Basu (1994) developed the conceptual framework of customer loyalty presented in Figure 15.
The model includes three types of antecedents of relative attitudes (cognitive antecedents, affective antecedents and conative antecedents). Attitude represents an association between an object and an evaluation. The attitude towards a brand could be positive but still might not result in repeat purchase over time because of comparable or greater attitudinal extremity toward other brands. Thus, relative attitudes provide a stronger indication of repeat patronage. Cross-classifying relative attitudes and repeat patronage leads to four loyalty conditions: no loyalty, spurious loyalty, latent loyalty, and loyalty. The classification is shown in Figure 16.

<table>
<thead>
<tr>
<th>Relative Attitude</th>
<th>Repeat Patronage</th>
<th>Loyalty</th>
<th>Latent Loyalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>Loyalty</td>
<td>Latent Loyalty</td>
</tr>
<tr>
<td>Low</td>
<td>Spurious Loyalty</td>
<td>No Loyalty</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 16: Types of Loyalty according to Dick and Basu (1994, 101)**

Now the types of loyalty as shown in above figure are explained in further detail.

*No loyalty.* Low relative attitude combined with low repeat patronage is leading to the absence of loyalty. First, this could occur when a new product is introduced and/or in the case of inability to communicate distinct product advantages. Second, low relative attitude may be due to specific market place dynamics where competing brands are seen as similar. A marketing manager in this case can make efforts to create spurious loyalty through manipulation of situational exigencies or social norms. This is achieved through favorable locations for brands or aggressive trade promotions (Dick and Basu, 1994).

*Spurious loyalty.* Low relative attitude, with high repeat patronage is spurious loyalty. This type is characterized by non-attitudinal influences on behavior such as subjective norms and situational effects. This is similar to inertia, in that a customer perceives little difference between the brands of a low involvement category and, thus, does not change.
brands. A strengthening of the value of social bondage may also lead to repeat orders (Dick and Basu, 1994).

**Latent loyalty.** A high relative attitude accompanied with low repeat patronage reflects latent loyalty. This is a concern for marketers in a marketplace environment with subjective norms and situational effects equally or even more influential than attitudes in determining patronage behavior. A person for example may have a high relative attitude toward a restaurant but still prefer going to a different one due to varying preferences of meal companions. It appears unnecessary to increase an existing and already high positive attitude, thus, marketing goals should be focused on addressing the normative/situational constraints.

**Loyalty.** Loyalty, the desired of the four conditions, signifies a favorable correspondence between relative attitude and repeat patronage. The discussion on relative attitude suggests that, provided customers perceive differences among competing brands, the level of attitude does not have to be the highest. However, it is desirable. The competition will try to induce spurious loyalty through manipulation of situational factors, decrease perceived differentiation with the leading brand reducing its relative attitude (Me-too strategy) or through an increase of perceived differentiation in its favor through competitive claims of superiority (Dick and Basu, 1994).

The concept of Dick and Basu was often used and frequently empirically tested (Oliver, 1997; Oliver, 1999; Pitchard, Howard et al., 1992).

### 5.4.1.4 Oliver’s Dynamic Loyalty Perspective

Oliver’s work is based on Jacoby and Kyner (1973) and Dick and Basu (1994) adding a dynamic perspective. According to Oliver there is an ultimate loyalty where the customer will pursue his request against all odds and at all cost. Proactive loyalty occurs when a customer frequently rebuys a product and will not change to an other (Oliver, 1997). In contrast to that, situational loyalty appears in certain situations with external influence.

The basic idea of Oliver’s model is that customers become loyal in a cognitive way first, then later in an affective, still later in a conative manner and finally in a behavioral manner. This is described as the *action inertia* (Oliver, 1999). At each stage the commitment and emotional connection increases.

The four-stage loyalty model has different vulnerabilities, depending on the stage and the nature of the customers’ commitment. This is summarized in Table 10.
Table 10: Loyalty Phases with Corresponding Vulnerabilities (Oliver, 1999)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Identifying Marker</th>
<th>Vulnerabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive</td>
<td>Loyalty to information such as price, features, and so forth.</td>
<td>Actual or Imagined better competitive features or price through communication (e.g. advertising) and vicarious or personal experience Deterioration in brand features or price. Variety seeking and voluntary trial.</td>
</tr>
<tr>
<td>Affective</td>
<td>Loyalty to a liking: &quot;I buy it because I like it.&quot;</td>
<td>Cognitively induced dissatisfaction. Enhanced liking for competitive brands, perhaps conveyed through imagery and association. Variety seeking and voluntary trial. Deteriorating performance.</td>
</tr>
<tr>
<td>Conative</td>
<td>Loyalty to an intention. &quot;I'm committed to buying it.&quot;</td>
<td>Persuasive counterargumentative competitive messages. Induced trial (e.g. coupons, sampling, point-of-purchase promotions). Deteriorating performance</td>
</tr>
<tr>
<td>Action</td>
<td>Loyalty to action inertia, coupled with the overcoming of obstacles.</td>
<td>Induced unavailability (e.g. stock lifts – purchasing the entire inventory of a competitor’s product from a merchant). Increased obstacles generally. Deteriorating performance.</td>
</tr>
</tbody>
</table>

**Cognitive loyalty.** In this first phase of loyalty the brand information available to consumers indicates that one is preferable over its alternatives. The loyalty is not very strong and the customer can be convinced to buy an other brand through product information. If satisfaction is processed (e.g. trash pickup, utility provision) it begins to take on affective overtones.

**Affective loyalty.** In this second phase a liking or attitude is developed toward the brand due to an accumulation of satisfying usage occasions. Here Oliver uses the confirmation disconfirmation paradigm known from satisfaction research (Oliver, 1980; Oliver, 1993; Oliver, 1997). Commitment at this phase is referred to as affective loyalty. Cognition is subject to counter arguments whereas affect is not as easily influenced. This type of loyalty is still subject to switching, thus, it would be desirable if customers were loyal at a deeper level of commitment. Satisfaction only cannot keep customers from buying different products (Jones and Sasser, 1995).

**Conative loyalty.** Conative loyalty is the next stage of loyalty development, which is influenced by related incidents of positive affect toward the brand and as a result leading to behavioral intention to use. Conation implies brand specific commitment to repurchase. In this stage at first appears deeply held commitment to buy as specified in the loyalty definition. The customer intends to rebuy, he or she has the motivation, but similar to any other motivation this desire may be an anticipated but unrealized action.

**Action loyalty.** For Oliver this stage is the connection between intention and action. The action control paradigm includes that a customer...
even overcomes obstacles to buy the desired product. This requires the highest level of commitment.

Oliver (1999, 36) identifies two main obstacles to loyalty - consumer idiosyncrasies and switching incentives. Marketing activities should address these two issues. Oliver's model can be applied for goods and services, with interpersonal factors appearing in a services setting that need to be acknowledged.

### 5.4.1.5 Measuring Loyalty

The high number of loyalty concepts lead to various operationalizations and measurement models. Oliver's (1999) approach for instance would require the inclusion of sustainers and vulnerabilities to enable a differentiation of the loyalty phases. He suggests a five point Likert scale with one item corresponding with each loyalty phase. The following table gives details on this operationalization.

**Table 11: Measuring Loyalty According to Oliver (1997, 398)**

<table>
<thead>
<tr>
<th>Loyalty phase</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive</td>
<td>Brand X has more benefits than others in its class.</td>
</tr>
<tr>
<td>Affective</td>
<td>I have grown to like brand X more so than other brands.</td>
</tr>
<tr>
<td>Conative</td>
<td>I intend to continue buying brand X in the future.</td>
</tr>
<tr>
<td>Action</td>
<td>When I have a need for a product of this type, I buy only brand X.</td>
</tr>
</tbody>
</table>

Oliver (1997) also gives an overview of alternative operationalizations. In line with research and as already described the loyalty concept consists of attitudinal and behavioral aspects. Thus, both of them have to be included in the measurement instrument. There are two ways of measuring behavioral intentions, either ex post investigating repeat purchase, or ex ante investigating repurchase intentions. One limitation is that intentions do not always lead to the specified behavior. The attitudinal component can be measured directly (reports on attitudes) or indirectly (intention to recommend, price sensitivity).

Finally, concluding the discussion on loyalty the measurement in this research will use a two dimensional loyalty concept including behavioral and attitudinal components. The behavioral component will be measured by investigating the intended behavior and the past behavior. The attitudinal component is measured indirectly assessing the users' responsiveness to competitors' promotional efforts.
5.4.1.6 The Relationship between Customer Satisfaction and Loyalty

Literature pertaining to the relationship between customer satisfaction and loyalty can be organized in three categories:

1. Provision of empirical evidence of a positive relationship between customer satisfaction and loyalty without further elaboration.
3. The examination of the effects of moderator variables on the relationship between the two constructs.

Research in the first stream has been based on the assumption of linear relationships (Homburg and Giering, 2001). However, researchers in the second category have provided theoretical and empirical support for a more complex, non-linear structure. Some suggest a convex relationship (Jones and Sasser, 1995), others a saddle curve shape of the relationship (Woodruff, Cadotte et al., 1983). Findings by Oliva et al. (1992) indicate that, depending on the magnitude of transaction costs, the relation between the two constructs can be both linear and nonlinear. The third and very limited group examines the existence of moderating factors on the relationship between satisfaction and loyalty (Homburg and Giering, 2001).

5.4.2 Value

Explanations of consumers’ services purchases have circled around the relationship between service quality and purchase intentions (Cronin and Taylor, 1992; Parasuraman, Zeithaml et al., 1985; Parasuraman, Zeithaml et al., 1988; Parasuraman, Zeithaml et al., 1994b; Zeithaml, Berry et al., 1996). However, customers do not always buy the highest quality product nor do they always buy the lowest cost products. In this dilemma the value construct has been introduced to enhance the understanding of the importance of price and service quality. There have been various attempts to define value. Zeithaml (1988) identified four patterns of responses in an exploratory study, resulting in four potential definitions of value:

- Value is low price.
- Value is whatever one wants in a product.
- Value is the quality that the consumer receives for the price paid.
- Value is what consumers get for what they give.

While each of these definitions has merit, the vast majority of past research has focused on the fourth meaning of value (Bojanic 1996;
Caruana, Money, and Berthon 2000; Zeithaml 1985). As Zeithaml suggested as a tradeoff between relevant “gives” and “gets”.

Specifically Zeithaml defines perceived value as “the customer’s overall assessment of the utility of a service based on perceptions of value” (Zeithaml and Bitner, 1996, 501).

Review of perceived value literature leads to two main perspectives that have been used to model customers’ value perceptions: utilitarian and behavioral (Jayanti and Fosh, 1996).

5.4.2.1 Utilitarian Approach to Perceived Value

Some authors argue that consumers’ value perceptions result from comparing different prices of products. This includes the selling price, advertised reference price and internal reference price (Monroe, 1990; Thaler, 1985). According to Monroe (1990) advertised selling prices and advertised reference prices influence potential customers’ internal reference prices. This suggests that customers reflect relevant information and then form price expectations and perceptions on value. Perceived value consequently is a combination of acquisition value and transaction value of that product.

Parasuraman and Grewal (2000) identified four types of value in the literature (Grewal, Monroe et al., 1998; Woodruff, 1997):

- **Acquisition value**: This is the benefit related to monetary cost the buyers believe they are getting by acquiring a product or service.
- **Transaction value**: This relates to the pleasure of getting a good deal.
- **In-use value**: This is the utility deriving from using the service/product.
- **Redemption value**: This is the residual benefit at the time of trade-in or end of life for products or the time of termination for services.

All these conceptualizations imply a dynamic perspective of perceived value and the importance of those components may change over time. Earlier work shows that antecedents of value changes over time and at the different stages of a customers’ lifecycle (Parasuraman, 1997; Woodruff, 1997).

Grewal et al. (1998) develop a model that shows the effects of advertised selling and reference prices on buyers’ internal reference prices, perceptions of quality, acquisition value, transaction value, purchase, and search intentions. Grewal et al.’s (1998) conceptualization of perceived transaction value combines previous conceptualizations and suggests that it is a “psychological satisfaction or pleasure obtained from taking advantage of the financial terms of the price deal”. Grewal
et al. (1998) argue that buyers’ perceptions of price deals are based on comparisons of different price structures which are included in the model. They are: advertised selling price, advertised reference price, internal reference price. If the comparison yields a positive result customers are satisfied which in turn is the transaction value of a product.

Conceptualizing perceived value exclusively based on price deals is an important but insufficient approach. Customers also take other product attributes into consideration. Thus, other models have been suggested to explain perceived value.

5.4.2.2 Behavioral Approach to Perceived Value

Zeithaml’s (1988) model of perceived value incorporates psychological antecedents and higher level attributes. It is a good starting point since many researchers considered it for their own conceptualizations.
The above model indicates that quality perceptions are reached through evaluations of product attributes, which also lead to overall value judgments. Therefore, Zeithaml (1988) suggests that the formation of quality and value perceptions occur in a means-end way. Literature review shows that the means-end approach was used to demonstrate how means as objects or activities are connected to ends (i.e. desired end states or values) (Gutman, 1982). There are three levels of abstraction in this means-end chain, from objects to values, that consumer's memorize in the end. First, attributes, representing the lowest level. Then, the consequences of those attributes which can be quality and value judgments in this case.

Woodruff and Gardial (1996) and Woodruff (1997) based their work on Zeithaml (1988) and suggest a similar explanation based on the means-end considerations. However, they propose their own model of consumer value to explain the three levels of abstraction also used by Zeithaml (1988). This is shown in the following figure.

![Figure 19: Consumer Value Hierarchy Model (Woodruff, 1997)](image)

Woodruff (1997) argues that customer value should be conceptualized at three levels, namely the levels of attributes, consequences, and goals. These three levels are incorporated into the 'Customer Value Hierarchy Model' depicted above. In this hierarchy consumers learn to relate the specific attributes to consequences and end-goals.

Attribute based satisfaction are the first level. Initially, at the pre-purchase stage, customers are concerned to identify and assess the products as bundles of attributes.

Consequences are the next step. After buying/using a product the customer learns how well it performs. The consequences may be positive or negative.

Goals are at the highest level. Consumers at this stage understand the contribution of the product to the achievement of their goals.
Woodruff and Gardial (1996) argue that customers want to achieve their end goals in every single consumption. The two columns of figure 19 (desired value and received value) distinguish between customer expectations (desired value) and customer-perceived performance (received value).

Other perspectives on value perceptions can be referred to as typologies. Holbrook (1999) for instance defines consumer value as "an interactive relativistic preference experience". His value typology consists of various dimensions. Based on the definition the dimensions of value are: efficiency, play, excellence, aesthetics, status, ethics, esteem, and spirituality. Holbrook includes extrinsic versus intrinsic, active versus reactive, and self-oriented versus other-oriented factors to build an extensive model.

![Holbrook's Typology of Consumer Value](image)

Similar to Holbrook (1996) Sheth et al.'s (1991) conceptualization is also benefit-driven. They provide five different values that drive consumer choice behavior as motivational forces. Those consumer value types explain the reasons behind consumers' product choice. According to Sheth et al. (1991) consumers buy products to reach one of the following value types:

- functional value (attribute related, utilitarian benefit)
- social value (social or symbolic benefits)
- emotional value (experimental or emotional benefits)
- epistemic value (curiosity driven benefits)
- conditional value (situation specific benefits e.g., Christmas Valentines day etc.)

Both, Holbrook's (1996) and Sheth et al.'s (1991) models only explain value by consumption benefits. The shortcoming is that no cost involved is considered.
5.5 Discussion of the Relevant Models and Constructs

Researchers deal with service adoption and service quality in various publications. This chapter summarizes and discusses important factors and findings from previous quantitative surveys.

First of all perceptions rather than objective technology attributes have been found to be more relevant to technology acceptance decision making (Moore and Benbasat, 1991). In Moore and Benbasat’s (1991) model Rogers’ complexity construct was renamed and called ease of use, consistent with Davis (1989), reflecting the dominant measurement paradigm in ICT research. They also developed the image construct which is comparable to social norm and one could argue that image was included by Rogers’ in his definition of the construct relative advantage. Rogers (1995, 204) discusses the importance of utilizing consistent instruments or measurements of innovation attributes to contribute to innovation diffusion research.

A myriad of such instruments, often with very little difference, just renaming concepts and strongly drawing on Rogers’ considerations emerged. Rogers draws attention to the fact that effort has been spent studying people related differences in innovativeness while relatively little effort has been devoted to analyzing innovation differences. In other words, differences on how attributes of innovations affect the rate of adoption. Concluding this line of arguments, in this research the attributes of an innovation will be evaluated and additionally the level of innovativeness of individual’s will be taken into account as a moderating variable.

For this survey the most important conclusion from the above described quality models is the differentiation between perception and expectation. One could argue that the quality perception of a mobile service user is determined by his expectations. Yet, researchers found that with new technology products customers do not know how well a new service could work and, thus, do not have precise expectations on its performance. Therefore, perceptions on the quality are the main object of interest.

Factors of Lociano et al. (2002) webqual model show constructs that also appeared in most adoption models and also can be drawn from the diffusion of innovations theory.

One of the main differences and achievements of Internet quality models is the acknowledgement of enjoyment or fun factors (Van der Heijden, 2003; Van der Heijden, 2004).
Furthermore, the perceived value of a service and its impact on loyalty is considered. In this study loyalty is a construct with attitudinal and behavioral components.

The following table gives an overview of relevant adoption and service quality surveys, including the method employed, the model used and additional constructs as well as the supported structural relations and major findings.

The review shows that most surveys empirically supported the models described in the previous chapters. Some extended the existing models to include: perceived enjoyment, perceived attractiveness, image, visibility, result demonstrability, gender, social presence/information richness, performance, fun, self-efficacy, novelty seeking, need for interaction, self-consciousness, perceived waiting time, social anxiety. The following moderators were identified: gender, age, experience, voluntariness of use.

Reviewing the models applied in mobile services research yielded the following extensions of traditional models: user friendliness, self-control, self-expressiveness, connection speed, service costs, personal innovativeness, perceived cost, social influence, perceived risk, relative advantage, compatibility, communicability, critical mass, navigation, payment options, perceived risk, cost, compatibility, fun, consumer visual orientation, Internet device. The review led to the following moderator variables: age, computer skills, mobile technology readiness, social influence.

Further details can be found in the table below.

### Table 12: Diffusion, Adoption and Service Quality Models in IS and Mobile Services Research

<table>
<thead>
<tr>
<th>Model/ Theory</th>
<th>Additional Constructs</th>
<th>Supported Causal Relations</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnes and Vidgen (2002): Qualitative and quantitative Surveys</td>
<td>WebQual</td>
<td>Usability, Design, Information, Trust, Empathy → Q</td>
<td>WebQual is a method for assessing the quality of Web sites, developed through application in various domains. WebQual is grounded in the impression of web users.</td>
</tr>
<tr>
<td>Cronin, Brady and Hult (2000): Survey, n=1844</td>
<td>Quality, Value, Satisfaction</td>
<td>Q → I, V, Sat V → I, Sat Sat → I Sacrifice → V</td>
<td>The study investigates the effects of quality, satisfaction and value on consumer’s behavioral intentions. The article compares competing models. It has to be noted that service quality, satisfaction and value are all directly related to behavioral intention.</td>
</tr>
</tbody>
</table>
### Davis et al. (1989): Experiment

| TRA, TAM | \( EOU \rightarrow U, A \) | \( U \rightarrow A, I \) | \( A \rightarrow I \) | \( I \rightarrow \text{Use} \) | EOU is secondary and acts through U. Attitudes have little impact mediating between perceptions and intention to use. |

### Davis (1989): Survey, n=152

| TAM | \( U \rightarrow \text{Use} \) | EOU \( \rightarrow \text{Use} \) | TAM fully mediated the effects of system characteristics on use behavior, accounting for 36% of the variance in use. Usefulness is 50% more influential than ease. |

### Dabholkar and Bagozzi (2002): Survey, experimental design, n=392

| TAM | Performance, Fun, self-efficacy, novelty seeking, need for interaction, self-consciousness, perceived waiting time, social anxiety | A \( \rightarrow I \) | PEN \( \rightarrow A \) | EOU \( \rightarrow A \) | Performance \( \rightarrow A \) | Moderators: self-efficacy, novelty seeking, need for interaction, self-consciousness, perceived waiting time, social anxiety |
| \( \text{TAM} \) | This survey investigates the moderating effects of consumer traits and situational factors on the relationships of a core attitudinal model based on TAM. The results lend support to the hypothesized moderating effects. |

### DeLone and McLean (1992): Exploratory study

| I/S Success | System qual., information qual \( \rightarrow \text{use, user satisfaction} \rightarrow \text{Individual impact} \rightarrow \text{organizational impact} \) | The authors introduce a taxonomy for IS success, integrating the diverse past research in this field. The main aspects are drawn into a descriptive model and the implications for future IS research are discussed. |

### Gefen and Straub (1997): Survey, n=392

| TAM | Gender, Social presence/ information richness (SPIR) | Gender \( \rightarrow U, \text{EOU, SPIR, Usage} \) | SPIR \( \rightarrow U \) | U \( \rightarrow \text{Usage} \) | EOU \( \rightarrow \text{Usage} \) | The study findings indicate that women and men differ in their perceptions but not in use. This suggests that gender should be included in diffusion models along with other cultural effects. |

### Karahanna et al. (1999): Survey, n=268

<p>| IDT, TRA, TPB | Image, visibility, result demonstrability | A ( \rightarrow I ) | SN ( \rightarrow I ) | EOU, Image, U, Visibility, Result Demonstrability, Trialability ( \rightarrow A ) | Top Management, Supervisor, Peers, MIS Department, Local Computer Specialist, Friends ( \rightarrow \text{SN} ) | Pre-adoption attitude is based on perceptions of usefulness, ease of use, result demonstrability, visibility and trialability. Post-adoption attitude is only based on instrumental beliefs of usefulness and perceptions of image enhancements. |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Measures</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathieson (1991): Experiment</td>
<td>TPB, TAM Same as Davis (1989)</td>
<td>Both TAM and TPB predict well. TAM is easier to apply; TPB provides more specific information for developers.</td>
<td></td>
</tr>
<tr>
<td>Taylor and Todd (1995a): Survey, n=786</td>
<td>TAM, TPB U → A, EOU → A, U A → I SN → I PBC → I, Use I → Use</td>
<td>The model consisting of TAM and TPB constructs explains for both, experienced and inexperienced users. The link between behavioral intention and behavior is stronger for experienced users. Antecedent variables predict inexperienced user’s intentions better.</td>
<td></td>
</tr>
<tr>
<td>Parasuraman et al. (2005): Survey, Measurement instrument development</td>
<td>E-S-QUAL Q → V Q, V → Loyalty intention</td>
<td>The E-S-QUAL scale consists of 22 items falling into 4 factors: Efficiency, fulfillment, system availability, and privacy. The E-RecS-QUAL scale (for customers with non-routine encounters with the sites) contains 11 items and three dimensions: responsiveness, compensation, and contact.</td>
<td></td>
</tr>
<tr>
<td>Teo et al. (1999): Web based survey, n=1370</td>
<td>TAM Perceived enjoyment EOU → U, Usage, PEN U → Use PEN → Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Van der Heijden (2004): Survey, n=1144</td>
<td>TAM Perceived enjoyment U → I PEN → I EOU → PEN, U</td>
<td>The survey supports the hypotheses that perceived enjoyment and perceived ease of use are stronger determinants of intentions to use than perceived usefulness.</td>
<td></td>
</tr>
</tbody>
</table>
**Venkatesh et al. (2003): Survey, n=215**

<table>
<thead>
<tr>
<th>Model</th>
<th>Moderator: Gender, age, experience, voluntariness of use</th>
<th>EOU/Effort Expectancy → I</th>
<th>U/Performance Expectancy → I</th>
<th>PBC/Facilitating conditions → I</th>
<th>SN → I</th>
<th>I → Use</th>
<th>This is a new model based on previous models/theories with the attempt to build a unified model. This measured well with respect to the sample chosen but further model tests are needed.</th>
</tr>
</thead>
</table>

**Wolfinbarger and Gilly (2003): Focus groups, Tasks, Survey**

|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------|

**Mobile Services Area**

**Bruner and Kumar (2005): Survey, n=212**

<table>
<thead>
<tr>
<th>Model</th>
<th>Fun, Consumer visual orientation, Internet device</th>
<th>U → A</th>
<th>EOU → U, PEN</th>
<th>A → I</th>
<th>PEN → A</th>
<th>Cons. Visual orientation → EOU</th>
<th>Internet device → EOU, PEN</th>
<th>TAM was extended by utilitarian and hedonic aspects. Fun contributes more to attitude than expected and visually oriented people will adopt more than less visually oriented ones.</th>
</tr>
</thead>
</table>

**Hung et al. (2003): Survey, n=267**

<table>
<thead>
<tr>
<th>Model</th>
<th>Connection speed, service costs, user satisfaction, personal innovativeness</th>
<th>Connection speed → A</th>
<th>User Satisfaction → A</th>
<th>INN → A</th>
<th>EOU → A</th>
<th>U → A</th>
<th>A → I</th>
<th>Peers → SN</th>
<th>SN → I</th>
<th>Self Efficacy → PBC</th>
<th>PBC → Use</th>
<th>The total variance explained in actual WAP usage is rather low, most respondents have no experience. All in all, the model fits well.</th>
</tr>
</thead>
</table>

**Kleijnen, Wetzels et al. (2004): Survey, n=99**

<table>
<thead>
<tr>
<th>Model</th>
<th>Perceived risk, relative advantage, compatibility, communicability, critical mass, navigation, payment options</th>
<th>Cluster profiling variables (innovativeness, leadership, Internet usage) lead to three clusters</th>
<th>Perceived risk plays a critical role in the adoption process, followed by complexity and compatibility. Also three segments are identified &quot;Value Seekers&quot;, &quot;Game Players&quot; and &quot;Risk Avoiders&quot;.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kleijnen et al. (2004): Survey, n=105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Perceived system quality, perceived cost, social influence. Moderators: Age, computer skills, mobile technology readiness, social influence | U → A  
EOU → U  
A → I  
Perceived system quality → A  
SN → I | From the three constructs added to the TAM model, system quality and social influence displayed significant effects. All of the moderating variables proved to be relevant in the context presented. |

<table>
<thead>
<tr>
<th>Pedersen (2003): Survey, n=190</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRA, TAM, TPB</td>
</tr>
</tbody>
</table>
| User friendliness, self control | U → A  
SN → I, A  
User friendly, External influence → U  
A → I  
PBC → I, I → Use  
Self control, interpersonal infl. → SN  
Self efficacy, facilitating conditions → PBC | The survey shows that a model integrating various concepts such as TPB, PBC and TAM measure well. Adding behavioral control to the model increased the explanatory power where as adding subjective norm did not. The simple TAM only explained 30% of variance in intention to use and 17% of variance in actual use. The complex model explained 49% of the variance in intention to use. Subjective norm combined with behavioral control improves model fit and adds to explanatory power. |

<table>
<thead>
<tr>
<th>Pedersen and Herbjorn (2003): Web based survey, n=452</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAM</td>
</tr>
</tbody>
</table>
| Self-expressiveness                          | A → I  
U → A, I  
EOU → U, A  
Self-expressiveness → A, I, U | When self-expressiveness is removed from the model the model fit is reduced. Additionally the explained variance in intention to use is also reduced from 58% to 50%. |

<table>
<thead>
<tr>
<th>Wu and Wang (2005): Survey, n=310</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAM2, IDT</td>
</tr>
</tbody>
</table>
| Perceived risk, cost, compatibility            | EOU → U, I  
I → Use  
U → I  
Compatibility → I, U  
Cost → I  
Perceived risk → I | All variables except perceived ease of use affected user’s behavioral intention. A puzzling finding is the positive influence of perceived risk on behavioral intention. The most important determinant for behavioral intention to use is compatibility. |

Legend: A=attitude, U=usefulness, I=behavioral intention, EOU=ease of use, PEN=perceived enjoyment/fun, INN=innovativeness, SN=subjective norm, PBC=perceived behavioral control, Q=quality, V=value, Sat=satisfaction, SPIR=social presence & information richness. For an additional review of related TAM, TPB, TRA, IDT, UTAUT, MM, C-TAM/TPB, MPCU etc. studies please refer to Lederer et al. (2000) Legris et al. (2003) and Gefen and Straub (2000).
5.6 Causal Modeling

“Structural equation modeling (SEM) is a statistical methodology that takes a confirmatory (i.e. hypothesis-testing) approach to the analysis of a structural theory bearing some phenomenon.” (Byrne, 2001, 3)

However, Pearl (2000) takes a more critical approach indicating that the hypothesis test should not be the main emphasis. Pearl’s (2000) book discusses causality and structural models in social science arguing that the most distinctive capabilities of SEM are currently ill understood and underutilized. He uses graphical models and the logic of intervention to alleviate the current difficulties. The ambitious goal is to reinstate the causal interpretation of SEM.

Causal analysis, often also called structural equation modeling, covariance structure analysis, structural equation methodology, causal modeling, LISREL (Linear Structural Relations) -Approach, or latent variable modeling is established in the recent empirical marketing science (Homburg and Hildebrandt, 1998).

Accordingly, SEM falls into the category of second generation multivariate methods typically conveying causal processes. These processes under study are represented by a series of structural (i.e. regression) equations. The main difference between the second and first generation (e.g. multidimensional scaling, factor analysis) of multivariate analysis are the following (Hulland, Chow et al., 1996):

1. The inclusion of measurement errors
2. The possibility to include abstract and latent constructs
3. The opportunity to combine theory and data and confront theory with data

The model of representing a set of linear relations devised by Joreskog incorporates both constructs or latent variables and their (multiple) indicators. It combines the causal approach with the powerful measurement technique of ML factor analysis. Therefore, according to Mazanec (1982) a latent variable-multiple indicator model can only be confirmed or rejected in its entirety inclusive of all measurement assumptions.

Covariance matrices depict the associations of observed variables, leading to the explanation of relations of a smaller number of underlying constructs. The fact that causal analysis enables the modeling and estimation of complex structures of dependence simultaneously is useful in the behavioral sciences. In this discipline researchers often study theoretical constructs that cannot be observed directly (Byrne, 2001, 4). This requirement is often recognized in consumer behavior and adoption theory, where constructs tend to be complex and, by definition, not directly observable. Consequently, many authors used struc-
tural equation modeling (Ajzen, 1991; Ajzen, 2001; Ajzen and Fishbein, 1980; Davis, 1989; Davis, Bagozzi et al., 1989; Davis, Bagozzi et al., 1992; Fishbein and Ajzen, 1975; Gefen and Straub, 2000; Kleijnen, Ruyter et al., 2002; Pedersen, 2003; Pedersen and Herbjorn, 2003; Pedersen, Leif et al., 2002; Straub, Keil et al., 1997; Varshney, 2003; Varshney and Vetter, 2001; Venkatesh, 2000; Venkatesh and Davis, 2000; Venkatesh, Morris et al., 2003).

Also in service quality and consumer behavior SEM is frequently employed (Ajzen, 2001; Bagozzi, 1980; Bagozzi, 1994; Baumgartner and Homburg, 1996; Bolton and Drew, 1991; Cronin, Brady et al., 1997; Cronin, Brady et al., 2000; Grewal, Monroe et al., 1998; Homburg and Baumgartner, 1998; Homburg and Giering, 2001; Matzler, Bailom et al., 2004; Oliver, 1993; Oliver, 1999; Parasuraman, Zeithaml et al., 1994a; Steenkamp and Baumgartner, 2000; Steenkamp and Baumgartner, 2001; Zeithaml, 1988).

5.6.1 Causal Models

A structural model consists of various variables which can be graphically represented. The following figure depicts these graphic symbols. The representation of a structural model via mathematical formulas follows later in this section.

A Rectangular or square box signifies an observed or manifest variable.

A circle or ellipse signifies an unobserved or latent variable.

An unenclosed variable signifies a disturbance term (error in either equation of measurement). A straight arrow signifies the assumption that a variable at the base of the arrow "causes" the variable at the head of the arrow.

A curved two-headed arrow signifies an unanalyzed association between two variables.

Two straight single-headed arrows connecting two variables signify feedback relations or reciprocal causation.

Figure 21: Primary Symbols Used in Path Analysis (Bollen, 1989, 33)

A major characteristic of causal models is the differentiation of observable (manifest) and latent variables. The latter are more complex...
constructs which cannot be observed directly. Latent variables are commonly called factors and observed (or manifest) variables are named indicators. Above that one should distinguish between exogenous latent variables and endogenous latent variables.

"Exogenous latent variables are synonymous with independent variables; they 'cause' fluctuations in the values of other latent variables in the model. ... Endogenous latent variables are synonymous with dependent variables and, as such, are influenced by the exogenous variables in the model, either directly or indirectly." (Byrne, 2001)

The structural model shows the hypothesized relations between the latent variables and the manifest ones with the help of factor analysis. One can distinguish between the measurement model for the latent exogenous and the latent endogenous variables.

The following figure shows a classical causal model consisting of a structural equation model, an exogenous, and an endogenous factor model.

![Diagram of a causal model](image)

<table>
<thead>
<tr>
<th>Measurement Model</th>
<th>Structural Model</th>
<th>Measurement Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x_1 = \Lambda_{11} \xi_1 + \delta_1$</td>
<td>$\Pi_1 = \gamma_{11} \xi_1 + \zeta_1$</td>
<td>$y_1 = \Lambda_{12} \Pi_1 + \epsilon_1$</td>
</tr>
<tr>
<td>$x_2 = \Lambda_{12} \xi_1 + \delta_2$</td>
<td>$\Pi_2 = \gamma_{21} \xi_1 + \beta_{21} \Pi_1 \zeta_2$</td>
<td>$y_2 = \Lambda_{12} \Pi_1 + \epsilon_2$</td>
</tr>
<tr>
<td>$x_3 = \Lambda_{13} \xi_1 + \delta_3$</td>
<td></td>
<td>$y_3 = \Lambda_{13} \Pi_1 + \epsilon_3$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$y_4 = \Lambda_{14} \Pi_1 + \epsilon_4$</td>
</tr>
</tbody>
</table>

*Figure 22: Causal Model (Homburg and Hildebrandt, 1998, 19)*

The covariance or correlation matrix is the beginning of the analysis. Covariances and correlations are calculated based on the indicator variables from the measurement model. Next to that an estimation of the relationships between latent and indicator variables and between the exogenous and endogenous variables is possible (Backhaus, Erichson et al., 2000). The following table summarizes the terminology.
Table 13: Notation for Latent and Measurement Model (Bollen, 1989, 14)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Dimension</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Π</td>
<td>Eta</td>
<td>m*1</td>
<td>Latent endogenous variables</td>
</tr>
<tr>
<td>ξ</td>
<td>Ksi</td>
<td>n*1</td>
<td>Latent exogenous variables</td>
</tr>
<tr>
<td>Ζ</td>
<td>Zeta</td>
<td>m*1</td>
<td>Latent errors in equations</td>
</tr>
<tr>
<td>Χ</td>
<td>Zeta</td>
<td>q*1</td>
<td>Observed indicators for Ksi</td>
</tr>
<tr>
<td>Y</td>
<td>Eta</td>
<td>p*1</td>
<td>Observed indicators for Eta</td>
</tr>
<tr>
<td>Δ</td>
<td>Delta</td>
<td>q*1</td>
<td>Measurement errors for x</td>
</tr>
<tr>
<td>Ε</td>
<td>Epsilon</td>
<td>p*1</td>
<td>Measurement errors for y</td>
</tr>
</tbody>
</table>

| Coefficients |                  |           |                                         |
|---------------|------------------|-----------|
| Β              | Beta             | m*m       | Coefficient matrix for latent endogenous variables |
| Γ              | Gamma            | m*n       | Coefficient matrix for latent exogenous variables |
| Λ₁             | Lambda x         | q*n       | Coefficients relating x to Ksi           |
| Λ₂             | Lambda y         | p*m       | Coefficients relating y to Eta           |

| Covariance Matrices |                  |           |                                         |
|---------------------|------------------|-----------|
| Φ                   | Phi              | n*n       | Covariance matrix of Ksi                |
| Ψ                   | Psi              | m*m       | Covariance matrix of Zeta               |
| θ₁                  | Theta-Delta      | q*q       | Covariance matrix of Delta              |
| θ₂                  | Theta-Epsilon    | p*p       | Covariance matrix of Epsilon            |

5.6.2 Usage Areas for Causal Models

Generally, causal analysis is considered as a tool for the test of hypotheses; in some cases it is a tool for explorative research. Homburg and Hildebrandt (1998) distinguish between four use cases:

1. Construct validation
2. Test of hypotheses
3. Group comparisons of model structures
4. Exploration of structures

These usage cases have been widely accepted, however, one needs to consider Pearl’s (2000) work on causality providing a comprehensive exposition of modern analysis of causation. He argues that structural equations are often interpreted as carriers of probabilistic information instead of carriers of substantial causal information. He contends that SEM focuses too much on model fitting while issues regarding the meaning and usage of SEM’s models are subject of confusion and controversy.

The validation of constructs is by far the most frequent use of causal models and became more widely accepted in science than correlative methods. Validity is mostly tested with convergent and discriminant validity. Baumgartner and Homburg (1996) found that nearly half of the applications of causal modeling deal with construct validation (Homburg and Hildebrandt, 1998).
Secondly, causal modeling is frequently used for hypotheses testing. For complex causal model structures, which are often observed in business administration and are suggested in real life, causal modeling is a strong tool. Thus, the above statement that half of all usage cases of causal models would be limited to an analysis of the measurement model not taking the relations of constructs in the structural model into account.

By separately testing the measurement and the structural model much can be gained in theory testing and the assessment of construct validity. This is an exploratory exercise. The measurement model with the structural model enables confirmatory assessment of construct validity (Bentler and Chou, 1987) and the measurement model only provides a confirmatory assessment of convergent validity and discriminant validity (Campbell and Fiske, 1959). If the discriminant and convergent validity are both satisfying the test of the structural model then constitutes a confirmatory assessment of the nomological validity (Campbell and Fiske, 1959).

Concerning this research, causal analysis is a confirmatory, hypotheses testing instrument.

5.6.3 Steps for Structural Equation Modeling

To analyze established models using causal analysis a number of steps proved successful. This approach is suggested by various authors (Backhaus, Erichson et al., 2000; Bollen, 1989; Bollen and Long, 1993; Homburg and Hildebrandt, 1998; Kelloway, 1998; Schumacker and Lomax, 1996).

The main stages characteristic of most applications of structural equation modeling, which are described into more detail in the following sections are model specification, model identification, parameter estimation, and model evaluation.

5.6.3.1 Model Specification

The specification of a general structural equation model involves three distinct tasks (Mueller, 1996):

1. A specific structure between latent exogenous and endogenous constructs must be hypothesized
2. The measurement of the exogenous latent variables has to be decided
3. Determination of a measurement model for endogenous latent constructs

The propositions for the composition of the a priori model are most frequently drawn from previous research (Bollen and Long, 1993). The
purpose of the model is to explain why variables correlate in a certain way.

With regard to the measurement of the factors, in practice there are sometimes only single indicators available that do not perfectly estimate the constructs. Ideally the researcher would have an independent measure from previous research which is often not available. Also, the choice of values can be arbitrary.

Non convergence or improper solutions can also occur with small sample sizes. Anderson and Gerbing (1984) found that a sample size of 150 are sufficient to obtain a converged and proper solution for models with three or more indicators per factor. If there are only two indicators per factor bigger samples may be needed.

5.6.3.2 Model Identification

While the estimation of models may sound simple in theory several problems may be encountered before estimates are obtained. The identification status (i.e. under-, just-, or overidentified) is difficult to prove mathematically and the identification problem must be dealt with.

The process of obtaining empirical estimates of model parameters of a model is either solving a set of equations or minimizing a function. A model with insufficient information to obtain an estimate for each and every parameter is nonidentified. A model with an equal number of equations and unknown parameters is just identified (Kellaway, 1998). If there are more equations than parameters to be estimated the model is overidentified.

The simple prerequisite to have as many equations as unknowns may be too general; certain parts of the model may be non- or overidentified. Therefore, several indicators for each latent variable should be chosen. The statistical power may also suffer if this criterion is not met (Kellaway, 1998).

5.6.3.3 Parameter Estimates

The model and the unknown parameters generate an implied covariance matrix. This should be similar to the observed covariance matrix. Now the parameters that make the difference as small as possible are to be found. A model may be estimated by several different methods or in other words by using different estimators.

The by far most used fitting function is based on the maximum likelihood (ML) considerations followed by generalized least squares (GLS) (Anderson and Gerbing, 1988).

The maximum likelihood estimator may be that popular as it is included in the most common software packages as LISREL and Amos,
even though those packages also include other estimators. ML is efficient with large samples (Bollen, 1989) and when the researcher is willing to assume (or show) that the observed variables are multivariate normal. Only then the chi-square test is reasonable. Since these underlying assumptions cannot be verified for this study a different estimator provided in Mplus is chosen.

Opposed to ML and GLS, which are full information methods, ordinary least squares is known as partial information technique. With partial information techniques each path is estimated independently of the others.

To solve the multivariate normality problem Browne (1984) introduced a distribution free estimation technique (Asymptotic Distribution Free estimator, ADF). However, according to Chou and Bentler (1995), big sample sizes are needed and the technique is computationally cumbersome.

The most used ones, ML and GLS are both recommended for theory testing and development (Jöreskog and Wold, 1982), unweighted least squares, generalized least squares or partial least squares are recommended for application and prediction (Jöreskog and Wold, 1982). For a discussion on the above mentioned estimators the reader may refer to Anderson and Gerbing (1988) for further details.

Since in this project the software package MPlus is used for data analysis, the Muthén estimator is employed for analysis. The used software package is a second generation tool in SEM and allows for estimation of thresholds when categorical data is used, which is the case in this survey. The Estimator used in this survey is further explained in chapter 5.6.4.2 on the estimators offered in MPlus.

Finally, the underlying assumptions on which the different estimators are based should be carefully considered before choosing one or the other.

5.6.3.4 Model Evaluation Measures

Structural equation modeling determines if a theoretical model successfully shows the actual relationships observed in the sample data. The output of the analysis provides indices that demonstrate whether the model conforms to the data and also demonstrates significance tests for specific causal paths. The researchers postulate a statistical model based on their knowledge of the related theory or/and on empirical research in the area of study. Once the model is specified, the researcher tests its plausibility based on sample data comprising all observed variables in the model. The primary task in this model-testing procedure is to determine the goodness of fit between the hypothesized model and the sample data (Byrne, 2001).
The discussion about Goodness of Fit Indices and how to assess validity of a structural equation model has been tremendous. Most of the software packages utilized for structural equation modeling calculate over 20 different indices. Among the most commonly used are the

- Chi-square statistic
- Goodness-of-fit and adjusted goodness-of-fit (Jöreskog and Sörbom, 1981)
- Normed and nonnormed fit indices (Bentler and Bonett, 1980)
- Normed comparative fit index and nonnomed fit index (Bentler, 1990)
- Parsimonious goodness-of-fit and parsimonious normed fit indices (Mulaik, James et al., 1989)

Each index has advantages and disadvantages depending on the underlying assumptions (e.g. they all depend on the multivariate normality assumption) the researcher has to be aware of before rejecting or accepting a model. Mueller (1996) points out some straightforward and valuable aid in identifying data-model inconsistencies – scrutinizing the individual parameter estimates. An understanding of the substantive theory and hypothesized model combined with statistical knowledge go a long way in assessing the adequacy of the proposed structure. Details on fit indicators can be found in: Anderson and Gerbing (1984), Arbuckle and Wothke (1999), Bentler (1990), Bentler and Bonett (1980), Browne and Cudeck (1993), Hu and Bentler (1995), Jöreskog and Sörbom (1981), Mulaik, James et al. (1989), Muthén and Muthén (1998). Details for measures of component fit can be found in: Gerbing and Anderson (1988), Fornell and Larcker (1981), Bagozzi and Yi (1988) and Homburg and Baumgartner (1998).

Table 14: Fit Indices (Hair, 1995; Hu and Bentler 1995)

<table>
<thead>
<tr>
<th>Goodness-of-fit Measures</th>
<th>Levels of Acceptable Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Fit</strong></td>
<td></td>
</tr>
<tr>
<td>Root mean square error of approximation (RMSEA)</td>
<td>≤ 0.05/≤ 0.08</td>
</tr>
<tr>
<td>Goodness-of-fit index (GFI)</td>
<td>≥0.09</td>
</tr>
<tr>
<td>( \chi^2 )</td>
<td>≤ 2.5</td>
</tr>
<tr>
<td>df</td>
<td></td>
</tr>
<tr>
<td>Adjusted goodness-of-fit index (AGFI)</td>
<td>≥0.90</td>
</tr>
<tr>
<td>Comparative Fit Index (CFI)</td>
<td>≥0.90</td>
</tr>
<tr>
<td>Standardized Root Mean Square Residuals (SRMR)</td>
<td>≤0.08</td>
</tr>
<tr>
<td>Weighted Root Mean Square Residual (WRMR)</td>
<td>≤0.09 or close to 1</td>
</tr>
<tr>
<td><strong>Structural Model</strong></td>
<td></td>
</tr>
<tr>
<td>Squared Multiple Correlation for each endogenous latent variable</td>
<td>(≥0.40)</td>
</tr>
<tr>
<td><strong>Measurement Model</strong></td>
<td></td>
</tr>
<tr>
<td>Construct Reliability</td>
<td>≥0.60</td>
</tr>
<tr>
<td>Average Variance Extracted</td>
<td>≥0.50</td>
</tr>
</tbody>
</table>
5.6.4 M-Plus

Since the introduction of the LISREL approach, various software packages have been developed for the calculation of structural equation models. Among the best known are LISREL/PRELIS, EQS, AMOS, Mx and LISCOMP. Most of these do not accommodate categorical data. Mplus, LISCOMP's successor, was developed by Bengt Muthén in (1998) to estimate models including categorical and binary data. Mplus differs from LISCOMP with regard to three issues (Maydeu-Olivares, 2000). These three extensions now allow the estimation of:

1. Models with categorical latent variables
2. Models for continuous dependent variables that contain data missing completely at random (MCAR) and missing at random (MAR)
3. Models for two level (disaggregated) data obtained under complex sampling.

Maydeu-Olivares (2000) provides a detailed paper including the advantages and disadvantages of Mplus over LISCOMP.

Mplus allows various model classes; among those are multivariate regression analysis, path analysis, explorative and confirmatory factor analysis, SEM, latent class analysis and Monte Carlo simulation (Muthén and Muthén, 1998).

5.6.4.1 Particularities Estimating Models with Categorical Data

In Mplus observed variables can be measured on a continuous or categorical scale. Observed categorical variables include dichotomous (binary) and ordered categorical (polynomial) variables. Either unordered categorical or continuous is the measurement scale of latent variables. When categorical data is used there are some specific characteristics to consider: Thresholds instead of means are estimated for dependent categorical observed variables. Mplus only allows a maximum of ten categories; this has to be considered when specifying the survey design. Correlation matrices are analyzed instead of covariance matrices.

5.6.4.2 Estimators in Mplus

Mplus has five estimator choices:
- Maximum likelihood (ML),
- Maximum likelihood with robust standard errors and chi-square (MLM, MLMV),
- Generalized least squares (GLS), and
- Weighted least squares (WLS) also referred to as ADF.
When at least one factor indicator or observed variable is categorical, Mplus has four estimator choices:

- Weighted least squares (WLS),
- Robust weighted least squares (WLSM, WLSMV), and
- Unweighted least squares (ULS).

The WLS-estimators were developed by Muthén and Muthén (1998). WLSMV uses the diagonal of the weight matrix in the estimation whereas WLS uses the full weight matrix. WLS and WLSMV use the full weight matrix to compute standard errors and chi-square. Neither estimator uses a fitting function to minimize residuals. The WLSMV estimator however, uses the diagonal weight matrix to get the estimates, thus, the residuals tend to be closer to zero than using the WLS estimator.

This estimator is always used for modeling with categorical data and will therefore be used for analyses in this project. More details on the Muthén estimator are offered at www.statmodel.com where one also finds a list of related technical papers.

### 5.6.4.3 Fit Indices for Categorical Variables

Muthén and Muthén (1998) advise against the use of most fit indices for categorical data. “The draw back is that little is known about how to use ... (different fit indices) ... for categorical outcomes in practice” (Mplus, 2000). According to the authors only RMSEA, CFI and TLI are applicable for categorical data. However, even concerning those they advise: “As far as we know, there have been no published studies of the behavior of RMSEA, CFI or TLI for categorical outcomes. Our very limited studies of RMSEA found that it does not work as well for categorical outcomes as for continuous.” (Mplus, 2000). Muthén and Muthén encourage studies in this area. Other authors do not have any reservations using fit indices such as the GFI that can be calculated theoretically.