ICT and Primary Health Care in Germany: Patterns of Innovation Adoption and Dissemination

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Abstract

The research explores the current state of information and communication technologies (ICT) in primary health care, as well as its adoption and implementation patterns in Germany. The research looks also into financial, sociocultural, political, legal and other challenges in introducing and implementing innovative information technologies, as well as gaps and needs in ICT health systems.

Based on data collected by application of explorative and qualitative methods as well as the Grounded theory as a main analytical framework, a new theoretical framework was developed after identifying and integrating several conceptual models. The new theoretical model extends and integrates Roger's theory on Diffusion of Innovation, Theory of Reasoned Action, Theory of planned Behavior and Technology Acceptance Model.

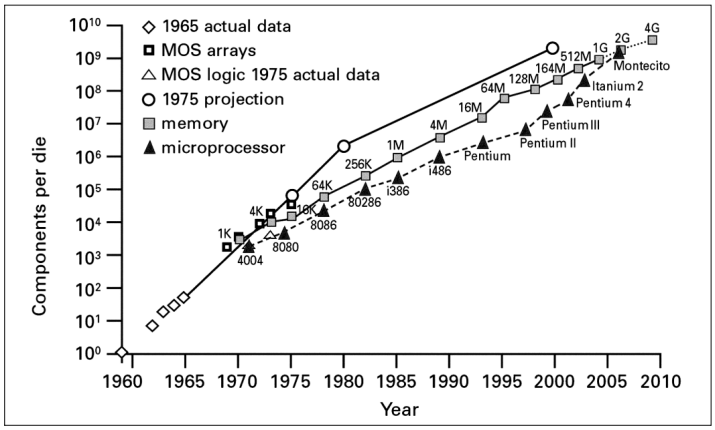
Keywords: Application of ICT in primary health care, ICT innovations, innovation adoption and dissemination, challenges in advancing ICT application in primary health care, ICT risk management, Roger's theory of innovation, public health informatics, primary health care in Germany.

Table of Contents

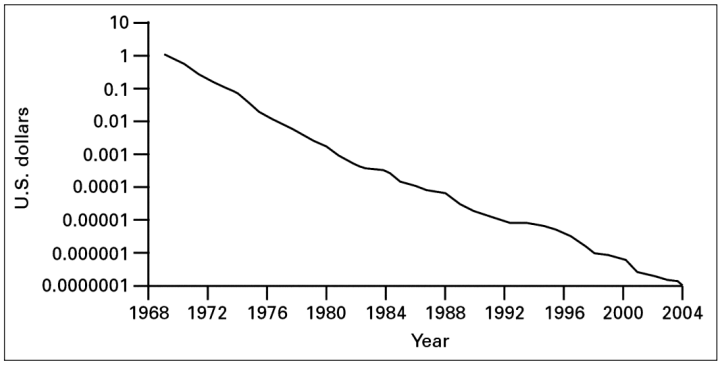
1. Introduction

Public and private healthcare institutions were one of the earliest adopters of information technologies. There are many new devices, software applications, information collection and surveillance systems, web-based applications, pattern recognition systems, artificial intelligence systems, complex database management systems, mobile applications and other information technologies developed for healthcare systems in various countries (Yasnoff, 2000).

Computers are becoming more powerful and cheaper at the same time (Sneed, 2015; Moore 2006). So-called Moore's law predicts the exponential growth of calculation power by computers, while the density of the transistors in an integrated circuit doubles every second year (Moore, 1965). Even though there is a criticism that integrated circuits are approaching their limits in terms of density of transistors, the calculation power of computers is still increasing thanks to advances in multi-core computer architecture, distributed systems and other technologies (Moore, 1975; Moore, 2006). The exponential growth of computational power led to the opportunity to create complex software systems, to work with big data and to introduce neural networks and artificial intelligence in many application fields, including healthcare. Invention of internet and network protocols also led to fast and simple communication and easy accessibility to the state-of-the-art technologies for everyone (Moore, 2006). The healthcare benefits from all these technological advances.



Pic 1. The exponential growth of integrated circuit complexity (copied from Moore, 2006).



Pic 2. The price of a digital circuit in USD (copied from Moore, 2006).

Information and communication technologies (ICT) have considerably changed routine, everyday processes in primary and secondary healthcare institutions, nature of interaction and social distance between a health care provider and a recipient, within a health institution or between several health institutions, structure of personnel and administrative burden, professional medical education, collection and analysis of medical data. In many aspects information and communication technologies influence onto quality of health care services and many innovations on the intersection of health care and informational technologies are being introduced in order to improve the quality of such services.

One of such examples can be Albanian immunization information system (WHO, 2013). The Albanian Institute for Public Health has introduced an immunization information system for digital recording of every child's immunization in Albania, which was integrated with the vaccine stock database. Thanks to the introduced information system a picture of immunization coverage was more accurate, unvaccinated children could be easily identified and reached, and less time was spent for paperwork, reporting and vaccination session itself. There are many other examples of such information systems implemented nationally or locally around the world that can serve as prominent examples of effective use of ICT systems.

However, introduction and implementation of such information systems can face multiple challenges or can simply fail. For instance, in 2002 the United Kingdom launched National Health Service National Programme for IT (Information Technologies). This program was adopted mainly in order to implement a nation-wide electronic medical record system that was supposed to keep personal electronic medical histories of every patient in the country. The system was planned to be designed within 3 years and to cost £2,3 billion. In 2011 the project was closed after £6,4 billion had been spent for the program (ibid).

There are many possible reasons of why this innovation has not been introduced successfully in the UK. Availability of funds is not the main cause that hinders innovation. Initially wrong technical requirements for ICT systems, unclear ownership of such systems, insufficient or inadequate cost-benefit analysis prior to implementation stages, lack of user friendliness in the developed systems, ignorance of local contexts, where such systems are implemented, and other risks can block implementation of the new systems. This research will look deeper into these failures in adopting information systems in primary healthcare, challenges in adoption and dissemination of such innovations as well as risk management strategies to avoid or mitigate those risks. Understanding of risks and challenges, as well as analysis of failures has a practical value for a wide range of stakeholders, who can use this for strategic planning or (policy) decision-making. A

number of recommendations for various stakeholders were compiled after the analysis of challenges and an overview of existing risk management strategies.

This research will examine patterns of adoption and dissemination of ICT innovations in the primary healthcare of Germany, a country with an insurance-based healthcare system. It can be valuable for policy and decision makers, because it will discuss not only the patterns of innovation adoption and distribution, but also identify major gaps and unmet needs in application of ICT in primary health care system.

There is very limited research available in the subject area of so called public health informatics, which is defined as "the systematic application of information and computer science and technology to public health practice, research, and learning" (Yasnoff, 2000). Since public health informatics is a new discipline, there are still many white spots and undiscovered issues within it. Even less studies are available on the topic of innovation adoption and diffusion in the area of ICT and health care. For instance, the search in the library database of OsloMet shows only one relevant article that covers ICT, health care and innovation diffusion at the same time and none with a focus on Germany. Thus, this research can be a trailblazer for future research on ICT innovation adoption and dissemination in health care in Germany.

This research is especially significant nowadays when almost all political parties in Germany agree upon the necessity of digitalization and the ruling coalition of the Christian Democrats (CDU and CSU) and Socialists (SPD) put digitalization of healthcare in Germany as one of the main priorities in their coalition program (Koalitionsvertrag) in the nineteenth legislative period from 2017 to 2021 (CDU, 2018).

2. Research Questions and Aims. Conceptualization

The study aims at exploring the current state of information and communication technologies (ICT) in primary health care, as well as its adoption and implementation patterns in Germany. The research will also look into financial, sociocultural, political, legal and other challenges in introducing and implementing innovative information technologies, as well as gaps and needs in ICT health systems. The last aim is to develop a new theory based on the collected data.

The main research questions are the following:

1. What are major patterns of ICT application and of ICT innovation adoption and dissemination in the primary health care in Germany? What model or theory can explain those patterns?
2. What are the major challenges and risks in introducing and implementing ICT innovations in the Germany's primary health care? What are the urgent needs and gaps in ICT systems in the primary health care in Germany? What policy and program recommendations can be provided for meeting those needs?

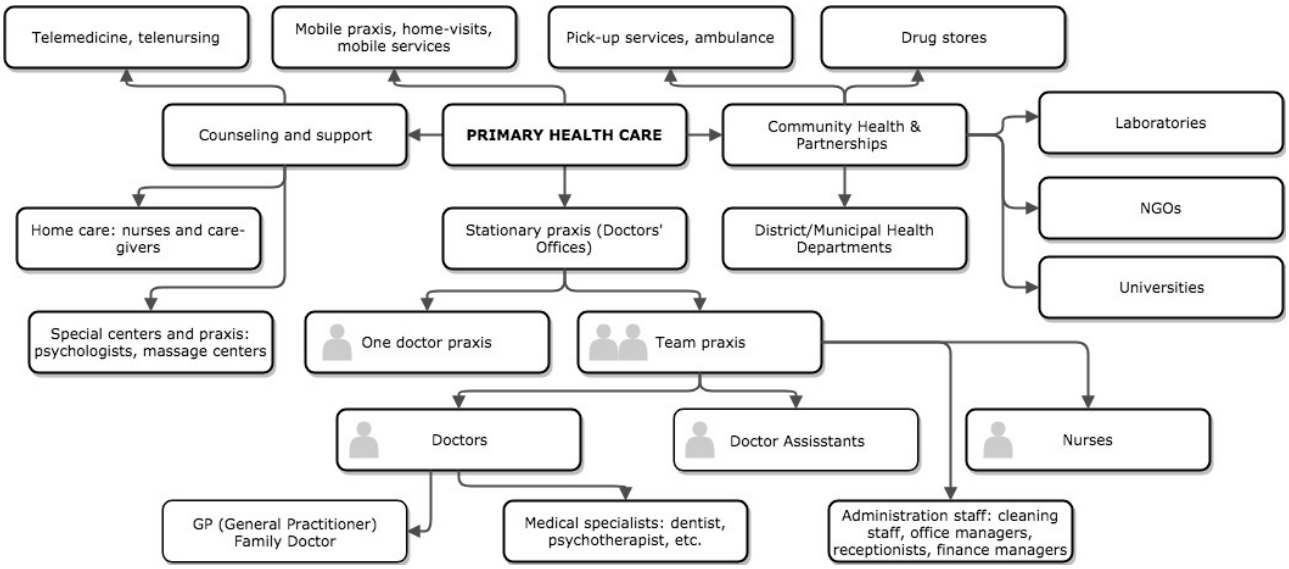
2.1. Key concepts

This research conceptualizes information and communication technologies (ICT) as technologies that store, manipulate and transfer digital data. This can include:

1. Hardware (servers, computers, medical equipment, cameras, Internet of Things (IoT) devices, local networks, card readers, etc.).
2. Software (software packages, web-based apps, mobile apps, client/server applications, cloud applications, data management systems, artificial intelligence, pattern recognition systems and neural networks).
3. Networks (global networks like Internet).
4. Data (databases, patient data, surveillance data, governmental statistical data, open data, Big Data).

More detailed conceptualization and description of particular technologies, mentioned in this research paper, will be provided in relevant chapters.

ICT innovation is conceptualized as the following:



Pic 3. The primary healthcare system in Germany

1. New or state-of-the-art technologies that are unknown or not yet implemented by the stakeholders.
2. New work approaches or procedures that are believed to reduce costs or bring some other benefits and that are implemented thanks to ICT.

Health care is a comprehensive set of policies, services and structures that are aimed at promoting, maintaining and improving health through disease prevention, diagnosis and treatment. Primary health care is conceptualized with peculiarities of a German healthcare system. It encompasses various services, provided to the patients through non-ambulatory, out-of-hospital institutions. Secondary health care, in contrast, is represented by state and private hospitals. The mapping of primary healthcare with a focus on the healthcare system of Germany is provided above as an UML (Unified Model Language) diagram (see pic. 3).

The diagram shows the complexity of the primary health care system in Germany. In fact, it is more complex if we include disease prevention institutions; water, sanitation, food safety monitoring organizations; as well as regional insurance companies and local departments of nation-wide insurance companies.

It is necessary to note that the division into primary and secondary healthcare, or primary, secondary, tertiary is vague and it is often hard to draw clear boundaries between them. For this research, we conceptualize primary health care mainly as services and institutions on a local,

district or community level. Again, it is difficult to define distinct borders between the local, regional and national levels. However, this research does not need a rigid distinction between them, since only some parts of the primary health care system will be discussed or mentioned.

The last two concepts that are widely used in this research are innovation adoption and dissemination. Adoption is a set of processes or activities taken by an individual or an organization that lead to use of innovation for everyday tasks. Dissemination describes the spread of innovations in a community or a society. There will be more discussion of innovation adoption and dissemination in the theoretical part and literature review.

3. Methodology

3.1. Interpretivism as a methodological framework

Interpretivism was chosen as a main methodological paradigm because the research is explorative in nature. It is necessary to achieve depth, insight and richness in data in order to understand how ICT innovations are introduced and disseminated in primary health care in Germany. Moreover, the context is important for the research goals in order to grasp the complexity of ICT innovation adoption and dissemination processes, to reflect upon and to revise the theoretical frameworks used for this research, particularly Roger's theory on innovation.

Interpretivism as a methodological paradigm suits the best if the above-mentioned considerations must be taken into account. Interpretivism is usually put in contrast with positivism, another dominant methodological paradigm, that advocates for the scientific methods used in natural sciences and believes that it is possible to attain objective truth. Unlike positivism, interpretivism states that it is impossible to achieve the objective knowledge (Macionis and Gerber, 2011; Miller, 2004). That is why there is more focus on understanding and perceiving.

The ontological stance of interpretivism (ontology describes the nature of reality) is based on relativism: there is no such thing as a single true reality (Hudson and Ozanne, 1988). In terms of epistemology, description of the relationship between the researcher and the reality, interpretivism states that verstehen or understanding and perceiving is key. In interpretivisim objective research is impossible: the researcher's background, his/her values and stances, as well as power dynamics between the researcher and his/her subjects influences onto the research results. The interpretative researcher usually tries not to detach from the research subject, in contrary, he/she tries to be insider. Immersion into the field and into social context yields the rich and deep data with captured nuances and specific details. The depth in data is necessary for Verstehen/Understanding and interpretation. (Neuman, 2000; Carson et al., 1988).

Unlike interpretivisim, positivism however focuses on description, explanation, generalization, abstraction, causality, comparison and correlation (Churchill, 1996). That is why positivism prefers mostly quantitative methods like surveys, questionnaires, structured interviews, while interpretivism is all about qualitative methods like participant observation and unstructured interviews that allow to explore and understand the research subjects. Hence, for the interpretivist the validity of data (assurance that the research accurately or deeply studies what it was supposed to measure and explore) is more important than its reliability (or replicability: the same study under

the same conditions will yield same results) and representativeness (assurance that the research finding are typical and may be generalized thanks to well represented data) (Berger and Luckman, 1967; Black, 2006; Carson et. al., 2001). The comparison table of the interpretivism versus positivism (see Table 1) summarizes the key aspects of these two main methodological paradigms.

Table 1. Interpretivism versus positivism

	Interpretivism	Positivism
Ontology		
Reality	Reality is relative. There is no one true reality.	There is one true reality.
Epistemology		
Objective knowledge	Objective research is impossible: the researcher's background (values, stances) and power dynamics influences onto the results. Understanding and perceiving is key.	It is possible to pursue objective knowledge: the researcher can detach and distance himself/ herself from the research subjects
Generalisation	Capturing nuances and specific details. Immersion into the social context.	Focus on generalization, abstraction, causality, comparison and correlation.
Facts	Difference between facts and judgments is not distinct	Clear distinction between facts and judgments
Philosophical and theoretical frameworks	Hermeneutics, phenomenology, symbolic interactionism	Realism, structuralism
Scientific method	Explorative methods that allow to understand research subjects. Qualitative methods are preferred: participant observation, unstructured interviews.	Scientific method close to natural sciences. Quantitative methods are preferred: surveys, questionnaires, structured interviews.
Research focus	Understanding/verstehen, interpretation	Description, explanation
Data	Depth, richness of data	Structured, limited data
Research quality	Validity is more important	Reliability and representativeness is more important
Researcher's role	Insider	Detached, external researcher

It is necessary to point out that the boundaries between interpretivism and positivism are not strict and there are also other metaphysical positions between them. Post-positivism is one of such

examples, which admits possibility of researcher's bias because of his prior knowledge, background, beliefs and values (Alvesson and Sköldberg, 2000). However, like in positivism, it is possible to pursue objectivity, when taken into consideration power relations in the field as well as a risk of bias. (Radical) relativists put this risk of bias onto pedestal. They think that there is no absolute objective truth and reality at all and everything is biased and relative. They believe that there are rather various, but equal and valid narratives (Berger and Zijderveld, 2009). Unlike in (radical) relativism, in post-positivism objective truth and reality exists and possible. Unlike in postmodernism, the reality is not represented by narratives and all narratives are not equally true (Epstein, 2012).

3.2. Grounded theory as a methodological and analytical framework

While being mainly interpretative in nature, this research attempts also to abstract and generalize the research findings thanks to the another methodological framework - grounded theory approach. Grounded theory was proposed as a reaction to a tendency to look for evidence to confirm existing theories as a routine practice by social scientists, rather than establishing and developing new theories. So, the core idea of the grounded theory is to create new ideas and to generate new theories in those fields, where very little is known and there is no enough data. This is done inductively though methodic analysis of gathered data (Goulding, 1998).

The sociologists Barney Glaser and Anselm Strauss studied patients with terminal diseases and published „Awareness of Dying" in 1965, and later in 1967 „The Discovery of Grounded Theory" that introduced a new comparative method, the Grounded theory in the decades when structuralism as a main theoretical framework was on pedestal. Glaser and Strauss argued that the theory should be grounded in the empirical research and proposed the first scheme of how the method of Grounded theory may be applied (Strauss and Juliet, 1994; Glaser and Strauss, 1967). The Grounded theory's methodology has been revised several times and became one of the most popular analytic methods used by sociologists. The theory has built its ways into a plethora of other areas, including medicine, psychology, management, education and even dramaturgy and software engineering (Strauss and Juliet, 1994; Fletcher-Watson, 2013).

The philosophical framework of the Grounded theories lies at the same time within positivism and realism on one hand and interactionism and symbolic interactionism on another, because Glaser was an adept of positivism and quantitative methods, while Strauss inclined to

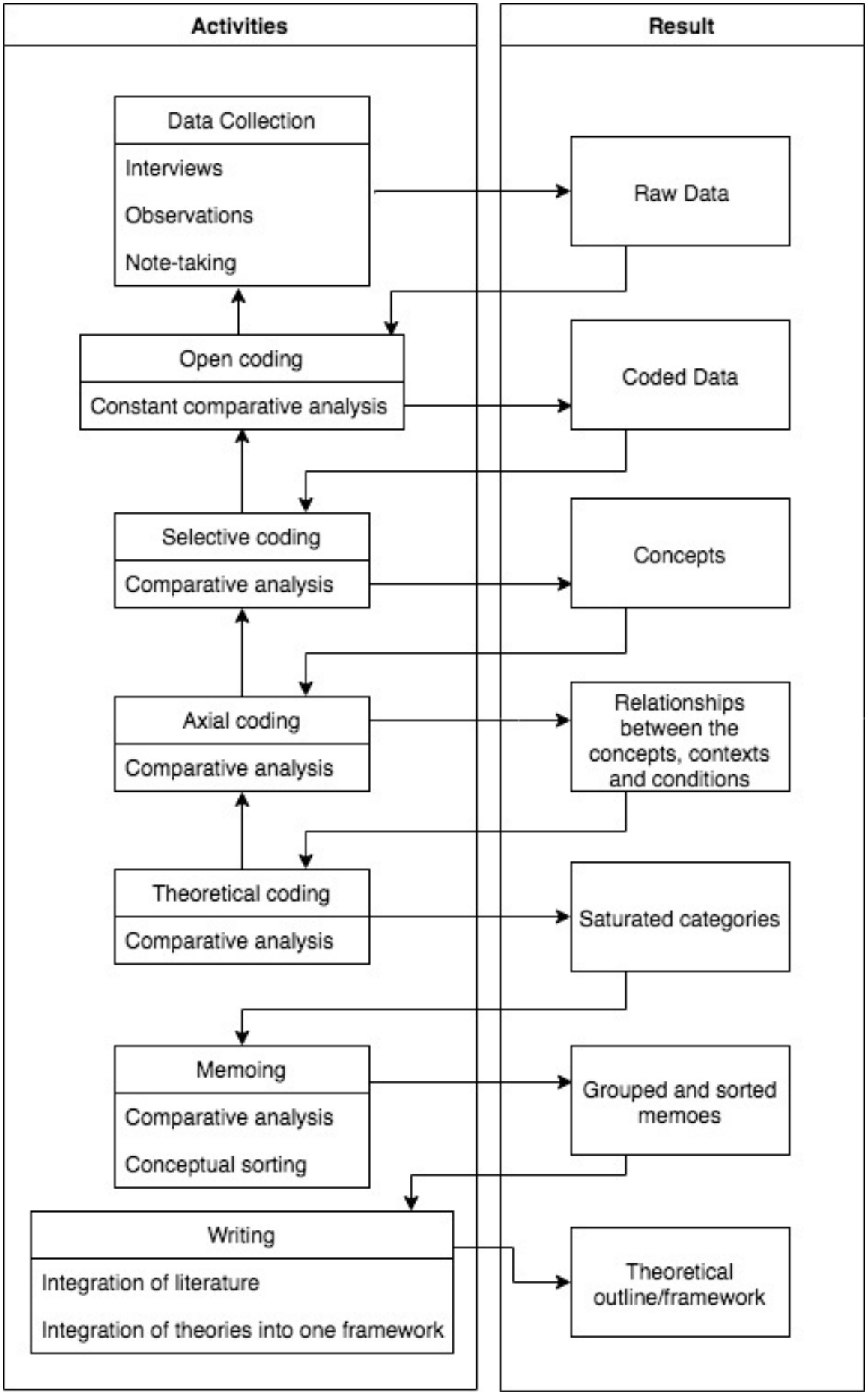
qualitative and explorative methods. This mix allowed to code and thereby abstract and generalize the rich and complex qualitative data and analyze symbolic meanings within them (Ralph, et. al, 2015; Khaldoun and Carole-Lynne, 2011).

According to the Grounded theory researchers should constantly work with data during its collection. They should code every small piece of the collected data, every sentence and line of the text, marking the ideas and concepts that are repeated (open coding stage). The codes are constantly analyzed and grouped into more general concepts. After this one or several core concepts are chosen that explain the main concerns of the respondents. All other concepts are then selected according to that core concept and delimiting the scope of the research by ignoring unrelated or nonsignificant concepts, which is allowed in the Grounded theory in order to reach abstraction and generalization (selective coding stage). Then those concepts can be generalized into more overarching categories and the relationship between them, conditions, contexts and consequences are identified (theoretical coding and axial coding stages). The last stage creates a basis of a new theory and applies also negative case analysis that rejects those categories that are not significant for the newly developed theoretical framework (Martin and Turner, 1986; Strauss and Juliet, 1994; Bernard and Ryan, 2010). The Grounded theory methodology can be divided into the stages as shown in the UML diagram (see pic. 4).

It is necessary to note though that the stages of analysis are usually not implemented linearly and there are constant jumps and cycles between the various stages. For instance, after some selective coding, axial coding or even theoretical coding we can begin a new data collection and come back to the open coding, or initial coding according to Charmaz (2006), followed by the selective coding. Moreover, theorizing and comparative method are used throughout the coding. This means that codes, concepts and categories are constantly compared, adjusted and integrated, examples are grouped to the each category and any overarching ideas are brought up that may underpin the new theory (Charmaz, 2006).

Such theorizing is possible due to memoing technique, when every concept is analyzed in detail and researcher's ideas and insights regarding the particular concepts are written down and later organized into groups and frameworks. Memoing bridges coding and theoretical frameworks. Memos are like field notes that are gathered simultaneously with data collection. In the Grounded theory memos are gathered from the first identified concepts (Savin-Baden and Major, 2013).

The Grounded theory implies not only inductive analysis, but also deductive, especially in the last stages of analysis when abstractions, concepts, categories and theoretical frameworks should be confirmed by the newly acquired data from the cycles of data collection.



Pic 4. The Ground Theory: Stages of Analysis

The quality of a research that used the Grounded theory as a methodological and analytical approach can be measured by the following indicators:

1. Fit: how well do the developed abstractions fit to previous abstractions and data? This means how well the theoretical frameworks is represented by the memos and categories, the categories by concepts, the concepts by codes, and the codes by the collected raw data.
2. Relevance: how is study as a whole and generated abstractions relevant to the respondents? This indicates that the newly developed theoretical frameworks take into account the needs and concerns of the respondents
3. Workability: how does the theoretical framework explain the possible solutions to the problem? This indicator shows how practical and useful the research is.
4. Modifiability: may the theoretical framework easy adjusted or changed if the new data is gathered and new concepts are developed? (Strauss and Juliet, 1994).

This research used Grounded theory as an analytic methodology, because a literature review showed that there is insufficient knowledge on the specific topic of ICT innovation adoption and dissemination in primary health care in Germany. There is very little known even about ICT in healthcare in general. Data analysis was conducted at the same time as data were extracted. The sets of data was continuously broken down into specific codes and later concepts until the saturation was reached. The more broad, overarching categories were generated, clustered together, and compared to Roger's theory of innovation and other respective theories. The larger, more comprehensive categories induced a new theoretical framework that we will discuss in the research findings.

According to Goulding (1998) a researcher should make a literature review after the data is collected in order to avoid internalization of existing theories and bias. Only after data is collected and analyzed, and the major concepts have been induced, other theories can be looked at and compared with (ibid). However, preparing preliminary literature review helps the researcher to understand what kind of existing knowledge is available and what kind of new knowledge or perspectives he/she can bring with his/her research. The literature review helps also to avoid reinventing the wheel and to come up with the same theories that other researchers have already developed. That is why some preliminary literature review was done prior to the data collection and was continued and revised after the data collection. The literature review helped a lot to rearrange the concepts and find links between them that were initially treated as separate.

Another reason why the Grounded theory was chosen is its focus on the analysis from the bottom to top, from the data to the inductively generated theoretical frameworks instead of fitting

collected data to preexisting hypotheses. This allows to prioritize concerns, understandings, viewpoints, beliefs and values of respondents in the rich data driven and grounded theoretical frameworks.

And, finally, the Grounded theory allows abstraction and generalization by using description of many incidents for generating respective concepts and categories. Without abstraction and generalization, it would not be possible to explain the patterns of ICT innovation adoption and dissemination in the primary healthcare in Germany.

It is also important to take into consideration that the grounded theory methodology is time consuming, since the researcher has to get back to the respondents to check whether the researcher interpreted the data in line with respondent's understanding. The researcher tries to achieve as much of saturation of data as possible and this requires a lot of patience not only from the researcher, but also from the respondents.

3.3. Other analytical frameworks

Certain aspects of some other analytical frameworks, namely interpretative phenomenological analysis, template analysis, framework analysis as well as thematic analysis, were also used in these research. These frameworks provide some additional analytic tools that were incorporated into the main methodological and analytical framework - the Grounded theory.

Interpretative phenomenological analysis (IPA) aims at analyzing and examining the insights, meanings and experiences of the respondents about the research topic in a certain context. The philosophical paradigm for the analysis are phenomenology and hermeneutics. IPA became especially popular in psychological research (Smith, et al, 1999; Smith, et al, 2009).

IPA is usually implemented on data that is collected via focus groups or interviews from a small group of respondents (3 to 15 respondents) that share more or less common experiences in regard to the studied phenomenon. The small numbers of respondents is chosen in order to ensure acquiring of rich data on insights into the given phenomenon and to understand better the contexts around the phenomenon. Sometimes a more diverse group of respondents is selected for IPA with a purpose of collecting different perspectives on the same phenomenon. IPA suits well for explorative studies, because it necessitates open-ended and flexible inquiry (Smith and Osborn, 2003; Smith, 2011).

As in the Grounded theory, no hypotheses are stated and tested, the analysis is implemented with a bottom-up approach, the researcher tries to clear the mind from any preconceptions that he/she has about the studied phenomenon (ibid). This can be done by a careful and deep reflection about the phenomenon prior to the data collection. Such detailed reflection was also done for the purposes of this research and explained in detail in the „Role of the researcher“ section.

Like in the Grounded theory, the raw texts are coded and memos of the researcher with his/her interpretations and thoughts are gathered. The main focus of IPA are meanings and insights about the phenomenon in question. IPA incorporates the notion of the double hermeneutic by Giddens: the researcher should also try to understand how the respondents understand their meanings and experiences (1984). Thus, the autonomy of the respondent is crucial for IPA as well.

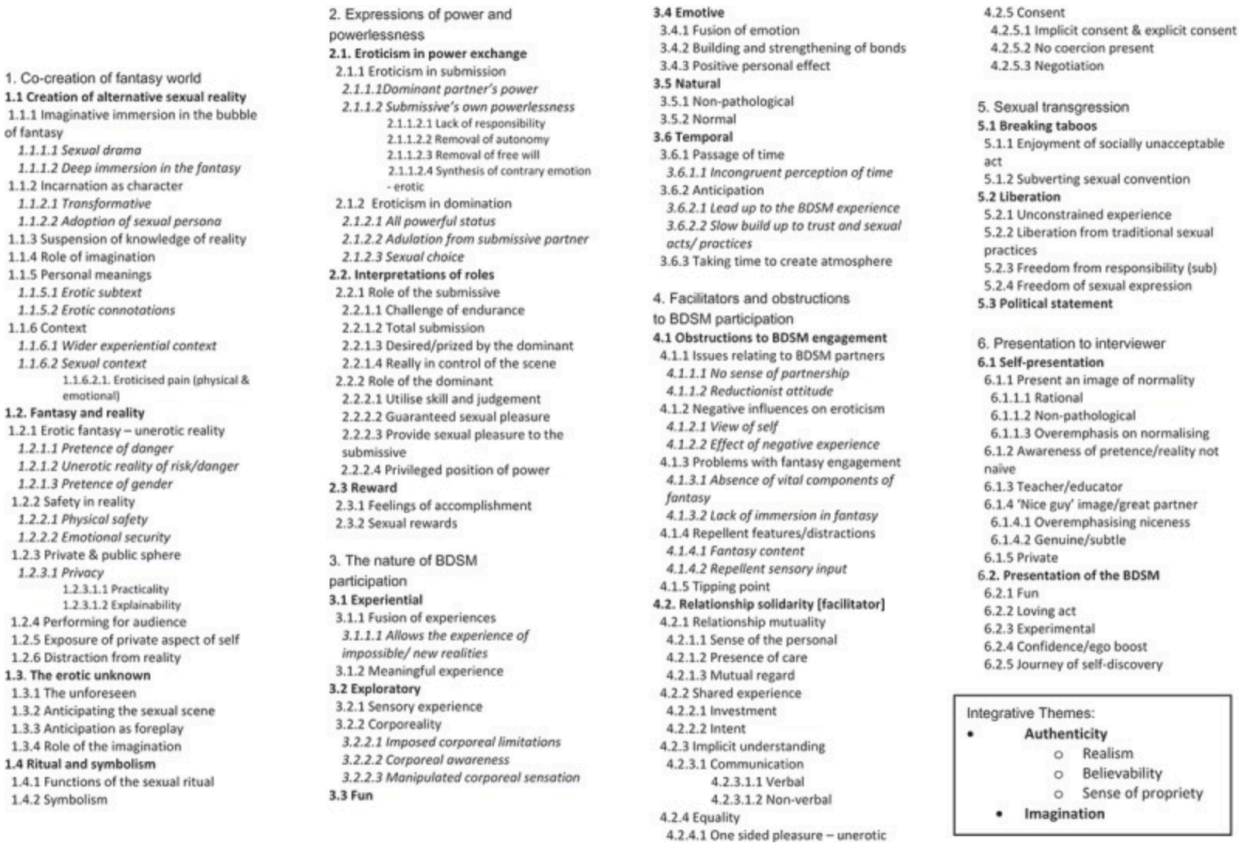
After the data collection and coding, the codes are analyzed for patterns. The repeating patterns of meanings and insights are grouped into themes with a focus on questions like "What matters to the respondents?“ or „What meaning do those things convey?“ After these, the themes are grouped again into wider superordinate themes that are listed in the findings with relevant examples from the raw data.

Another analytical framework that inspired some aspects of the analysis in this research is **template analysis (TA)**. TA analyses qualitative data according to certain themes in order to reduce a lot of unstructured textual data without loosing the insights into the meaning of the given phenomenon (in this case opinions, understandings, feelings, assumptions, attitudes, perceptions, values). Some sections of the textual data can point out to several themes simultaneously (Crabtree and Miller, 1999).

Unlike the Grounded Theory, TA codes the whole sections of texts and not every single sentence or line and assigns them to the specific themes. Unlike the Grounded Theory, the themes in TA can be developed and structured prior to the coding, revised and refined later during the coding process. As in the Grounded Theory, clear names and definitions for each theme are provided to make the process of coding easier (Brooks, et al, 2015).

The themes have usually sub-themes and they create a hierarchical structure, called the template. Some predefined themes can turn out to be irrelevant and can be thrown away, because they were not supported by any codes or parts of the textual data. Those themes that have only a few support data linked to them are usually grouped into bridging themes. The possible relationships between the final themes are then explored and defined. The frequency of the repeated themes can point out to the relevance of those themes in the studied phenomenon. The example of

the hierarchical template of themes is provided on the pic. 5 (Crabtree and Miller, 1999). The example was taken from the case study #3 in the article of Brooks et al (2015).



Pic 5. Example of the final template copied from the case study #3 in Brooks et al (2015).

There can be, however, some loss of insights and meanings since TA does not code every single line and focuses rather on the chunks of textual data. On the other hand, too many codes create a complexity that is much more difficult to analyze (ibid).

Another limitation in this analytical approach is the risk of loosing the meanings and insights from the participants because of the pre-defined themes. The pre-defined themes conflict with the basic principles of phenomenological approach such as the bottom-up approach which prohibits any pre-defined themes before acquiring and analyzing the data. Brooks et al (2015) propose several solutions to these, such as: 1) preliminary themes are developed according to the similar study and without consulting wider literature or 2) the pre-defined themes template should be very detailed to ensure the depth and richness a priori.

Framework analysis (FA) is another analytical methodology that is often applied for policy research. „Framework analysis is better adapted to research that has specific questions, a limited time frame, a pre-designed sample and a priori issues. In the analysis, data is sifted, charted and sorted in accordance with key issues and themes using five steps: familiarization; identifying a thematic framework; indexing; charting; and mapping and interpretation. Framework analysis provides an excellent tool to assess policies and procedures from the very people that they affect“ (Srivastava and Thomson, 2009).

FA differs from the Grounded theory in its focus on describing and interpreting the given phenomena in the particular context rather than attempting to induce new theories (although FA allows generation of new theories as well). In comparison to the Grounded theory, FA can be implemented in the short period of time and thus requires less resources (Gale et al, 2013).

Unlike the Grounded theory, TA is more flexible when it comes to the time when the collected should be analyzed: the analysis can be done either during the data collection or after all necessary data is collected. The analysis is divided into the following stages:

1. Familiarization: the researcher immerses himself/herself into the collected data by reading or listening to it. He/she identifies recurring themes/ideas and notes them. The researcher can also use only specific parts of the data for familiarization if too much of raw data was collected and there is some time pressure. In this case the researcher should attempt to pick those chunks of data that will probably provide the various perspectives, i.e. data from different respondents, contexts or time (Ritchie & Spencer, 1994).

2. Identifying a thematic framework: the researcher compares the recurring ideas, concepts and themes emanating from the respondents and builds a common tentative thematic framework by finding relationships between them. The themes in that framework can also be similar to the a priori themes and the role of the researcher is to stay open-minded and not to force the newly emerged concepts into the pre-defined thematic framework. This stage involves also setting priorities and relevance within the themes and concepts. Some concepts with no relevance to the emerging framework may be ignored (ibid).

3. Indexing is a deductive step in this analysis, when the researcher finds and indexes all textual data that fits to the concepts and themes from the thematic framework (ibid).

4. Charting: the researcher charts all themes into the thematic framework matrix and fills it in with corresponding indexes. (ibid).

5. Mapping and interpretation is a final stage of the analysis when a schematic diagram of the phenomenon is prepared by further comparing, contrasting and explaining (ibid).

Some researcher add additional stages, including open coding stage between familiarization and identifying the theoretical framework. The coding stage in FA is basically the open coding stage in the Grounded theory (Gale et al, 2013).

The last analytical method worth mentioning is **Multiple Perspectives Methodology (MPM)** developed by Linstone in his book "Using Multiple Perspective to improve performance" (1999). MPM is aimed at "viewing complex systems and decision about them from different perspectives, each providing insights not attainable with the others" (Linstone, 1999). Linston identifies three perspectives in his model:

1. Technical: the technology and environment belong to the same system. This perspective is rational, quantitative, objective, generalized. It represented by data, models, optimization schemas, needs-costs analysis, etc.
2. Organizational perspective is concerned with everything on the level of institutions. It describes the culture, norms, insights, capabilities, etc.
3. Personal perspective is concerned with individuals and describes behaviour, individual values, attitudes, characteristics etc. This perspective helps to better describe and understand the organizational perspective. (ibid).

„When using the perspectives to build a real-world model or make a decision… all inputs from various perspectives should to be integrated. The process of integration is never simply adding the information up from various perspectives. The perspectives have to fit each other, sometimes

	Technical (T)	Organizational (O)	Personal (P)
Worldview	Science-technology	Unique group or institutional view	Individual, the self
Objective	Problem solving, product	Action, process, stability	Power, influence, prestige
System focus	Artificial construct	Social	Genetic, psychological
Mode of inquiry	Observation, analysis: data and models	Consensual, adversary, bargaining and compromise	Intuition, learning, experience
Ethical basis	Logical, rationality	Justice, fairness	Morality, personal ethics
Planning horizon	Far (low discounting)	Intermediate (moderate discounting)	Short for most (high discounting)
Other descriptors	Cause and effect Optimization Quantification, trade-offs, cost-benefit analysis Probabilities, averages, statistics, expected value Problem simplified and idealized, reductionism Need validation, replicability Conceptualization, systems theories Uncertainties noted	Agenda (problem of the moment) Satisfying Incremental change Reliance on experts, internal training of practitioners Problem delegated, factored, issues, and crisis management Need standard operating procedures, reutilization Reasonableness Uncertainty used for organizational self-preservation	Challenge and response, leaders and followers Ability to cope with only a few alternatives Fear of change Need for beliefs, illusions, misperception of probabilities Hierarchy of individual needs (survival, …) Need to filter out inconsistent images Creativity, vision by the few, improvisation Need for certainty
Criteria for "acceptable risk"	Logical soundness, openness to evaluation, decision analysis	Institutional compatibility, political acceptability, practicality	Conduciveness to learning, focus on "me-now"
Communications	Technical report, briefing	Insider language, outsiders' assumptions often misperceived	Personality and charisma desirable

Pic 6. Summary of MPM copied from Behkami and Daim (2016).

reinforcing each other or canceling each other out“ and at the same time „perspectives are dynamic and change over time; they also can conflict or support each other“ (Behkami and Daim, 2016). The pic. 6 shows the MPM in a summarized table that was taken from the paper of Behkami and Daim (2016).

This research uses the ground idea of the MPM that different perspectives are important to understand the studied phenomenon. MPM itself as analytical tool is not used in this particular research, but its philosophy was applied in addition to the previously mentioned analytical methodologies.

We have to note that the analytical methodologies that we have discussed above have many similarities in their approaches and in their steps/stages. They all can be categorized as thematic analyses with more or less these key stages:

1. Coding data
2. Finding recurring concepts/themes, combining some of them
3. Finding the relations between those concepts/themes by comparing them
4. Building a thematic framework, excluding unnecessary elements
5. Checking the theme framework for validity via deduction
6. A thick description, writing

After exploring the above-mentioned analytic frameworks, the list of advantages was compiled:

1. Explorative frameworks
2. Mostly phenomenological frameworks, focus on the meanings told by the respondent
3. Bottom-up approach, the a priori conceptual and thematically frameworks are usually not allowed. This ensures that the data are grounded
4. Possibility of abstraction, generalization and generation of new theories and ideas
5. Flexibility in research methods and in types of data sources
6. Broad application in various disciplines. Researchers with different backgrounds and philosophical and methodological stances can use these frameworks
7. Themes and concepts are verified deductively which makes the theoretical frameworks valid

The possible disadvantages of the discussed analytical frameworks are the following:

1. Reliability can be problematic because of broad interpretations of concepts and themes. Different researcher may interpret the concepts/themes in different ways.
2. Some nuances and details may be omitted from the final thematic framework

3. Difficulty of the analysis because of a massive number of concepts, several layers of analysis, complicated conceptual structures
4. Flexibility leads to challenges in identifying the main concept or theme and finding the continuity in the concepts/themes
5. Time-consuming analysis

During the analysis stage of this research some of the above-mentioned disadvantages challenged the researcher. In order to improve validity and reliability, the researcher showed the emerging conceptual frameworks to two of his respondents, on of which was an expert and a researcher himself. This was necessary to confirm the conceptual framework and to adjust it.

The other problem that the researcher faced was a tremendously large number of issues and concepts. It was hard to understand which ones are relevant, because the time and access to the respondents to confirm the relevancy of particular concepts was very limited. The researcher had to use his own judgement in identifying the relevant concepts and rejecting others. A lot of concepts were rejected in order to simplify the emerging conceptual frameworks.

It was also hard to group the concepts and understand the relations between them. The researcher used mostly his own judgement and experience here as well, especially in defining the hierarchical structures between the concepts and themes. Instead of one core concept, several core concepts were chosen because of the nature of relations between them.

In general, the analysis process was new, but an interesting endeavor. It required a lot of learning, patience, reflection and time. The pressure of time led to a concern that final gathered data may not be saturated and the analysis had to be done with the data that was available to that point.

Summing up, some ideas and methods from all of the above-mentioned methodological and analytical approaches were used in this research with a main focus on the ground theory methodology. As mentioned earlier, this research deals with a new, relatively undiscovered topic that requires exploration, curiosity and creativity. Using only one methodological approach does not allow that creativity to flourish. Instead, this research used a mixed methodology and multi methods that resulted in richer in-depth data and in validity of the research. Some other researcher like Yin also noted that using mix methods leads to validity and reliability of the findings (2003).

3.4. Choice of methods

This study is descriptive, explorative and holistic in nature and the researcher is looking for insights, opinions, experiences, meanings, and feelings emanating from the respondents. As it was already mentioned, the interpretivism and the Ground theory fit the best to approach the research aims and questions as the methodological and analytical frameworks. These frameworks prefer qualitative methods. However, quantitative methods can be also applied in some instances. For the purposes of this research qualitative methods were chosen. The table below shows the reasons of the researcher's choice of qualitative methods in detail:

Table 2. The explanation of the choice between quantitive and qualitative research methods

Needs and requirements	Qualitative or quantitative research suits well?
Descriptive and explorative nature of the research questions and aims	Qualitative
Holistic research and complexity	Qualitative
Phenomenological approach. Search for insights, meanings, feelings and opinions of the respondents	Qualitative
Inductive approach and generating new concepts, theories and theoretical frameworks	Qualitative
Richness and depth of data is necessary. Nuances and details are important.	Qualitative
Flexibility and creativity are important qualities for the research design	Qualitative
The influence of researcher onto the findings is negligible	Quantitative
It is easy to replicate the research	Quantitative
Suitable to study ICT innovation patterns in primary health care	Both
Simplicity of methods	Neither
Flexibility in potential data sources	Neither
Limited time and resources	Neither

Exploration of qualitative methods and comparison of their advantages and disadvantages let the researcher to decide on semi-structured interviews and observation as main methods. The overview of the advantages and disadvantages of every considered method in regards to the aims and questions of this particular research is provided in the Table 3.

Table 3. Analysis of advantages and disadvantages in the relevant research methods (merged from various sources: Denzin and Lincoln, 2000; Ritchie and Spencer, 1994; Creswell 2003; Silverman 2000; Gubrium and Holstein, 2002; Crabtree and Miller, 1999; Patton, 2002; McCracken, 1988).

Advantages of the method in comparison to other methods	Disadvantages of the method in comparison to other methods
NON-PARTICIPANT OBSERVATION (the participation observation was rejected immediately because it is impossible to become a participant observer and a part of the group in such a short period of time) **Short explanation of the method:** the data is collected via observation of events, phenomena, participants, etc. **Resulting data used for the analysis:** field notes, diaries, transcripts of conversations between the participants, conference materials, minutes of meetings, policy documents	
1. New insights about the ICT innovation adoption/dissemination can be found that are otherwise not mentioned verbally by the respondents/participants or considered to be not significant according to them. 2. Provides better insight into everyday processes of how ICT innovation is adopted and disseminated 3. Opportunity to build some level of trust and a stronger connection between the participants and the researcher 4. The best method to see the ICT innovation through the eyes of the participants, from their perspectives 5. Better suited to understand the dynamics within the organization and the behavioral patterns	1. Ethical issues - collecting information about the people can make them feel uncomfortable and worried, accidental access to the private data (of the patients, for instance) 2. Much more time consuming than other compared methods 3. Very small sample sizes that makes it hard to gain perspective of other stakeholders or of wider population. 4. Concerns with the role of the researcher, who may introduce more bias because he starts to sympathize certain people or who can change the dynamics among the participants with his presence. 5. It is hard to convince the potential participants to be observed.

Advantages of the method in comparison to other methods	Disadvantages of the method in comparison to other methods
FOCUS GROUP **Short explanation of the method:** a discussion about the certain phenomenon/event with a small group of people that usually have a shared experience **Resulting data used for the analysis:** transcripts of the discussion, notes with researcher's observations and insights	
1. The researcher may somewhat get insight into the power dynamics as well as different perspectives within the participant group. This is possible because the participants may communicate also among each other. 2. Other participants can confirm or reject the opinions and perspectives of each other. 3. The required information can be obtained faster than by interviewing each participant one by one.	1. The participants may influence onto the perspectives and opinions of each other. 2. Because of the power relations or group dynamics, some participants may be hesitant to share their honest and personal perspectives and opinions 3. There is not so much depth of data achieved as in other given methods. 4. Focus group requires a lot of resources: human and organizational: the participants should agree to come together at a certain point of time, it is hard to encourage them to participate. Time and money resources to compensate to the participants are often needed. 5. The researcher's bias: the researcher can introduce a lot of bias and unintentionally pose suggestive questions while moderating. 6. There is a risk that discussion will not be sufficiently moderated and time may be lost to the discussion of unimportant or unrelated issues 7. The obtained ideas and perspectives are limited only to the particular participant group 8. It is much more difficult analyze the output data. 9. The ethical issues are more problematic: respect of the privacy and confidentiality depends also on the focus group participants.

Advantages of the method in comparison to other methods	Disadvantages of the method in comparison to other methods
STRUCTURED INTERVIEWS **Short explanation of the method:** face-to-face conversation with strict schema of predefined questions that are given to every respondent. Limited scope of responses. **Resulting data used for the analysis:** transcripts of the interview, notes with researcher's observations and insights	
1. Less time is necessary in comparison to other discussed methods. This means more respondents may be interviewed. 2. Easy to analyze the output data and better suited for software applications for coding the data 3. Opportunity to compare data between the interviews 4. More reliability, because it is easy to replicate.	1. Limited exposure to the emotions and attitudes of the respondents. 2. Data does not reach the same level of depth and richness as other compared methods. 3. More careful work with structuring the interview questions is required 4. The lack of flexibility leads to ignoring of some important and interesting emerging ideas and perspectives

Advantages of the method in comparison to other methods	Disadvantages of the method in comparison to other methods
SEMI-STRUCTURED AND UNSTRUCTURED INTERVIEWS **Short explanation of a semi-structured interview:** face-to-face conversation with some schema of predefined open-ended questions. The flexibility is allowed and additional questions that make the respondent's perspective more clear or that deepen the respondent's perspective are welcomed. **Short explanation of an unstructured interview:** face-to-face conversation without schema of predefined questions. Holistic questions in the beginning, high flexibility and the leading role of the respondent are encouraged. Questions that make the respondent's perspective more clear or that deepen the respondent's perspective are welcomed. **Resulting data used for the analysis:** transcripts of the interview, notes with researcher's observations and insights	
1. The validity is easier achieved thanks to the better understanding of the opinions and meaning of the respondents, thanks to their feedback and immediate clarifications. 2. The depth and richness of data is secured even though the interview is directed and structured by the researcher. 3. Flexibility: the researcher can change the direction and focus if interesting emerging perspectives are provided by the respondent 4. Better understanding of the respondent's opinions and perspectives	1. Requires a lot of time to conduct every interview. This means fewer people will be interviewed in comparison to structured interviews. 2. Every interview is unique, that is why unlike in structured interviews, it is much harder to compare the data between the interviews. 3. Harder to analyze than structured interviews. More time needed for the analysis than in the structured interviews.

After identifying the priority advantages and disadvantages (underlined) in the table above the semi-structured interview was taken as a main method. Non-participant observation were also used however as an additional method that could fill in the gaps of the data obtained by the semi-structured interviews.

Semi-structured in-depth interviews as well as observations were conducted within one team praxis with two doctors, two medical assistants, three nurses and one receptionist. The semi-structured interviews for this study were given by the following stakeholders:

- one team praxis in Berlin: one doctor, one medical assistant, two nurses and one receptionist were interviewed,
- one representative of the ICT company that provides software to the interviewed and observed team praxis,
- two health care recipients/patients that visited the observed team praxis,
- one official in the municipal health department,
- two independent ICT and healthcare consultants.

At least thirty medical specialists from other praxes and hospitals in Berlin and Brandenburg, as well as other stakeholders were found via snowball sampling and contacted per email, phone or personal meeting. Interviews with some of them were initially planned. However, the overwhelming majority of them had to reject or cancel interviews because they did not have enough time, interest or there was not enough close social distance between the researcher and the interviewees.

Only one team praxis agreed to be interviewed and allowed the researcher to be present two full days in their praxis mainly because one of the doctors is a close friend of the researcher. This doctor helped to convince some other stakeholders, like the representative of ICT company and two patients also to be interviewed.

The difficulties with outreaching to potential interviewers and convincing them to take part in the interview led to the point when the methods were reconsidered and only a case study of the team praxis in Berlin that was ready to be involved in the research was proposed. However, after some consideration it became clear that more observation should be done within that praxis and more days should be spent there. This was impossible because of two main reasons: 1. Another doctor in the praxis was hesitant to have the observer for more than two days in the praxis. 2. This would complicate already complicated ethical issues, because the researcher would intrude symbolically for a longer period, leading to potential conflicts.

Instead, the researcher focused on searching and convincing approaches and he found eventually several respondents by approaching them at the IT/healthcare conferences and events in Berlin. The case study of the team praxis was rejected also because it is necessary to ensure more comprehensive picture of ICT innovation adoption and dissemination.

The researcher tried to be creative in his approach and some visualization methods were used. For instance, one respondent was asked to cluster a pieces of paper with concepts written on them that were generated during the certain stage of the research. This was aimed at exploring and reflecting upon the conceptual frameworks together with the respondents. Another example of using

visualization with the respondents is when another respondent was asked to represent the primary healthcare system graphically.

In addition to the interviews and observations, a various other data sources were used, including governmental and municipal reports and statistics, data visualizations and infographics, conference presentations, newspapers and even notes from informal meetings with experts. Available research findings from similar studies, governmental data on this topic were covered and addressed in the literature review. The data in literature review as well as analyzed data were visualized in order to aggregate and summarize complex concepts and to build a new theoretical framework.

Most of visualizations in this research are done using **UML (Unified Modeling Language)**, which is a visualization technique that comes from the software engineering and computer science fields. UML were introduced in order to better understand structural complexities in functional and nonfunctional requirements, processes and stakeholders when building software applications (Henderson-Sellers and Gonzalez-Perez, 2006).

UML is a graphical modeling language that offers a lot of ways how to represent various structures, domains, systems, behaviors, actors, relationships, scenarios, decision-making models, workflows, data flows, timelines and many other things. All the graphical representations can be roughly divided into static and dynamic diagrams. As the names suggest, the static diagrams represent fixed systems and objects and the relationship between them, while the dynamic diagrams have an aspect of time and represent changing behaviors and situations. UML graphical representations have strict notation requirements that are managed by the Object Management Group for Software Engineering problems (Meyer, 1997).

Despite of being a useful tool for visualization, UML is heavily criticized for being difficult to learn, too complex, hard to be applied in social sciences, not so „universal“ with only few examples of it being used in research areas other than computer science (Dobing and Parsons, 2005; Batra, 2009; Siau and Cao, 2001; Evermann and Wand, 2006; Siau and Loo, 2006). Some scientists stated that usability of UML suffer a lot, especially if systems and contexts require multiple diagrams in order to be well represented and they proposed some alternative approaches (Peleg and Dori, 2000; Dori, 2001). Most of the criticism of UML revolves around its complexity and lack of user-friendliness, however, this is not an issue for this particular research, because the researcher has a background in software engineering and computer science as well and it was easy for him to apply UML for the data analysis.

3.5. Research quality

Quality of qualitative studies, namely validity (of data) and reliability (of methods) should be examined. Hammersley (2008) points out three major pillars of a research: measurement, generalization (external validity) and the control of variables (internal validity). Measurement implies reliability ("the extent to which the same measurement technique or strategy produces the same result on different occasions, for example when used by different researchers" or "assessing the measurement technique or strategy employed") and validity ("assessing the findings of the measurement process"). Hammersley also clearly points out that applying the methodology correctly does not automatically mean that the results will be always valid and that we can not fully eliminate the role of judgement (ibid).

Seale et al (2007), who analyzed two qualitative studies on validity and reliability, shows us on practice that for a good quality research we need also to distinguish facts from theories, description from interpretation. Other important aspects in research quality that were named were cooperative cross-validation of the findings, transparency of methods and research process, contextual details, researcher's notes and reflections, independent audit (ibid).

During the research process, the following criteria were assessed in order to understand the quality of this research:

A. RELIABILITY

As mentioned earlier, reliability is assessment of the measurement technique or strategy or in other words it measures *repeatability* and *consistency* of the research methods. It is a challenge to repeat this research using its methods even in similar contexts because of its explorative and qualitative nature. It is highly doubtful that the research will yield the same results, in our case the same codes and concepts, if it will be replicated by in another setting. More likely, some new concepts may emerge which can support, adjust or even refute the conceptual and theoretical framework developed in this particular research. However, if the same methods are used with the same respondents in the same contexts by another researcher, it is more likely that he/she will obtain similar codes and concepts and come up with similar conceptual or theoretical framework.This is possible due to saturation of categories that is one of the main aspects of the Grounded theory. Due to lack of time and other resources, it is not feasible to make tests on reliability and invite another researcher to use the same methods with the same or other respondents in similar contexts.

B. INTERNAL VALIDITY

Internal validity is assessment of systematic bias that has the following aspects to consider:

- *Completeness of descriptions*: during this research the researcher tried to attain as much depth and richness in data as possible. There was a lot of focus on comprehensive description of social, political, cultural contexts, of participants and respondents, of their behaviors, opinions and attitudes, as well as of the everyday processes and interactions that lead to ICT innovation adoption and dissemination.
- *Credibility*: the researcher's interpretation is grounded in data and the conceptual framework was developed mainly on the basis of understandings and meanings of the respondents. In order to improve the credibility, one respondent was asked to get familiarized and confirm the tentative conceptual framework. This led to even much better understanding of the respondent's opinions and meanings. Eventually, a slight adjustment in the framework was done.
- *Selection bias*: due to many difficulties in attracting new respondents (lack of time or interest) the self-selection of respondents happened. All respondents in this research have certain characteristics that could be different if the research would be conducted in another state, city or even praxis. Gender, ethnic background, personality, education level, age, level of income and other characteristics of the respondents could have impact onto the relations between the categories within the theoretical framework, however, due to scope of the research and its qualitative nature, the exploration of dependencies between these variables is not examined. The selection bias influences also on the external validity.
- *Researcher expectations* were also minimized in this research by implementing only limited literature review on the topic before the data collection and by constant self-reflection on his role to avoid unintentional communication of his expectations to the respondents. The researcher's role will be discussed later in detail.

C. EXTERNAL VALIDITY

External validity is assessment how much the findings are generalizable and includes the following aspects:

- *Saturation of categories* was achieved within the team praxis, when the interviewees there were providing the repeating ideas and opinions. However, new interesting ideas were delivered by the respondents out of praxis, especially by the experts in IT and healthcare, who are themselves researchers. There was initially a concern that the saturation of categories was not fully achieved, since the experts were providing different opinions and concepts; and new experts were not

interviewed due to the limited time and difficulties in outreaching to them. However, the other available data sources were used instead to achieve the saturation of categories. The detailed description of data sources that were relevant for this research is provided in the next subchapter.

- *Consistency in the findings* was achieved by eliminating some irrelevant concepts and by being overviewed by one of the respondents. It is recommended to obtain more opinions about the consistency of findings via consultations with other researchers and experts, however because of the limits of this research this was not feasible.
- *Plausibility*: the research findings are consistent with the conducted literature review and the existing theories about the innovation adoption and dissemination.
- *Representativeness*: as mentioned earlier, the respondents self-selected themselves and there is a lack of representativeness in this research due to a small sample.

D. QUALITY INDICATORS OF THE GROUNDED THEORY (Strauss and Juliet, 1994).

- *Fit,* or as explained in the discussion of the Grounded theory, how well the developed abstractions fit to previous abstractions and data? The final theoretical frameworks are well represented by the memos and categories and concepts that are grounded in the collected raw data. This was possible thanks to the tedious and careful coding of the data as well as the constant defining of concepts and categories and applying the comparison method throughout the analysis. Moreover, one respondent was asked to check the preliminary theoretical framework and its categories to test the fit of the framework.
- *Relevance* of study as a whole and its generated abstractions to the respondents: the developed theoretical framework takes into account the needs and concerns of the respondents and well grounded in the data that was provided by them. The concepts describing the data obtained from the respondents was treated with the highest priority and importance in comparison to other sources of data, like governmental reports and conference presentations.
- *Workability* means how the theoretical framework explains the possible solutions to the problem? This research is very practical and useful, because it provides also recommendations to the various stakeholders with insights on how to approach the challenges in ICT innovation adoption and dissemination.
- *Modifiability* means the easiness to adjust or change the theoretical framework if the new data is gathered and new concepts are developed. The theoretical framework based on the findings of this research is adjustable and refutable. The researcher welcomes new research on the topic to test the theoretical framework.

After examining the research quality, it can be concluded that the research is mostly unreliable and non-repeatable, however it is mostly internally and externally valid with some issues in the selection of respondents and their representativeness. Moreover, the research fulfilled all quality indicators for the Grounded research.

3.6. Data sources and data quality

According to the Grounded theory everything that generate concepts for a theoretical framework can be regarded as data. This includes not only primary data gathered from interviews and observations, but also field notes, lectures, courses, conferences, newspaper and magazine articles, mailing lists, TV debates, informal conversations, self-interview, etc. The Table 2 shows other possible resources mentioned by some grounded theorists (Ralph, et. al, 2014).

Table 4. Possible Sources of Data for the Grounded Theorist. Copied from Ralph, et. al (2014)

Authors	Types of documents
Glaser and Strauss (1967)	Letters, interviews and conversations, speeches, sermons, proceedings, symposia, fictional and non-fictional literature, and media publications
Glaser (1992)	Ethnographies, biographies, diaries, comments, manuscripts, records, reports, and catalogues
Bernard and Ryan (1998)	Political speeches, song lyrics, personal diaries, and newspaper editorials
Birks and Mills (2011)	Newspapers and magazines; government reports; policy documents, organizational policy; procedure manuals; personal diaries; journals; log books; letters; biographies; non-fiction books; and novels

Main data sources for literature review were academic articles that could be found in library databases of two universities: Oslo Metropolitan University and Freie Universität Berlin with the following searches:

"ICT" OR "information and communication technologies" OR "information technologies" OR "IT"
AND "primary health care" OR "health care" OR "public health"
AND "innovation" OR "innovation dissemination" OR "innovation adoption."

Additionally, other searches as "public health informatics," "ICT innovations in Germany," were conducted. The researcher speaks fluently Germany and searches were conducted both in

English and German. This helped to gain a wider access to various academic and non-academic literature.

Relevant books, archives, governmental and nongovernmental reports and statistics, policy documents were also searched and looked at. However, main data source were interviews with the respondents, since there is considerably insufficient knowledge and available academic research on this topic.

Additional secondary sources were also used like:

a. *lecture, conference and seminar notes and presentations*: the researcher participated in two conferences in Berlin about the digitalization of healthcare in Germany. He also took a course on Software Engineering, where the Elektronische Gesundheitskarte (eGK), the electronic health card, was analyzed in detail.
b. *traditional media*: the researcher subscribed to the medical journals „KV Blatt“ and „Ärztteblatt“. He tried also to follow some debates on a German public television related to the research topic.
c. *social media*: the researcher subscribed to several Facebook pages and Youtube channels on the topics of ICT innovations in healthcare as well as to social media pages of politicians, who promote healthcare digitalization in Germany (for instance, Jens Spahn, the new minister of health).
d. *informal conversations*: the researcher had several informal conversations (not semi-structured in-depth interviews) with various stakeholders: experts, researchers, consultants in ICT and healthcare, doctors, and governmental officials.
e. *technical and software manuals*: the researcher get familiarized with all technical and software manuals available for the technology mentioned by the respondents to understand the complexity and user-friendliness of the software applications.

Using the above-mentioned secondary data rises some propriety issues as well as the issues with the data quality. The most reliable data is considered to be primary data as well as academic literature. Other secondary sources, like magazines, web-sites, social media, etc. are usually considered to be unreliable and their content should be checked in more reliable sources.

For the purposes of this research, the secondary data sources for divided into two groups: quality and bad-quality data sources (see the Table 5). The quality data sources are relatively reliable and were used in the literature review, while bad-quality data sources were treated as texts and memos that could be also coded to obtain new concepts. As mentioned earlier, this is allowed

and encouraged in the Grounded theory research. It is necessary to note though, that we can also question quality of academic literature that can be sometimes also non-reliable. Some secondary sources that traditionally considered to be unreliable, in fact, may have better quality that some „quality“ data sources.

Table 5. Secondary data used in this research

	Quality data sources	Bad-quality
Quality	Relatively reliable	Non-reliable
Usage	In the literature review	In the analysis
Examples	Academic journals, academic books, archives, governmental reports, nongovernmental reports, statistics, official policy documents	Non-academic books, lecture, conference and seminar notes and presentations, journals, notes and transcripts of television programs, social media, informal conversations, technical and software manuals

3.7. Data security

The data security is a fundamental part of ethical research. There were several measurements implemented in order to ensure data security and privacy. In fact, it is punished by the German law, concretely by BDSG (The law on data protection) § 3 Abs. 9, if the researcher ignores the data privacy of his/her respondents (Bundesdatenschutzgesetz, 2017).

The primary data used in this research is considered to be sensitive with a lot of information that can help to identify the respondents. If disclosed, the data could inflict little to moderate psychological or material harm onto various stakeholders. The additional measures were done

therefore in order to protect the data and privacy of the respondents. The respondents were also informed about those measures, their rights as well as scope of using the obtained data. They were asked to sign the informed consent in German to approve that they are informed about the measures to secure data, their rights as well as possible risks and measures in the case of theft, loss or unauthorized use of obtained data.

In order to protect data security and privacy the audio and written records of the interview were kept in the folder, secured with a password on the working laptop of the researcher, and on the external hard drive for back up availability. The password-protected external hard drive was kept in a secure space in the house of the researcher and the researcher's laptop was also password-protected with automatic lock-out function and it was accessible only for the researcher. No flesh drives or other physical means to transport the data from one computer to another were used. The paper print-outs as well as handwritten records were avoided as much as possible. All handwritten data was subsequently digitalized and the papers with handwriting were destroyed.

The respondent names and contact details were kept as a separate file and were also be password-protected. Each respondent was assigned a personal code that was used for identification of respective files. The privacy of the respondents is discussed in more detail in the subchapter about ethical consideration.

After the submission of the final version of the research to OsloMed, all data which can identify respondents will be deleted from the laptop and the hard drive. The collected data that does not have any information that may point to the characteristics of the respondents will be kept on the researcher's laptop and hard drive for unknown period of time.

In case of data breaches like theft or unauthorized use of research data, this strategy was planned: informing the effected respondents and the police. Informing the police is necessary, since the law on data protection criminalizes theft or unauthorized use of personal data (Bundesdatenschutzgesetz, 2017).

In case of data leakages like unintended disclosure or unintended loss of data because of computer failures, only the effected respondents were supposed to be informed. During this research, no data breaches and leakages occurred.

3.8. Researcher's role

It is important to reflect on the researcher's role in order to understand the possible bias he introduced into the research findings and analysis and the ways to avoid it.The researcher may introduce bias on all research stages: choosing methodology and methods, data collection, data analysis, writing and presenting the findings. In order to reduce the bias, the following aspects were analyzed and discussed:

1. The *power dynamics* between the researcher and the respondents/participants: for the purposes of this explorative research it was important that the researcher treated the respondents/participants as equal partners. He consulted the respondents on various aspects of research methods, data collection and data analysis. The researcher tried to give more space for respondents to set the priorities in their answers and to convey their opinions and perspectives as fully as possible. However, it is impossible to remove the influence of power dynamics between the researcher and the participants onto the research findings. This is one of the basic limitations of the research.
2. *Confirmation bias* can directly influence onto the research findings and the researcher tried to avoid this through careful introspective reflection during the data collection and analysis. The researcher was constantly asking himself: why does he consider the certain concept relevant? Would the respondents think the same way? Is there a possibility of confirmation bias in the researcher's focus on the particular concept? The confirmation bias can be diminished by using this self-reflecting questions, but it can not be fully eliminated in the qualitative research.
3. The interview questions avoided *suggestive questions* and no suggestive information on ICT innovation patterns in health care in Germany was given by the researcher prior to the interview. There is, however, a possibility of intentional communication of the researcher's initial expectations about the research topic to the respondents.
4. The *experience and background of the researcher* were analyzed. The researcher had some basic skills in conducting both quantitative and qualitative research and experience in the chosen methods (semi-structured interviews and observations), however, this is his first time using the Grounded theory as a main methodological and analytical framework. So the researcher was also in a learning process, while conducting this particular research. This could potentially negatively influence onto the research results and the quality of the research as a whole. Moreover, during the research process, the researcher relied mostly onto himself without much of external help from the advisors or professors. This could also have negatively influenced onto the choice of methodology, the data collection and analysis.

5. The *preconceptions and prior assumptions* about the research topic: the researcher had already some little experience in the area of health care digitalization that could shape initial preconceptions about the research topic. However, the optimistic nature of those preconceptions and strong belief in impact of the new technological innovations had been changing during the research: the researcher lost partially his optimism in the innovation during the data collection and analysis, because the whole picture of ICT innovations in health care turned out to be more complex than initially expected. The researcher tried often to reflect upon his assumptions and preconceptions in the notes and memos and upon the possible influence of those assumptions onto the research findings. This reflection led to some tangible changes in the methods and the analysis:. For instance, self-reflection notes after each interview were prepared with recommendation to himself and those self-recommendations were followed in the consecutive interviews. This ended up also sometimes with some adjustments in interview questions.
6. The *interest and motivation of the researcher* were also analyzed. He studied Sociology and Software Engineering for his Bachelor and he was conducting this research as a part of his Master's level education in International Social Welfare and Health Policy at the Oslo Metropolitan University. He was working for a startup company in Berlin and developed his research idea on the basis of his academic and professional experience and interests. The researcher hopes that the study results can be practical and its recommendations given to the various stakeholders will be taken seriously.
7. *Insider-outsider continuum*: the researcher was an insider in certain aspects of the research, like software engineering, and at the same time outsider for many other aspects of the research. During the observation of the team praxis, the researcher had to switch sometimes between his roles as a close friend of one of the doctors or insider's role and his role as an external researcher or outsider's role. This was helpful to gain access to behind-the-scene coffee conversations in the kitchen, for instance, and in other circumstances to be regarded by the praxis team as a neutral researcher.
8. *Checking the privileges and vulnerabilities*: the researcher reflected also upon his privileges of understanding complicated technical information, software systems, hardware architectures, of having certain age, gender and educational, social, economic and ethnic backgrounds. All of these could potentially influence onto the interest, willingness and openness of the respondents, and, thus, also onto the research findings.

3.9. Ethical Considerations

Ethics was a significant component of the research and many aspects of it were already mentioned or discussed in previous chapters. There are also a few other aspects worth mentioning:

Approval from ethical review boards: the researcher was given a recommendation during the presentation of the research proposal to the research advisors and fellow students that approval of special bodies like ethical review boards is not necessary for this research, because it does not deal with huge potential harm to the respondents or the society, highly sensitive data and marginalized communities.

Informed consent and rights of the respondent: Every respondent was interviewed only if they agreed to the interview and signed the consent to be interviewed or observed. The consent forms contained information about the research topic, aims and questions; the importance of the respondent's involvement for the research; the respondent's rights, including right to withdrawal of the consent and collected data as well as right to obtain all interview records provided by the participant until the publication of the research; exceptions from the respondent; data proprietary issues; potential risks to the respondent; and contact details of the researcher. Upon request of the respondent the gathered data could be taken out of the research paper any time until the final draft was ready. The research findings will be sent to all respondents who participated in the research.

Power relations between the researcher and the respondents were taken into consideration, when designing interview guides as well as consent/information sheets. Respondents were treated as important and equal contributors to the research. The observations were made with as much little disturbance as possible to the work of the team praxis. The researcher was attentive to any feedback from the praxis team regarding the power dynamics. More details about the power relations were discussed in the researcher's role section.

Privacy and confidentiality of respondents was ensured through data security measures discussed earlier as well as informed consent, consistent reflection and sensitivity towards the needs of every respondent. The major concern with confidentiality and privacy with accidental access to patient's data during the observation phase of the research.

To minimize those risks, the researcher had a thorough conversation with the main doctors regarding the rights of the researcher: what he was allowed to do and what not, what spacial and physical access was granted to him. The researcher was not allowed to be in the doctor's or laboratory rooms when the patients were inside. He was not allowed to have access to any patient data. In order to understand the ICT systems at place and have access to them, the researcher had to

play a role of the patient. Other staff of the praxis was also informed about the limitations to the rights of the researcher.

Propriety issues or the question who owns the research is addressed through continual appraisal of the contribution of the respondents as well as open publication of the research findings on free academic online resources and open access journals.

Conflict of interest is likely irrelevant for this research, because the researcher is not paid for conducting this research. The *independence* of the research is expressed through the fact that the researcher does not represent any political party, social movement, private or governmental organization with their specific agendas.

Transparency of the research methods and analysis is secured through the detailed description of the research methodological and analytical frameworks

Utilitarianism of the research is expressed through the researcher's strong belief in potential benefits that this research brings to the stakeholders and the German society in the whole, especially in the current context when the public policies in Germany are designed with a focus on digitalization of all aspects of life (CDU, 2018).

Other ethical considerations are addressed and discussed in detail in the relevant sections, including chapters on research quality, data security and the researcher's role.

4. Theoretical frameworks and a literature review

4.1. Dissemination of innovation theory

Dissemination of innovation theory (DIT) by Everett Rogers was chosen as a main theoretical framework. This theory explains ways, reasons and rates of diffusion of new technologies and information. In general, according to E. Rogers' book „Diffusion of Innovation": "diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1983). Innovation diffusion as a process is spread over time thanks to social communication. New ideas and technologies spread through communication channels in a particular social system. Certain innovations are adopted by the critical mass, some are simply forgotten (ibid).

Rogers divides the diffusion process into four main elements: an innovation, communications channels, time, and social systems. These elements are key in the Rogers' DIT and described further in detail.

INNOVATION

According to Rogers, an innovation is a new idea, method, approach, practice, technology or product that is found to be useful by an individual or an organization. Newness means not the period when the innovation was invented, but it is rather about the point of time when the organization or the individual became aware of that innovation and its benefits. The innovation may represent something physical like new medical equipment, something less tangible like software system, and something intangible like a business idea. It is more difficult to conceptualize and measure less tangible and non tangible innovations (ibid).

What are the sources of innovations? One of the sources may be a need of certain individuals and/or organizations in new methods, approaches or technologies in order to overcome some challenges like insufficient human resources or to improve some aspects of their work, like the production output. The other possible sources of innovation are changes in political structure, in the market, in beliefs and values of people, in education and awareness and in many other things (ibid).

Innovations have also characteristics or properties that are crucial for the decision outcome to adopt or not to adopt. The characteristics are described later in detail.

ADOPTERS

Adopters can be individuals, organizations, communities, governments and even regional political structures and international organizations. E. Rogers (1983) categorizes people into five main groups: innovators, early adopters, early majority, late majority and laggards.

Innovators are those, who adopt the innovations first, sometimes by taking risks and with considerable financial contributions. The innovators tend to have a high social status and to form communities with other innovators. They tend to be tolerant to potential risks when adopting adopting innovations and they survive any failures thanks to their financial resources (ibid).

If proved to be beneficial and successful, the innovation then is adopted by early adopters who tend to be opinion leaders and influencers. Early adopters also tend to have a high social status, financial security, higher levels of education. However, they try to avoid unnecessary risks and adopt after the careful costs-benefits evaluation (ibid).

The early adopters are followed then by early majority which adopts the innovation in a significantly longer period of time than the early adopters and the innovators. The early majority tend to have a middle or high social class, average financial security, and higher levels of education. They usually have strong relationships to the early adopters, but only a few of them serve as opinion leaders and influencers (ibid).

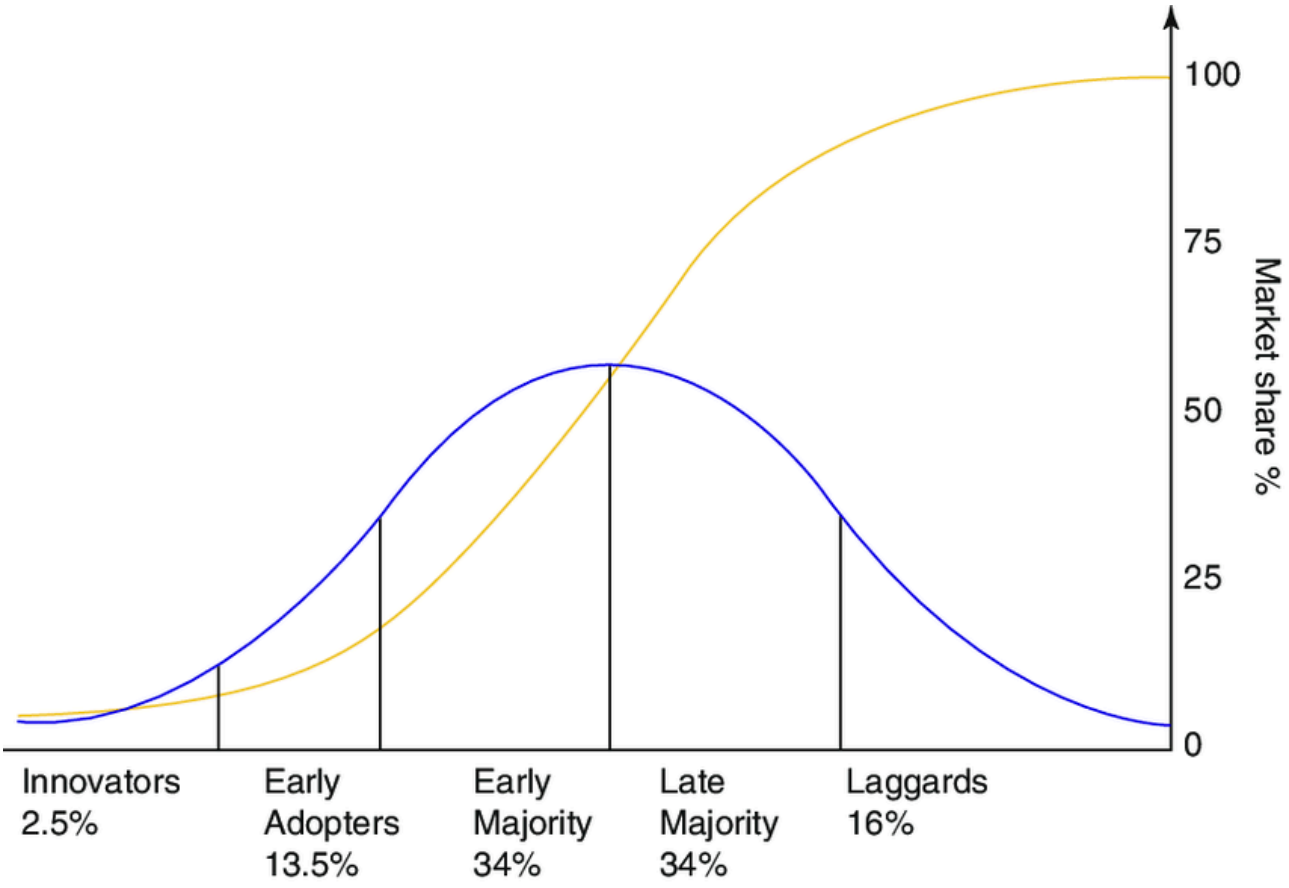
At this point the critical mass is reached, the innovation turn to be self-sustainable, and late majority also adopts the innovation. The late majority tend to be skeptical regarding the innovation and to have lower social status, lower education levels and less financial security than the earlier adopters. There is very little opinion leadership within the late majority (ibid).

Laggards are the most conservative members of the society, who adopt the innovation the latest. They tend to have the lowest social status, low education levels, and financial insecurity. The laggards tend to be older as well (Rogers, 1983; Fischer, 1971).

The table 6 gives a full summary of adopter categories and the picture 7 shows the innovation adoption by these groups and represents the diffusion of the innovation in a bell-shaped and S curve forms. However the graphic ignores the non-adopters. Also, it is unclear how exact percentages of certain adopters were determined in the graphic.

Table 6. Adopter categories.

Adopter category	Innovators	Early adopters	Early majority	Late majority	Laggards
Attitude to innovations	Very positive	Very positive	Positive	Sceptical	Negative
Risk tolerance	The highest	Moderate	Moderate	Low to none	None
Social status	The highest	High	High to middle	Middle to low	Low
Educational level	High	High	High to middle	Middle to low	Low
Financial resources	The highest	High	Average	Average to low	Low
Age	Younger	Younger	Varied	Varied	Older
Social interactions	Mostly with other innovators	With early majority and some innovators	With early adopters and late majority	With early majority and some laggards	With some late majority. Mostly limited social interactions
Opinion leadership	High	Very high	Average	Low	None
Adoption rate	The fastest	Fast	Slow	Very slow	The slowest



Pic. 7. Roger's diffusion of innovations. Copied from (Patel and Aylott, 2017)

COMMUNICATION CHANNELS

Communication channels are used between the various actors (individuals, organizations, communities, governments) in order to exchange information and experience about the innovations (Rogers, 1983; Ghoshal and Barlett, 1988).

The communication channels are often described by the distinction of homophily and heterophily. Homophily occurs when the potential adopters tend to interact with someone with similar social class, education, financial resources and other traits. They tend to be organized into small groups or communities, where the innovation is adopted very quickly (Rogers, 1983; McPherson et al., 2001; Rostila, 2010).

Heterophily happens when there is also interaction between individuals, communities and organization that are not similar to each other and do no share many common traits. Heterophily is very important for the innovation diffusion, because it allows to communicate information about the innovation between different adopter categories and across closed communities (Rogers, 1983; Rogers and Bhowmik, 1970; Centola, 2011).

TIME

Innovation adoption occurs not instantly and takes time. Some innovations need more time to reach critical mass, others need less time. This speed of adoption is described by the concept of the adoption rate. The adoption rate describes the speed at which the potential adopters adopt any given innovation. There were various attempts to measure this rate in different case studies and there some methodologies how to do that. One of the most popular ways to measure it is by length of time necessary to adopt the innovation by a certain number or share of the potential adopters in a specific geography (Rogers, 1983). Measuring the adoption rate is, however, methodologically tedious and questionable: how do we put a clear border between adoption and non-adoption? Does the adoption rate include the cases when the adopter rejects the innovation after some time passed?

There are also several theories that explore influences onto the adoption rate. For instance, the adoption rate among innovators and early adopters is faster in comparison to the late majority and laggards. (Rogers, 1983).

SOCIAL SYSTEM

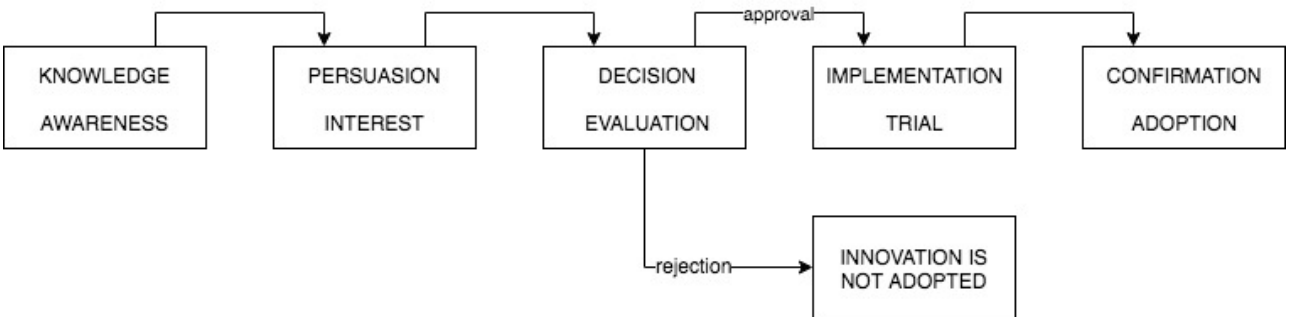
The social system represents the complicated picture of external influences from mass media, public policy, law, etc. and internal influences, like social relationships or opinion leaders

(Rogers, 1983). Let us discuss some aspects of the social system, in particular opinion leaders and social networks.

Opinion leaders or influencers are those individual whose opinion and symbolic power can influence onto the opinions of other people. Opinion leaders can be famous and popular people from business, technology, entertainment, mass media, and other areas. They are key in communicating positive or negative information about innovations. They can inspire others either to adopt them or discourage them from adoption. The opinion of influencers is taken into account during the evaluation and decision-making by the potential adopters. Opinion leaders are usually innovators or early adopters and have a high social status and economic security. They usually have exposure though traditional or social media (ibid).

Social networks are communities of people with strong or weak connections and that share a certain set of similarities. Social network can be a group of friends, colleagues, a sports club, a professional network, etc. The era of Internet is also changing how people interact and Internet created also online social networks, where people share the knowledge and opinions. Online social networks usually lead to a better exposure of the innovation, to better observability and better analysis and understanding of costs and benefits of the innovation (Valente, 1996).

The theory also emphasizes five stages of the adoption process, namely: knowledge, persuasion, decision, implementation and confirmation. Rogers provided also another scheme earlier in his work, namely, awareness, interest, evaluation, trial, and adoption that are linked to the stages above (Rogers, 1983; Newell, 2011). The stages are graphically represented on the picture 8. Each stage is described in detail below.



Pic. 8. Innovation adoption process according to Rogers

KNOWLEDGE

A potential adopter learns about a given innovation for the first time. The adopter can have only superficial information about the innovation and he/she is not yet inspired to search for more information about the innovation (Rogers, 1983).

PERSUASION

At this stage the potential adopter is interested by the innovation and actively looks for more information about it (Rogers, 1983).

DECISION

The potential adopter evaluates the possible benefits and costs of the innovation adoption and makes a decision to approve or reject the innovation.

Based on the type of actors, who make a decision to disseminate innovation, three decision ways were identified: optional innovation-decision that is made by an individual, collective innovation-decision that is provided by all participants, and authority innovation-decision, people in power decide for others (Rogers, 1983).

Decision regarding the innovation adoptions are made by taking into consideration so-called characteristics or properties of innovation. Some of those characteristics are explained below.

Relative advantage characterizes any benefits brought by the innovation in comparison to the old practices or technologies.The relative advantage can represent some economic benefits such as cut in costs or improved productivity or it can represent non-tangible benefits like improved brand image, safety, or client/user-friendliness. Relative advantage influences positively onto the rate of adoption, which means that the higher is the perceived relative advantage of the innovation, the higher its adoption rate (Rogers, 1983; Greenhalgh et al, 2005; Tornatzky and Klein, 1982).

Compatibility describes how well does the given innovation fit into the current structures, contexts, culture, values and needs of the adopters. The better is compatibility, the faster is the adoption rate. In case of low compatibility individuals need more time and resources to adjust their old practices, processes, structures, etc. Low compatibility can eventually lead to the rejection of the innovation (Rogers, 1983; Tornatzky and Klein, 1982).

Complexity and knowledge requirements characterize the difficulty in understanding or applying the given innovation. Innovations that require additional training and special skills or

knowledge take more time to get adopted than innovations that are easier to understand and use. Complexity can lead to the immediate rejection of a certain innovation. For instance, a medical specialist who have difficulties in understanding the complex software systems will reject them even if the new technology could bring a competitive advantage to his/her services. The simpler and easier the technology is, the faster its adoption rates are (Rogers, 1983; Aubert and Hamel, 2011).

Trialability or testability describes the opportunity to try the given innovation for the potential adopters. The trialability leads to positive decision to adopt and higher adoption rates. Especially in the field of software engineering, the trialability became an important concept. Many software applications provide some trial periods over limited time for the potential customers for free. So the customer can get acquainted with the software and make an informed decision whether to buy the license for the software and to continue using it. The trialability helps to reduce the feelings of uncertainty in potential adopters and help them to make faster decision (Rogers, 1983).

Observability describes the extent of how the potential adopters can notice benefits of a given innovation. Those innovations, whose benefits are easily seen, are adopted faster. The information about the benefits of the given innovation are usually transferred through peer-to-peer networks (Rogers, 1983, Tornatzky and Klein, 1982).

Comparability is an attribute that describes opportunity to compare the given innovation with other similar innovations. If it is easy to compare the benefits of one innovation with other innovations' advantages, then it is more likely that the innovation will be eventually adopted (ibid).

Potential for reinvention describes the circumstances when the innovation turned out to have other unexpected benefits. The example may be the use of the given innovation for purposes other than it was intended (Rogers, 1983; Denis et al, 2002).

Risk potential characterizes the whole set of risks that an innovation may bring to the potential adopter. The more risks are associated with the innovation, the more likely it will be rejected (Meyer and Goes, 1988).

Disruptiveness describes how innovations disrupt the routine processes and tasks. The disruptiveness can be also seen as an opposite of compatibility. The more disruptive is a given innovation, the more unlikely it will be adopted (Dobbins et al, 2011).

All above mentioned characteristics or properties of an innovation can interact with each other and can be treated as a whole for the decision-making. For instance, an innovation may be very difficult to learn, but it may also be very beneficial to a potential adopter. In this case, the adopter may decide positively (Rogers, 1983).

Besides the properties of innovations, there are also properties of adopters that influence onto the decisions. The properties of adopters are usually subdivided into two groups: of individual adopters and of organizations. In the table 7 some of those properties are presented.

Table 7. Characteristics of adopters

Characteristic	**Influence onto decision to adopt**	**Adopter types**	**Source**
Abilities	Strongly positive	Individual, organization	Rogers, 1983
Motivation	Strongly positive	Individual, organization	Fergie et al, 2001; Eveland, 1986
Personality traits	Uncertain and debatable: for some strongly positive, for others negligible	Individual	Greenhalgh et al, 2004
Residence, location, geography	City residents are more likely to adopt than rural residents	Individual, organization	Ryan and Gross, 1943
Power	Those with more power of decision are more likely to adopt	Individual, organization	Rogers, 1983
Culture and norms	Strong, depends on the culture and norms	Individual, organization	Rogers, 1983
Compatibility, fit to an innovation	Strongly positive	Organization	Rogers, 1983; Gustafson et al, 2003
Ability to assess possible implications	Strongly positive	Individual, organization	Rogers, 1983
Environment, context: economy, industry, famous people (influencers) and opinion leaders, who have already adopted the innovation	Strong, depends on the environment. If the environment had adopted or pushes to adopt, it is very likely that the organization will also adopt	Individual, organization	Meyer and Goes, 1988
Policy, law	Strongly positive	Organization	Øvretveit et al, 2012; Exworthy, 2003

One of the most significant characteristics of the adopters is motivation. Motivated adopters can even adjust their current behaviors and setting in order to adopt an innovation. Symbolic value of the innovation can also influence onto motivation and eventually onto decision to adopt (Fergie et al, 2001; Eveland, 1986).

The characteristics of organizations as adopters are usually more complex than the characteristics of individuals, because organizations can comprise of many individuals and thus, they can be treated as a structure with its culture, norms and power dynamics (Rogers, 1983).

IMPLEMENTATION

At this stage the adopter applies innovation in his/her everyday processes and setting and understand the usefulness of the innovation (Rogers, 1983).

CONFIRMATION

This stage implies the crystallized opinion of the adopter regarding the innovation. He/she actively shares information about the innovation and raise awareness with his/her group or wider community (Rogers, 1983).

An innovation fails to diffuse when it brings certain disadvantages, it has many weaknesses, it fails to compete with other innovations, it is very complex or it lacks observability and interest from potential adopters. Some innovations may be successful in one settings and geographies, but fail in others (Rogers, 1983). Certain network structures can be also a reason for failed dissemination (Gibbons, 2004).

The other important aspect to consider is the analysis of consequences of an innovation adoption. Those outcomes can be divided into the following categories: positive/desirable (benefits) and negative/undesirable (costs), direct (tangible and easy to identify) and indirect (non-tangible), anticipated and unanticipated, public (the innovation impacts not only the adopter, but the society as a whole) and private (the innovation impacts the adopter or his/her immediate community or organization only) (Rogers, 1983).

Nowadays the Rogers' DIT found its application in many fields from sociology to medicine, from psychology to software engineering, from political science to marketing, from development studies to biology. The Rogers theory first gained its popularity among the industries, especially in agriculture and electronics, and later was successfully adopted by a broad range of disciplines (Greenhalgh et al, 2005; Strang and Soule, 1998; Nutley and Davies, 2000).

As a conclusion, it is important to identify and critically assess the weaknesses of the Roger's theory. Some critical aspects are listed and described in the table 8. The weaknesses and gaps in the Roger's theory led to reassessment of the theory by other researchers. Extensions to DIT will be discussed in detail in the next chapter.

Table 8. Critical aspects: weakness and gaps of the Roger's Diffusion of Innovation Theory

Aspect	Description	Source
Lack of cohesion and consistency with other theories	Several other theories on innovation adoption and dissemination were developed by other social scientists. Some of DIT aspects are not coherent and consistent with those theories.	Meyers, et al., 1999; Katz, et al., 1963
Difficult to measure	Rate of diffusion, causes of innovations, and other aspects of DIT are difficult to measure and to quantify.	Damanpour, 1996
Ignoring the complexity	DIT does not take into account the complexity of all variables and predictors of innovation adoption. Some critical aspects can be missed or ignored by the theory.	Plsek and Greenhalgh, 2001; Downs and Mohr, 1976
Pro-innovation bias	The pro-innovation bias of DIT is reflected by the implication made by Rogers that all innovations should be adopted. This bias is also reflected in the positive connotations of the word „innovation."	Rogers, 1983
„Rational individual" bias	The individual is regarded usually as an actor, who is capable of making free and informed decisions. There is a little attention devoted to the context influences and the pressure from outside.	Rogers, 1983
Oversimplification of the categories	The theory of Rogers oversimplifies the process of innovation adoption as well as classification of adopters. For instance, it does not analyze those opinion leaders in detail, who are conservative and skeptical regarding the innovation. In contrary, Roger assumes that all opinion leaders are not conservative and welcome the innovations.	The researcher's ciriticism
One-directional communication channel	The information flows are directed only towards the potential innovator according to the DIT. There is an assumption that the sender of the information has to persuade the potential adopter and not vice-versa. Chaotic information flows and feedbacks to the sender are not addressed in the DIT.	Giesler, 2012; Robertson et al., 1996
Focus on the decision stage	Rogers also focuses mostly on the decision stage and pays less attention to other stages.	The researcher's ciriticism
The rejection of the innovation happens on the decision stage	Rogers implies that the innovation is rejected. In fact, it may happen in all stages of the innovation adoption process, also, during the implementation stage.	The researcher's ciriticism

Linear process of adoption	Roger implies that the adoption process is linear and one stage is followed by another one. Other scholars argue that there could be however jumps, loops between the stages and returns to the previous stages. Multiple iterations of the same stage could also occur.	Cousins and Simon, 1996
Predictive optimism	Roger is optimistic in the predictive nature of his theory. Some other scientists think it is very difficult to predict the innovation adoption and dissemination patterns.	Vandeven and Rogers, 1988
Innovativeness of organizations	Some of organization are more innovative than others. Roger's theory focuses mostly on the individuals and does not take into account the differences in innovativeness between various organizations. However, other researchers were not able to fully conceptualize what innovativeness is as well as explain the reasons of why one organizations are more innovative than others.	Damanpour, 1988, 1991; Nutley and Davies, 2000
Insufficient discussion of innovation types	The Rogers' DIT does not provide a good framework of classification of innovation types.	(Wolfe, 1994; Osborne, 1998; Damanpour & Evan, 1984)
Limited discussion of the role of cultural symbols, mass media, fashion and trends	The Roger's DIT touches upon the trends through discussion about the opinion leaders. However, he does not provide the full picture of how trends, fashion, mass media and cultural symbols influence onto the decision to adopt.	

4.2. Extensions to Diffusion of Innovation Theory

As mentioned earlier, the Roger's Diffusion of Innovation theory has many flaws and gaps. Some of those gaps were addressed by other scholars and new theories were developed that were extending the DIT. Some of the extensions to the theory of Rogers are mentioned and explained below.

CLASSIFICATION OF INNOVATION TYPES

Each type share both similarities with other types and have its own peculiarities. Some proposed the classification such as technical and administrative innovations; product and process; social policy (public) and private innovations. Other proposed the classification based on innovation attributes or properties (Wolfe, 1994; Osborne, 1998; Damanpour & Evan, 1984)

IRRATIONALITY OF DECISION MAKING

Some scholars argue that decisions to adopt innovations are based on trends and fashion, institutional and peer pressure rather than rationality. Potential adopters do not come from the position of rationality and logic and do not make a full analysis of benefits and costs, advantages and disadvantages. Their decisions are not free of pressure of cultural symbols, peers, fashion and trends. It is important for the potential adopter to keep his symbolic status and power. The adopter seeks constantly for the approval and acceptance of their actions (Abrahamson, 1991, 1996; O'Neill, Pouder, and Buchholtz, 1998; Abrahamson and Fombrun, 1994; Abrahamson and Rosenkopf, 1993).

INNOVATION JOURNEY AND ADOPTION REVERSAL

Some scholars view innovation as a journey rather than a limited step-to-step linear model. The innovation journey perspective admits unpredictability of the innovation path. The innovation adoption and dissemination is regarded as a chaotic and non-linear path with jumps, loops, iterations, and dead-ends. This perspective also highlights the significance of past experiences for successful adoption of future innovations (Vandeven and Rogers, 1988; Nutley and Davies, 2000).

The Roger's theory ignores also the adoption reversal, when the decisions about the innovation adoption can reverse because of the unexpected disadvantages of the innovation or lack of approval from the social surroundings of the adopters (ibid).

PROPOSAL TO THE ADOPTION MODEL OF DIT

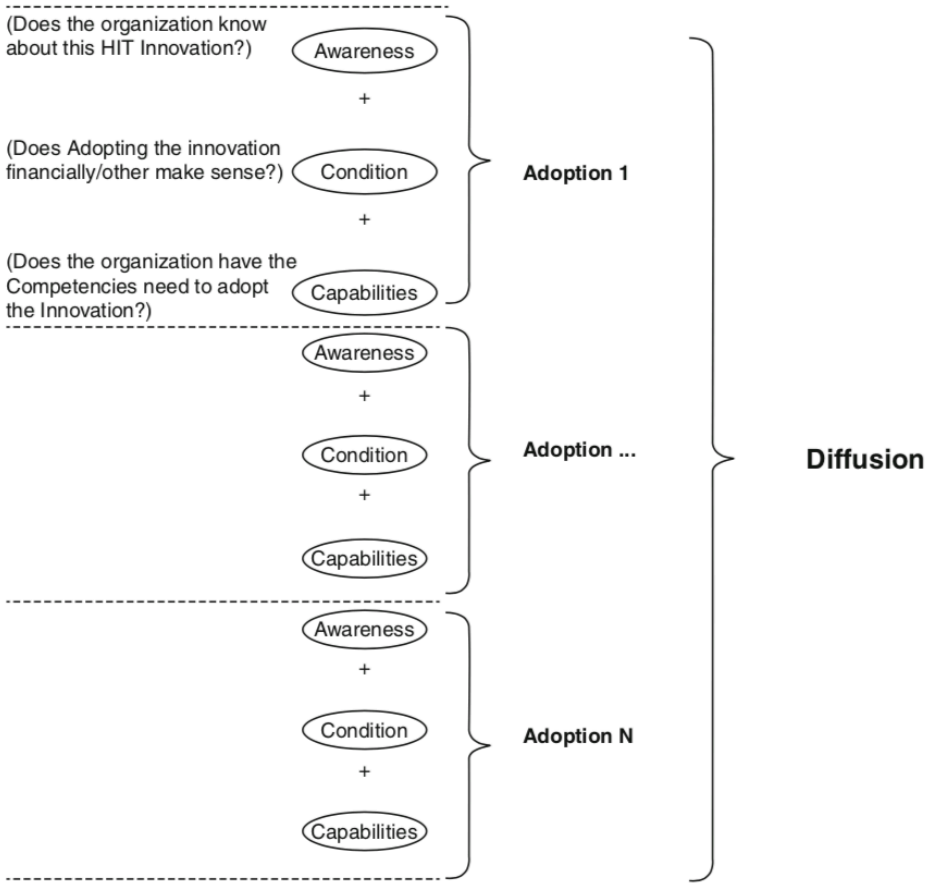
Some researchers proposed extensions to the five-stage adoption model of Roger's theory: knowledge, persuasion, decision, implementation, and confirmation. They included routinization and infusion. Routinization describes the stage when the adoption become non-innovative. This is common among late adopters. Infusion is a stage, when innovation becomes an integral part of the organization, its culture, norms, policies and processes to the level that no one notice the innovation any longer and regards it as usual and normal phenomenon (Cooper and Zmud, 1990).

EXTENSION TO INNOVATION PROPERTIES

The Roger's theory describes several innovation properties, attributes or characteristics that influence onto the decision to adopt, like relative advantage, compatibility, trialability, observiblity, etc. Wolfe (1994) proposed such additional properties as adoptability, centrality, and additional work load.

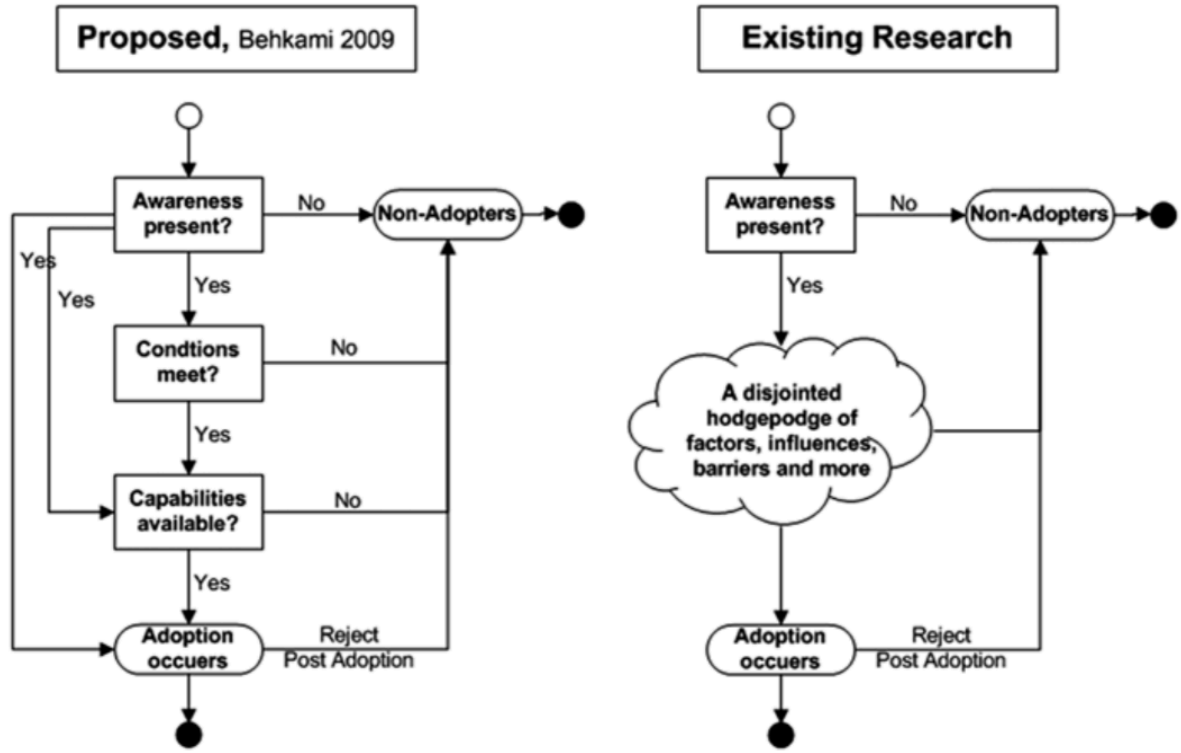
DYNAMIC CAPABILITIES AND CONDITIONS

N.A. Behkami and T.U. Daim (2016) propose a new framework by extending the Roger's theory with dynamic capabilities and conditions, which have not been examined as an integral part of the innovation adoption. They criticized the Roger's theory on defining awareness/knowledge as the main aspect influencing onto the innovation diffusion. They argue that this definition fits better the consumer behavior, but it is not suitable to organizations. So these two scholars proposed the trinity of awareness, conditions and capabilities. This trinity is visualized with relevant questions for each factor in the picture 9. The visualization shows also how accumulation of individual adoptions leads to diffusion of the innovation (Behkami and Daim, 2016).

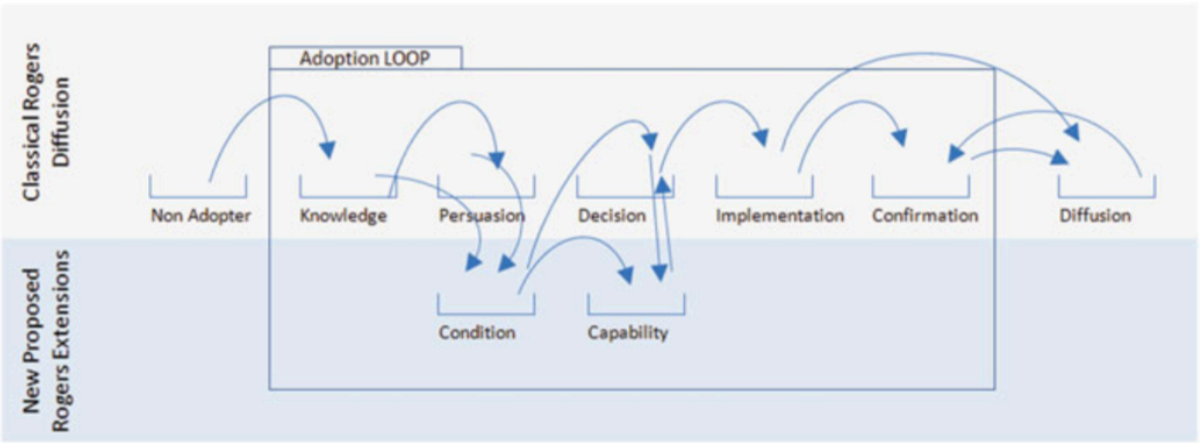


Pic. 9. Innovation diffusion with capabilities.
Copied from Behkami and Daim, 2016

The picture 10 is the comparative diagram of the decision flows in the diffusion theory of Rogers and in the new proposed model by Behkami with conditions and capabilities extension. As seen in the diagram, the former model did not include the conditions and capabilities in the decision flow. However, the new model proposed by Behkami has also a linear flow and assumption that the



Pic. 10. Comparison of decision flow in the new and old frameworks.
Copied from Behkami and Daim, 2016



Pic. 11. New extensions to the Roger's theory.
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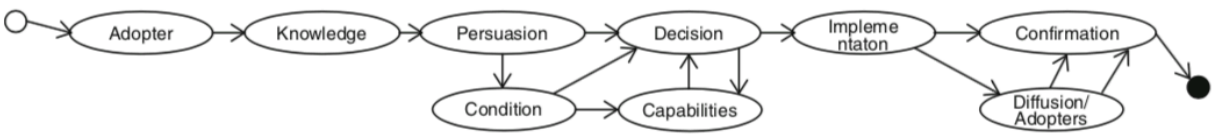


Pic. 12. The flow between the stages in the new extended framework.
Copied from Behkami and Daim, 2016

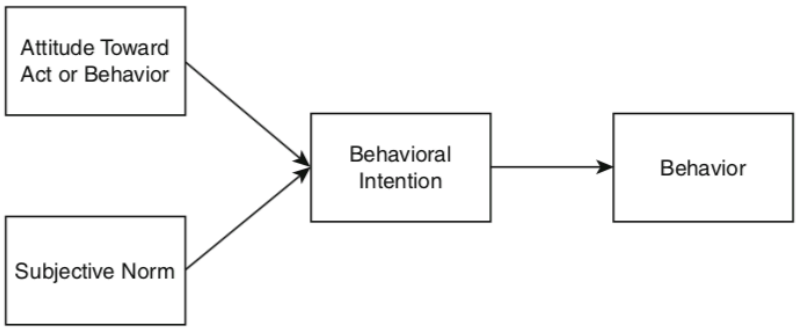
potential adopter is an independent actor, who makes only rational decisions based on logic. The model does not take into consideration the influence of external factors like institutional pressure.

The final extended framework proposed by Behkami and Daim is visualized on the pictures 11 and 12. The picture 12 indicated new extensions to the Rogers' theory with blue area. The picture 12 shows the flows between the stages.

The gaps and flaw in the theory of Rogers can be explained by the long period of its stagnation. Theory did not gain much attention up until the recent time. N.A. Behkami and T.U. Daim (2016) mention that „Rogers in his seminal work has highlighted his concern for almost overnight drop and near disappearance of diffusion studies in such fields as sociology and has called for renewed efforts in diffusion research". These two scholars argue that „the main models used for diffusion of innovation were established by 1970. The main modeling developments in the period 1970 onwards have been in modifying the existing models by adding greater flexibility to the underlying model in various ways" (Behkami and Daim, 2016). The debate and discussion of the Roger's theory is revived again in the recent areas and it blooms with new theoretical and conceptual extensions.

4.3. The Theory of Reasoned Action

Another theoretical framework that can be applied to the explanation of innovation adoption and dissemination patterns is the Theory of Reasoned Action (TRA), developed by Fischbein and Aizen and has its foundations in the theory of attitude, learning theories, expectancy-value theories,



Pic. 13. The Theory of Reasoned Action.
Copied from Behkami and Daim, 2016

consistency theories (Fischbein and Ajzen, 1975). TRA is a predictive model that describes how pre-existing attitudes, subjective norms and behavioral intentions influence onto an individual's behavior. In simpler words, it helps us to understand someone's behaviour through attitudes and subjective norms. The model is illustrated in the pic. 13 and shows that behavior (in our case adoption of innovation) is rooted in the intentions (to adopt) that are formed by the attitudes towards the behavior (towards the adoption and the innovation itself) and subjective norms (Behkami and Daim, 2016; Fishbein and Ajzen, 1975). Each of the stages are explained in detail below.

The intention to act in a certain way is the main predictor of the actual behavior: there is no behavior without intention. It is based on the assumption that any behavior has outcomes and the individual has intentions to reach those outcomes by exercising the behavior. This intention is named behavioral intention (Fishbein and Ajzen, 1975).

The behavioral intention is a sum of two components: the attitudes and subjective norms, which influence onto the intention not on an equal level. For some individuals their attitudes are more decisive, for others - the subjective norms. Some studies found the relation between the previous experience with the certain behavior and its results on one hand and the weight of attitudes on the other (ibid).

Attitude toward a behavior is either a positive or negative attitude toward a behavior, in our case adoption of an innovation. Attitude can be, however, also toward the innovation itself. Attitudes are quantifiable and measurable: there were several studies conducted in various field of application, where the individual's attitudes, desires and beliefs toward a behaviour and its results were measured (Ajzen and Fishbein, 1973).

Subjective norm is simply a positive or negative attitude toward a behavior or its results from other people around the given individual. The subjective norms influence onto the individual's intention is varied depending from the readiness of the individual to conform to opinions of the surrounding people. It is harder, but possible to measure the subjective norm. (Fishbein, 1967).

There are also three conditions that influence onto the relationship between the behavioral intention and behavior:

1. A specific behavior requires a specific behavioral intention.
2. The behavioral intention remain stable until the behavior is completely performed.
3. The individual have a full control to decide whether or not to act (ibid).

A strong correlation of attitude toward a behavior to behavioral intention as well as a strong correlation of subjective norms to behavioral intention has been confirmed in many studies

(Sheppard et al., 1988). However, the lack of correlation between the behavioral intention and the behavior itself was also shown in other research studies (Norberg et al., 2007).

There are many other gaps and limitations within the TRA. The model ignores however the social distance between the individual and other people. A closer social distance between the respondent and others could have a different effect onto the behavioral intentions in comparison to the weak social distances. Moreover, the model assumes that the surrounding is homogeneous. In fact, the surrounding can be very complex and the individual can receive even conflicting opinion and attitudes from others.

Moreover, the TRA ignores broader social institutions that may influence onto individual's behavior. Although, the model recognizes the influence of social norms, it narrows it down simply to the attitudes of others. The complexity of social norms is not taken into consideration by this model.

Other researchers have pointed out some limitations as well. For instance, the TRA model does not take into account that attitude can be a product of the subjective norms and vice versa. Moreover, there is an assumption in the TRA that the individual is independent from other factors such as time, environment, and laws (Eagly and Chaiken, 1993).

Additionally, behavioral intention seems to influence onto the behavior only in the short term. The history of older intentions appears to be ignored (Bagozzi, 1981). Other scholars mentioned the ambiguous conceptual basis, difficulty to generate hypothesis based on the TRA model, unfalsifiability, ignoring cross-cultural aspects and contexts (Park, 2000; Bagozzi et al., 2000; Ogden, 2003)

Because of the many limitations, several scholars proposed to expand the TRA. For instance, Triandis (1979) proposed additional factors that influence onto the behavior, namely habit (routine actions/behaviors) and facilitating conditions (conditions that introduces complexity and makes it more difficult to implement the behavior). He also mentioned the affect (emotional responds toward a behavior) that affects behavioral intention.

Ajzen himself later extended the TRA and introduced the theory of planned behavior that is discussed in the separate chapter. Briefly, it is the same model as TRA, but it includes another main predictor, a perceived behavior control. According to the new model the actual behavior can be influenced by many other reasons (Aizen, 1985, 1991).

Despite many gaps in the TRA, the model was successful and was used as a main framework in different studies across the disciplines. Most of these studies focus on consumer,

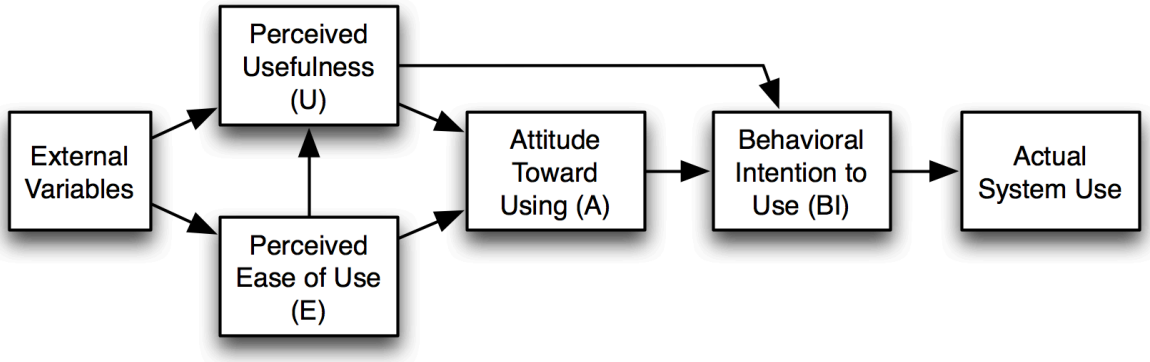
communication, health, and deviant behavior in such fields as communications, business, law and health care.

4.4. The Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis and Bagozzi, is based on the Theory of Reasoned Action that was adapted to the application in the information technology (IT). TAM explains the reasons why and how individuals (in the TAM: users) adopt a certain technology and use it (Davis, 1985).

In TAM perceived usefulness and perceived ease of use influence onto the attitude toward using which in turn affects behavioral intention to use. The perceived usefulness can also directly influence onto the behavioral intention. Moreover, the model incorporates so-called external variables. The illustration of the model is shown in the picture 14. (Davis, 1989; Davis, et al, 1989).

Perceived usefulness describes the belief of a user in the benefits of the technology and in particular in any improvements of job performance. Perceived ease of use describes the belief of a user in how easy the technology is for learning and using it. Perceived ease of use can also directly influence onto the perceived usefulness as seen on the diagram (ibid).



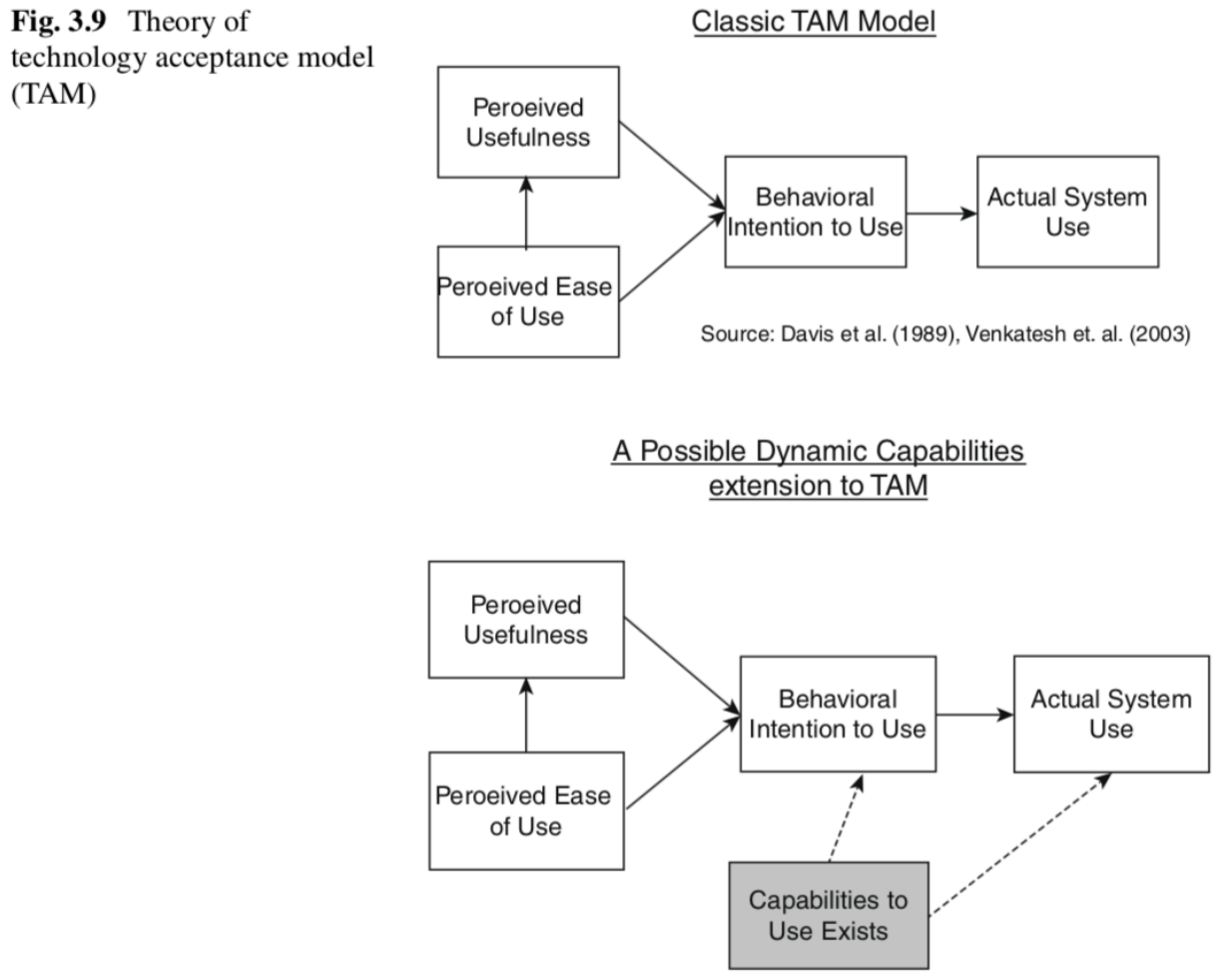
Pic. 14. The Technology Acceptance Model.
Copied from Davis, Bagozzi, and Warshaw, 1989

The limitations of TAM are similar to those of the Theory of Reasoned Action (TRA). In addition to the described criticism of TRA, „limited explanatory and predictive power, triviality, and lack of practical value“, „illusion of progress in knowledge accumulation“, „ theoretical chaos

and confusion“ because of many adaptation and extensions, overestimation of perceived ease of use were also mentioned (Benbasat and Barki, 2007; Chuttur, 2009; Bagozzi, 2007; Wu and Wang, 2005; Pikkarainen et al., 2004; Hu et al., 1999; Okafor et al, 2016).

Several scholars tried to extend the original TAM. Now there is TAM 2 and TAM 3 models, as well as Unified Theory of Acceptance and Use of Technology (UTAUT). TAM 2 in addition to the original model includes social influence (subjective norms, symbolic power, image) and cognitive instrumental processes (relevance, quality, result demonstrability). TAM 3 includes such aspects as trust and perceived risk on system use. UTAUT unifies previous modes and creates a new complex and comprehensive model (Viswanath et al., 2003; Venkatesh and Davis 2000; Venkatesh 2000; Venkatesh and Bala, 2008).

Another proposed extension to TAM was adding dynamic capabilities to the model. As seen on the pic. 15 capabilities to use exist was added to the TAM 1. The dynamic capabilities are then determinants of behavioral intentions to use and actual system use (Behkami and Daim, 2016).



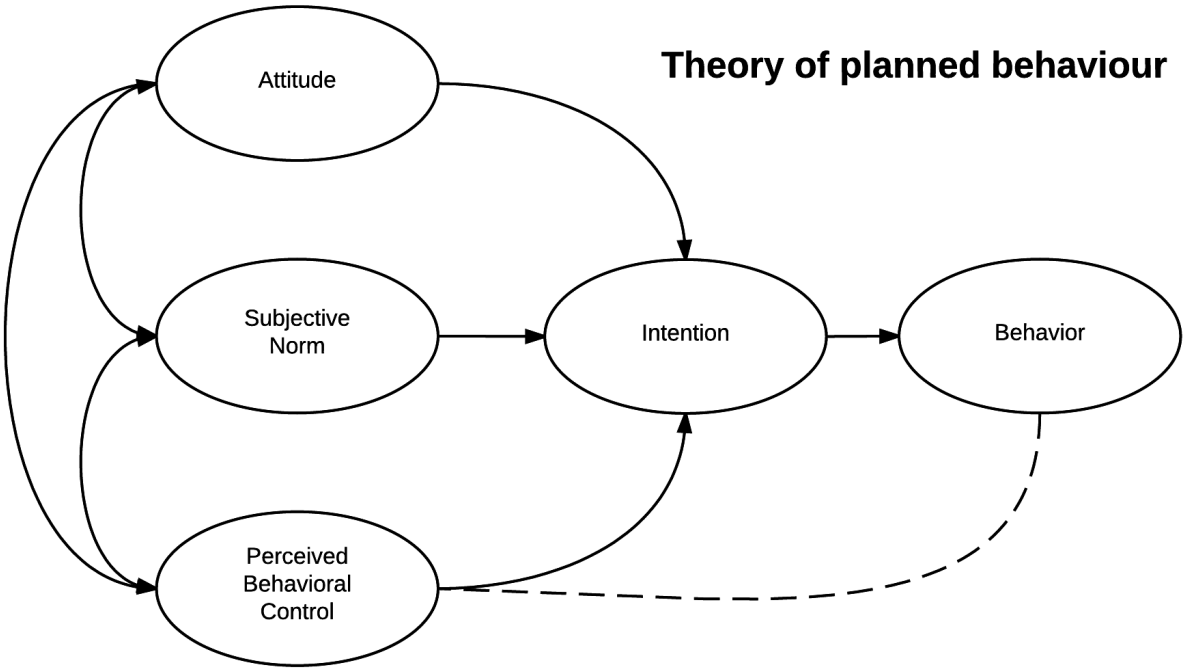
Pic. 15. Extension to the Technology Acceptance Model.
Copied from Behkami and Daim, 2016

4.5. The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is an extension and improvement of the Theory of Reasoned Action (TRA) and has origins in the psychological studies as well. TPB includes a perceived behavioral control into the model as the determinant of the behavioral intention. Unlike the TRA, TPB includes also mutual influences between attitude and subjective norm, between subjective norm and perceived behavioral control, between attitude and perceived behavioral control as seen on the picture 16 (Ajzen, 1985, 1991).

Behavioral control describes controllability: external factors and the perception of the individual on how well he/she controls his/her behavior, as well as self-afficacy: perception of the difficulty in actual performing of the behavior. This was added by Ajzen as a response to criticism that there is no strong correlation between behavioral intention and the behavior itself. In the new model, the behavioral control explains the external influences onto the behavioral intention and the behavior (ibid).

Some of the limitations of TPB reflect the limitations of TRA. Some researchers also added that the role of individual's needs, emotions during the decision-making are ignored in the TPB model (Sniehotta, 2009).



Pic. 16. Theory of Planned Behavior.
Copied from Ajzen, 1991

4.6. Context: healthcare in Germany

In order to proceed with data analysis, understanding the context of health care in Germany is also important. The following aspects of health care in Germany will be described in this chapter: structure of health care system in Germany, statistics, financing, expenditures, corruption, digitalization.

HEALTHCARE SYSTEM

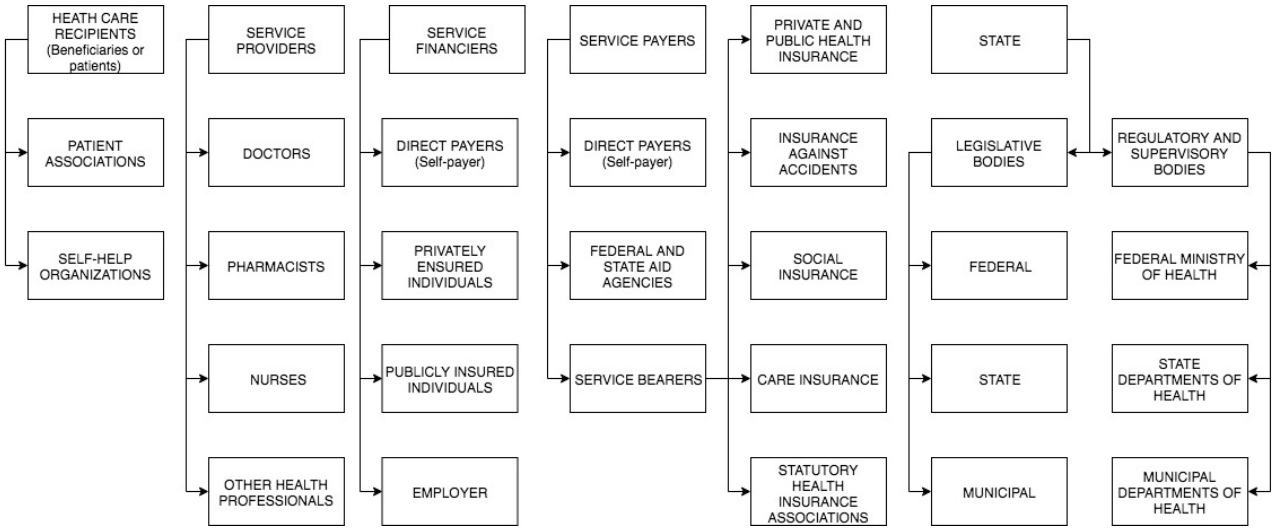
There are different ways to categorize the healthcare systems around the world. One approach is to identify the following types of healthcare systems (Reid, 2010):

- A single payer national health service model, sometimes also referred to as universal health care system, „Beveridge“ model, or national health insurance system (Examples: UK, Canada, Taiwan, Norway).
- A social insurance model, also referred to as „Bismark model“, multi-payer model, sickness funds model (Examples: France, Belgium, Netherlands).
- A market-driven healthcare system, also referred to as „out-of-pocket“ model (Example: USA)

Germany has the longest tradition of social security benefits. Its social system was already established during the Bismark's time in the nineteenth centurey, when the Germany was still an empire. Germany is considered to be the first country in the world that introduced comprehensive state-sponsored social system. In 1845 the law on health insurance was adopted that made it compulsory to have a health insurance for every working citizen. In the next few year, the new types of the insurance were also introduced (Ayass, 2010).

Nowadays, the Germany's healthcare system belongs to the social insurance model, where everyone is required to have a private or public medical insurance (Reid, 2010). The healthcare structure in Germany is visualized in the picture 17 as a UML hierarchical structure with five main components: health care recipients, service providers, service financiers, service payers, and state. The alternative names of the concepts are given in brackets. The primary healthcare system was already discussed in the Chapter 2.1, where the picture 3 visualizes the primary healthcare system in Germany.

Health care recipients can be members of patient associations and self-help organizations. Patients associations play a crucial role in protecting the rights and interests of patients. Service



Pic. 17. Healthcare system in Germany

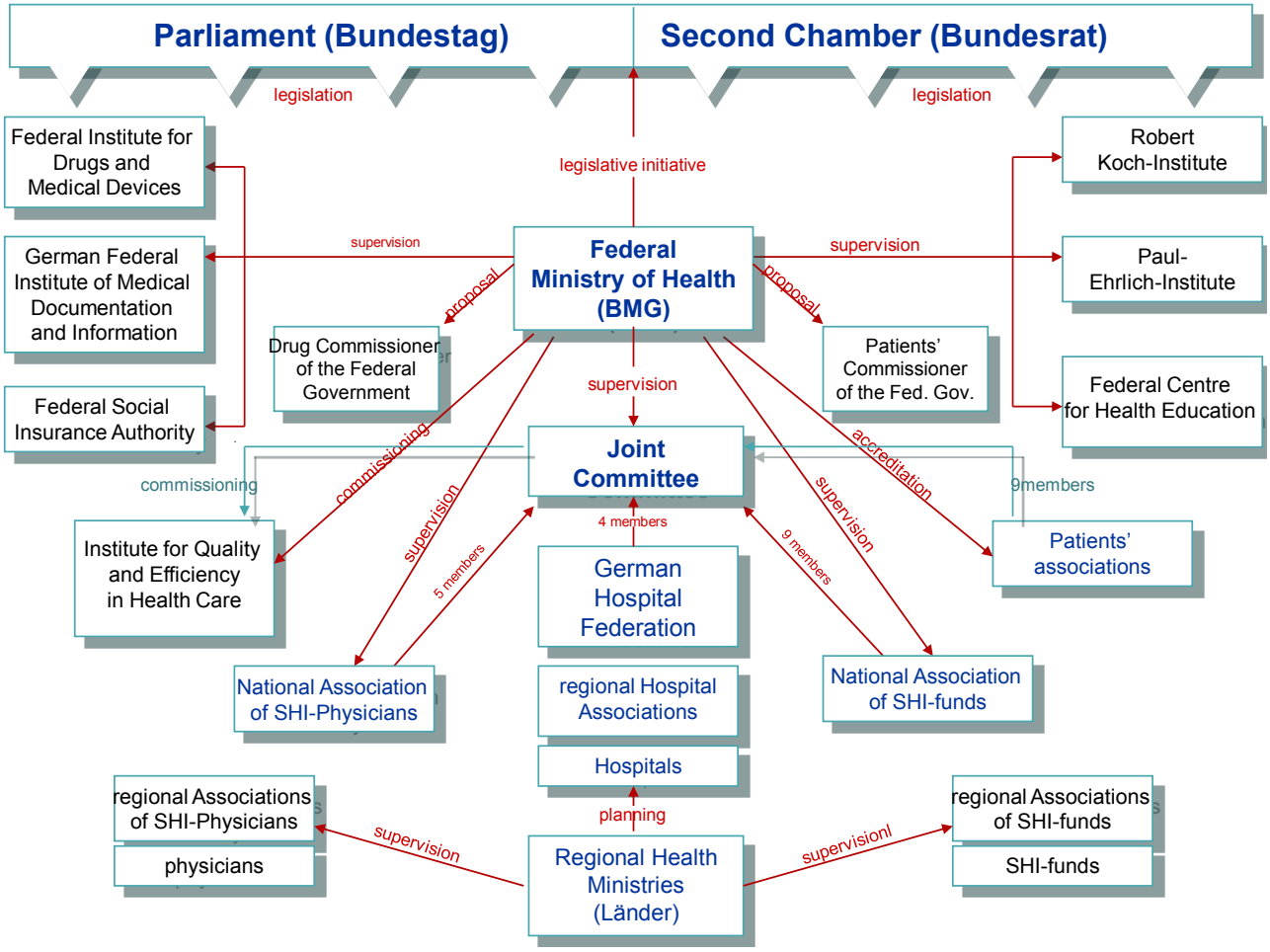
providers can include doctors, pharmacists, nurses, opticians, dentists, and other health and care professionals. Doctors can work independently in individual or group praxis (private doctor centers), as a visiting doctor or they can work in public and private hospitals (Baur et al., 2001).

There is a clear distinction between service financiers (those, who finance the health care in Germany) and service payers (those, who actually pay for the services). Service financiers include self-payers, privately and publicly insured individuals, employers. Service payers are self-payers, federal and state aid agencies, and so-called service bearers, various public and private insurance companies (ibid).

The component of state includes legislative bodies on federal, state and municipal levels, as well as Ministry of Health and local departments of health (ibid). This is a rough and very simplified structure of the health care system. Every aspect of it has complex substructures, including the relationships between them. For instance, in the picture 18 the complicated diagram of relationships of the Federal Ministry of Health (BMG, 2018) with other bodies is shown.

The picture 19 gives an overview of the internal organizational structure of the Federal Ministry of Health. It is important to notice that it has a new department on digitalization and innovation within the Ministry with the following offices:

- Telematics and eHealth,
- Legal, economic, and medical issues of telematics, patient concerns, and electronic patient acts.
- Technical issues of telematic, application of telematic
- Cybersecurity, critical infrastructures



Pic. 18. The relations of the Federal Ministry of Health with other bodies. Copied from BMG, 2018

- Innovation funds
- Federal research, research coordination and sociopolitical analysis
- Ethics in health care, health experts council.

In addition, there is an independent commissioner for data protection. This new department on digitalization and innovation was founded recently in 2018 by Jens Spahn, the current Federal Minister of the Health, and reflects the general focus of the whole federal Government on innovation and digitalization (BMG, 2018; DATEV, 2018).

Except of public hospitals the healthcare services are largely provided privately. Outside the hospitals, independent and private entities such as praxis, medical practitioner offices, and pharmacists as well as private companies such as the pharmaceutical and medical technology industries dominate the healthcare landscape in Germany. Hospitals are often still run by non-profit organizations, but there is a tendency that hospitals are being privatized. The state participates as a service provider only in the form of health departments, municipal hospitals or university hospitals.

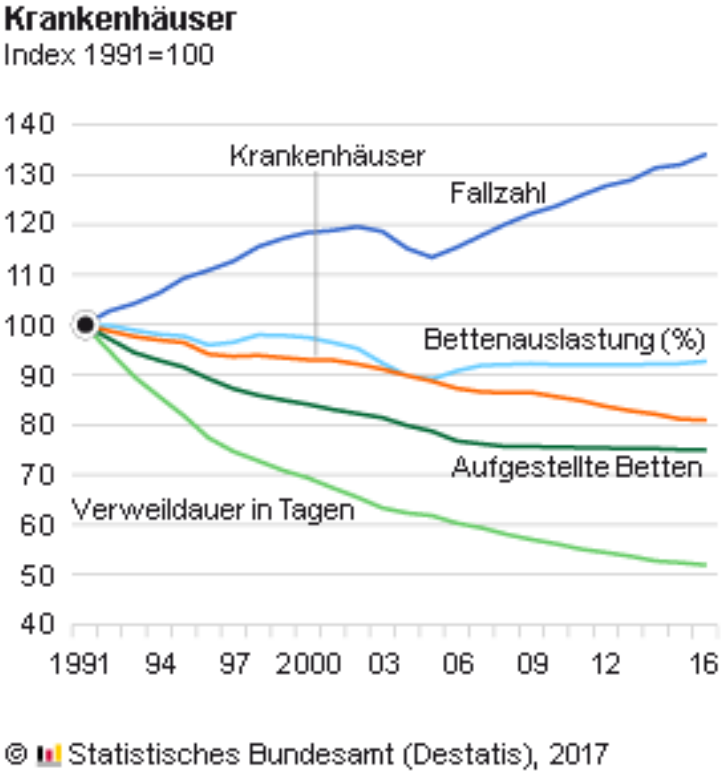
Outpatient and inpatient sectors work almost isolated from each other. Critics complain that this leads to inefficient treatment (Baur et al., 2001).

STATISTICS: HEALTH CARE SYSTEM

Personnel density in Germany is above the OECD average. In 2016, there were 377 000 doctors and 74 000 dentists (Destatis, 2017). The total number of health care personnel is 5,5 million people, which is about 10% of all employees in Germany (ibid). 20,7% of the total personnel works in hospitals, 12,5% in praxis, 6,6% in ambulant care (ibid). 75.8% of the total personnel are women (ibid).

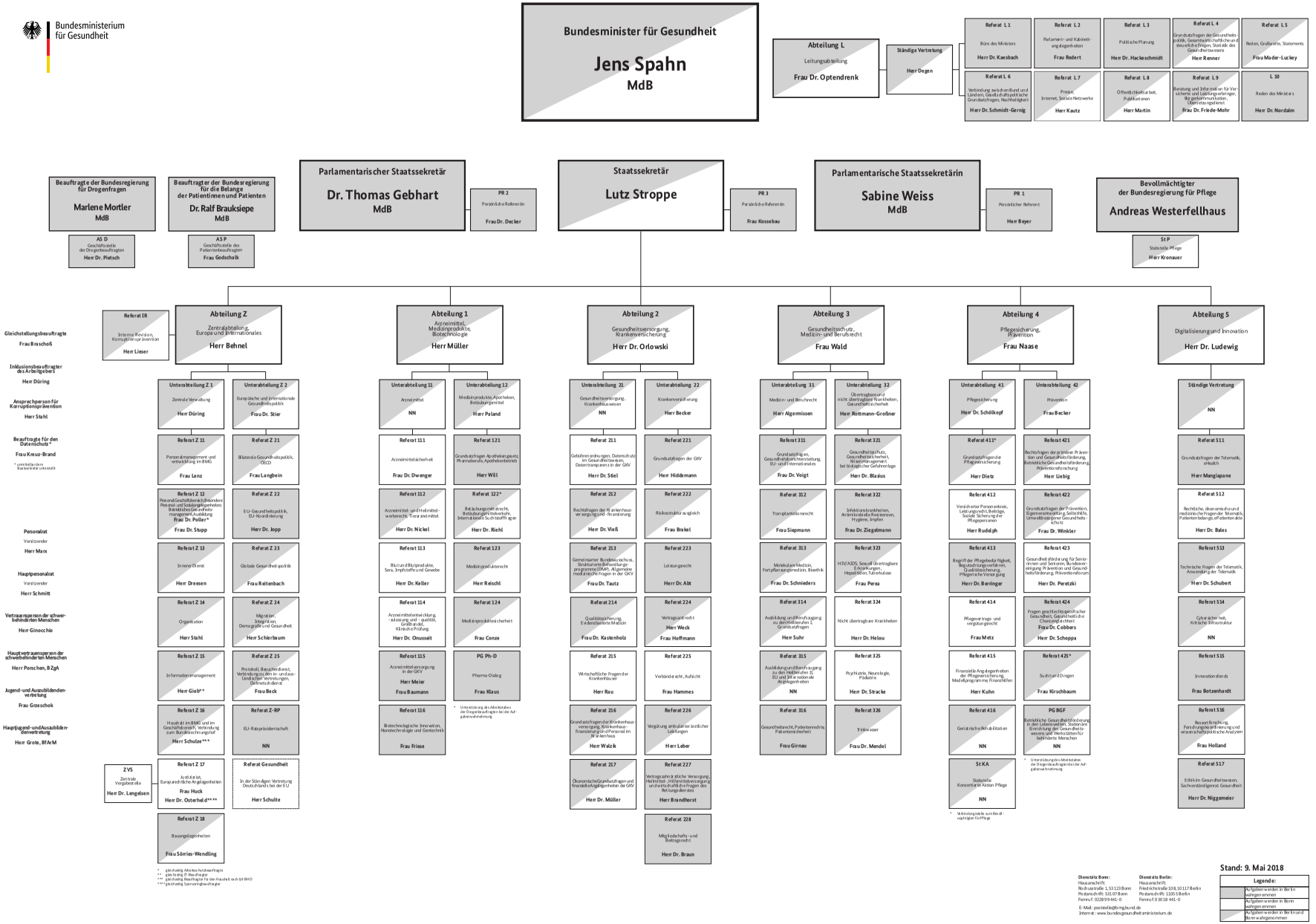
Statistics regarding the hospitals show that the number of hospital beds, the average hospital beds occupancy, and the length of stay have been decreasing steadily since 1991 despite of the ever increasing number of patients in the hospitals and of treated cases (See the pic. 20). This can be explained by the better productivity of hospitals and probably by the digitalization and adoption of various innovations. Quantitive research that will explore this possible causality is needed.

Number of hospital beds in 2015 was 8.1 beds per 1000 inhabitants (ibid). Treated cases in hospitals in 2016: 19.5 million (ibid). Average length of stay in the hospital in 2016: 7.3 days (ibid). The total average occupancy of hospital beds in 2016: 77,9% (ibid).



Pic. 20. The Hospitals in Germany. Copied from Destatis, 2017.

Krankenhäuser - hospitals;
Fallzahl - treated cases;
Bettenauslastung - occupancy of beds;
Aufgestellte Betten - available beds;
Verweildauer in Tagen - average length of stay in days;



Pic. 19. The organization structure of the Federal Ministry of Health.
Copied from BMG, 2018

Some other important indicators concerning the structure of health care system in Germany are provided in the table below.

Table 9. The structure of healthcare system in Germany: statistics

Indicator	Value	Date of the source	Source
Number of hospitals	1143000	2016	Destatis
Stationary and partially stationary care	697000	2016	Destatis
Praxis	687000	2016	Destatis
Praxis of other medical specialists	505000	2016	Destatis
Ambulant care	365000	2016	Destatis
Pharmacies	225000	2016	Destatis
Pharmaceutical industries	155000	2016	Destatis

GENERAL HEALTH INDICATORS

In comparison to other OECD countries, general health of the German population lies around the OECD's average as shown in the table 10. As in other high-income countries, the main causes of death are noncommunicable and degenerative diseases as illustrated on the picture 21.

Table 10. General Health Indicators in Germany

Indicator	Value	Date of the source	Rank in comparison to other OECD countries	Source
Life expectancy at birth	78.3 years	2015	Around the average	OECD
Life expectancy at 65	21 years	2015	Lower than the average	OECD
Infant mortality rates	3.3 deaths per 1000 live births	2015	Lower than the average	OECD
Potential years of life lost	2880 per 100000 inhabitants	2014	Lower than the average	OECD
Deaths from cancer	201 per 100000 inhabitants	2014	Higher than the average	OECD

Indicator	Value	Date of the source	Rank in comparison to other OECD countries	Source
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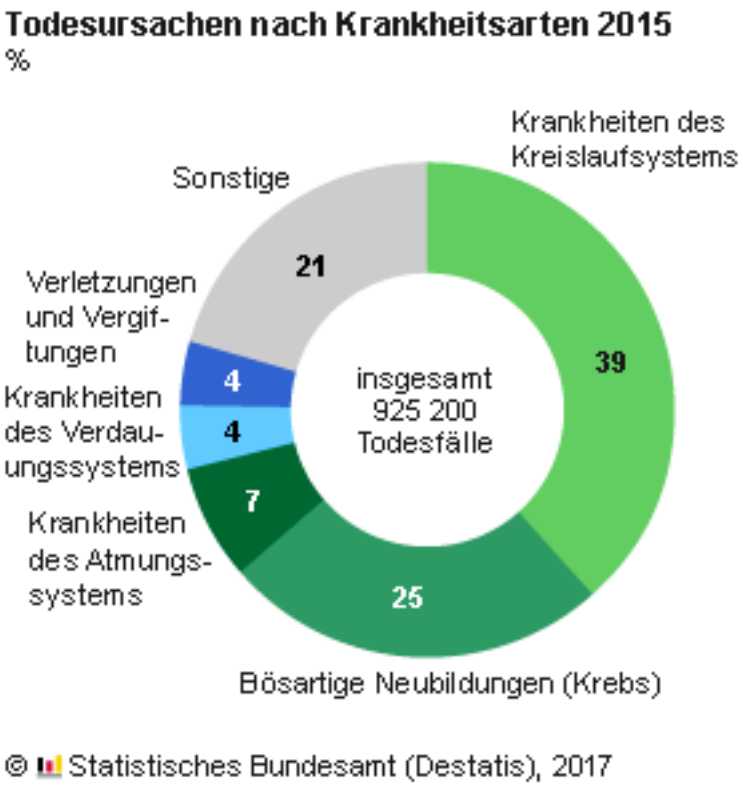
Life expectancy at 65	21 years	2015	Lower than the average	OECD
Infant mortality rates	3.3 deaths per 1000 live births	2015	Lower than the average	OECD
Potential years of life lost	2880 per 100000 inhabitants	2014	Lower than the average	OECD
Deaths from cancer	201 per 100000 inhabitants	2014	Higher than the average	OECD
Suicide rates	10.8 per 100000 inhabitants	2014	Lower than the average	OECD
Overweight or obese population	60% of population aged 15+	2012	Higher than the average	OECD



Pic. 21. The Causes of Death according to the disease types in 2015.
Copied from Destatis, 2017.

Krankheiten des Kreislaufsystems - Diseases of the circulatory system;

Bösartige Neubildungen (Krebs) - Malignant neoplasms (cancer);

Krankheiten des Atmungssystems - Diseases of the respiratory system;

Krankheiten des Verdauungssystem - Diseases of the digestive system;

Verletzungen und Vergiftungen - Injuries and poisonings;

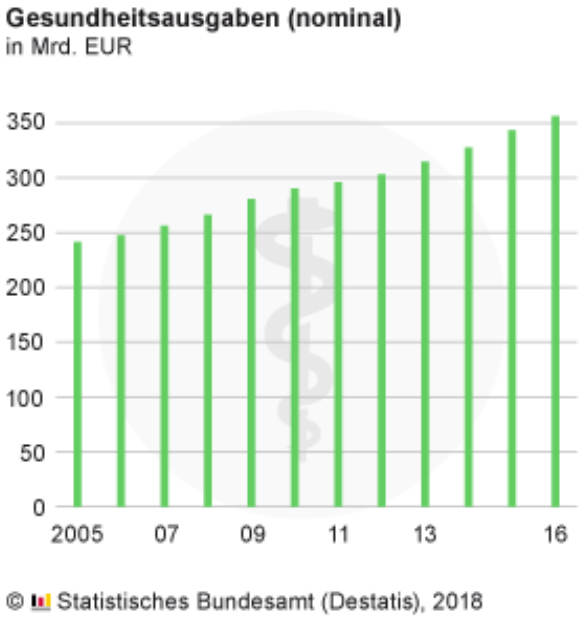
Sonstige - Other.

HEALTH EXPENDITURE

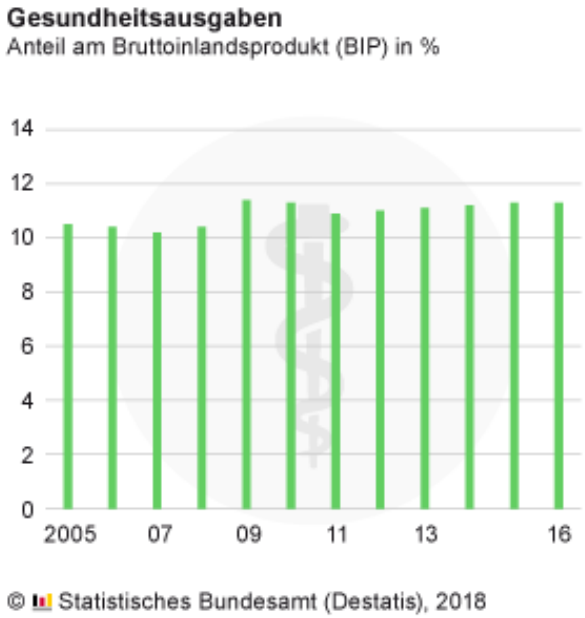
Compared with health expenditure in OECD countries, Germany ranked fifth in 2016 after the USA, Switzerland, Luxembourg and Norway. In 2016, the average health spending is 5 551 USD per capita (OECD, 2017) or 356,5 billions EUR or around 2,700 EUR per person (Destatis, 2017) accounting for around 10% of GDP. The German health system is thus one of the most expensive in the world. The public sector contributed around 77% of these costs, when OECD average comprises 73% (OECD, 2017). As illustrated on the pictures 22 and 23, the health expenditures in Germany have considerably increased since 2005, however it stays always around 10-12% of total GDP since 2005.

The total expenditures of hospitals in 2016 equals 101,7 milliard EUR (Destatis, 2017). The most of the expenditures are spent to treat noncommunicable diseases: in 201513,7% of all costs went for cure of diseases of the circulatory system; 13,1% for mental diseases and behavioral disorders; and 10,1% for musculoskeletal disorders (Destatis, 2017).

111 billion euros or 47% of all medical expenses were spent in 2006 for the treatment, rehabilitation or care of people over 65 (approximately 17% of the population). This is 6,910 euros per capita compared to 1,880 euros for the younger people (Destatis, 2017). The demographic shift



Pic. 22. Health expenditures (nominal) in Billions EUR
Copied from Destatis, 2017.



Pic. 23. Health expenditures as a percentage of GDP in %.
Copied from Destatis, 2017.

of fast growing part of the older population is one of the urgent challenges in the Germany's healthcare that puts large financial pressures onto the whole social security system (Baur et al., 2001).

All medical expenses could divided into two groups: direct and indirect costs. The direct costs includes those expenses that are directly related to the treatment of diseases. The direct costs include drug costs, laboratory costs, hospitalization costs, etc. The indirect costs are incurred, when an individual's working time is reduced due to the illness. They also count such intangible aspects as a loss of quality of life which is more difficult to calculate. The indirect costs of illness can significantly exceed the direct ones (ibid).

FINANCING HEALTH CARE

The largest part of the German population is insured by the statutory health insurance (GKV, gesetzliche Krankenversicherung). The contributions of insured individuals to GKVs are calculated according to the level of his or her income. Family members (a partner or children) are insured without any contribution under certain conditions. The entitlement to benefits is independent of the amount of the contributions paid (PKV, 2017).

About 10.5% of the population is privately insured (ibid). In this case the contributions of the insured individuals are based on the agreed scope of services, the general state of health and the retirement age. 2.3% of the population is covered by other means, e.g. members of the armed forces, civil service providers, welfare recipients (ibid). Only about 0.1% to 0.3% are without any health insurance coverage (ibid). Health insurance contributions, with some exceptions, were shared equally between employees and employers until 30 June 2005. Since 1 July 2005, the contribution rate of the employees has been 0.9 percentage points higher than that of the employer (PKV, 2017).

In addition to the payments from private and statutory health insurance, patient co-payments became a growing part of the healthcare financing. In some areas, grants or co-payments are provided by the state or non-profit organizations. Moreover, outside of the insurance system, a significant healthcare market has been developed with individual health services" (IGeL, Individuelle Gesundheitsleistungen), fitness and wellness, anti-aging and cosmetic surgery, non-reimbursable medicines, and alternative medicine (Baur et al., 2001).

CORRUPTION IN HEALTH CARE

The German health care system is repeatedly criticized for corruption that causes billions euros in damages (Transparency International Deutschland e.V., 2017). According to findings of the Federal Criminal Police Department, public health officials are among those most affected by corruption (BMI and BMJ, 2006). In 2004, for example, one pharmaceutical company had paid doctors and hospital staff throughout the federal territory of Germany with a purpose to increase the sales of its drugs. The Federal Court of Justice has denied later in 2012 any allegations of corruption against most of the doctors, since the physicians in private praxis are private, independent freelance service providers and not public officials, which means they are not a subject of corruption. This gap was addressed by lawmakers in 2016, when they introduced the Act to Combat Corruption in Health Care (BMI and BMJ, 2006).

Another example is from 2013, when 59 out of 134 health insurance companies were criticized and went through the meticulous checks by the federal authorities. They were suspected of manipulation and misinforming about the illnesses of their members in order to receive more contributions due to the „increased" sickness rates (BMI and BMJ, 2006).

Transparency International's estimations of the annual damage caused by fraud, waste and corruption in the German health system are about 6% of the total budget (Transparency International Deutschland e.V., 2017).

DIGITALIZATION OF HEALTH CARE

In comparison to other OECD states, Germany shares the leading role in ICT and Research with 5 other countries (OECD, 2017). The Table 11 visualizes the main indicators in the spheres of ICT and research in Germany.

Table 11. Some indicators on ICT and research in Germany

Indicator	Value	Date of the source	Rank in comparison to other OECD countries	Source
Gross domestic spending on R&D	2.9% of GDP	2015	Higher than the average, 6th place	OECD
Triadic patent families	78.6 per 1000 inhabitants	2015	Higher than the average, 4th place	OECD

Indicator	Value	Date of the source	Rank in comparison to other OECD countries	Source
Researchers	9.2 per 1000 employed	2016	Higher than the average	OECD
Government researchers	13.5% of national total	2016	Higher than the average	OECD
ICT value added	5.1% of value added	2011	Less than the average	OECD
ICT employment	4 %	2011	Higher than the average	OECD
ICT investment	13 %	2010	Lower than the average	OECD
ICT goods exports	61 850 USD	2012	Higher than the average, 4th place	OECD
Internet access	92.9% of all households	2017	Average	OECD

Germany is also one of the pioneers in the digitization of health care. The Federal Ministry of Health started so called, ambitious comprehensive „digitization offensive“. Germany has already introduced the digital health card (e-card) into practice (even though the e-card has some considerable limitations) and has adopted a unique e-health law (EHG) that includes all three future fields of digitization - eHealth (electronic health), mHealth (mobile health) and telemedicine (Auer, 2017).

The ruling coalition, the Christian Conservatives (CDU and CSU) and the Socialists (SPD), has agreed upon the coalition document that puts digitalization of all spheres into focus (CDU, 2018). The new eHealth Strategy for Germany with twelve points on digitalization of health care was developed. Those twelve points are (CDU, 2018):

1. Pave the way to a self-determined patient through eHealth
2. Strengthen citizens' digital health literacy
3. Enable networking of all stakeholders in the healthcare sector in the long term
4. Bring networked digital medical care into the action
5. More transparency and efficient regulation
6. Strengthen Germany as an innovative spot for health care digitalization
7. Privacy and security
8. More effective use of big data for healthcare and research
9. Ensure interoperability based on recognized standards

10. Use the potential of digitization for savings the healthcare costs and weakening the administrative burden
11. Ensure Germany's contribution into the development of global health information and communication technologies
12. Address the ethical challenges of digitalization and preserve solidarity principles of health care and health insurance.

The rapidly expanding world of health apps also deserves attention. There is a growing number of start up software companies in Germany that develop various health apps and other technologies for various stakeholders. The Government of Germany plans to introduce an independent federal authority for app certification in order to introduce some regulation into the yet unregulated sphere of mobile- and web-based health apps (Auer, 2017)..

Germany has already introduced the law in 2017 that allows video-consultations between doctors and patients as a part of Telemedicine policy. This should lessen the administrative and financial burden onto healthcare system and cut the waiting times for patients (Auer, 2017).

The stance of the German Government, and the Ministry of Health in particular, is very optimistic regarding the future of healthcare digitalization in Germany. Jens Spahn, the new minister of health, paid special attention to the topic of digitalization in his inauguration speech. In 2016 he also published a book „App from the doctor: lesser health through digital medicine“ and called for the „medical revolution“ by which he meant the digitalization of healthcare (KV Blatt, 2018).

5. Research findings and discussion

5.1. Thematic analysis and conceptual framework

There were three main stages of data collection. The first stage was during the two-days observation in the team praxis in Berlin, when the researcher „played“ the role of a patient. A dozen of pages of pure text full of researcher's notes with observations, thoughts and ideas as well as technical manuals were collected. Because of the restricted time and the ethical concerns (see the chapter on the ethical considerations) the researcher had to limit the focus onto the available ICT technologies, their functionalities and nonfunctional characteristics like user-friendliness, ease to use, reliability, etc. The researcher focused also on how people in the praxis use those technologies, what they say and think about those technologies during the private conversations, how interaction is shaped among them and other stakeholders thanks to ICT technologies and many other aspects. Two days in the praxis helped to get to know future interviewees, build some trust with them, as well as understand the context better.

The second stage was conducting face-to-face semi-structured interviews with some team praxis members. This was the first richest data that was collected during total 10 hours of interview. Some of the concepts/themes in the resulted conceptual and thematic frameworks are grounded in that data. Some preliminary coding and data analysis, in this case building concepts, was done after the first and the second stages of data collection.

The third stage of data collection was with external stakeholders: a representative of the ICT company that provides software to the interviewed and observed team praxis, two health care recipients/patients that visited the observed team praxis, one official in the municipal health department, two independent ICT and healthcare consultants. This part was richer in content and generated more codes than the first two stages of data collection even though totaling into approximately the same amount of time for the interviews. Most of cocnepts/themes in the resulted conceptual and thematic frameworks are based upon the data from interviews with these individuals.

The transcribes were coded using the special software QCAmap: http://www.qualitative-content-analysis.org. The software turned out to be very useful because of several features it offers for coding the transcripts, namely content analytical technique, counting the codes, level of abstractions, multiple categorization, definitions of concepts and categories, coding guidelines with definition and anchor examples.

In the result of open and selective coding, the following hierarchical structure (thematic or conceptual framework), so called Hierarchy of Themes, was developed:

1. Innovation adoption process
    1. Getting to know about the innovation
        1. Sources of awareness: where?
            1. Fellow peers and colleagues
            2. Patients
            3. Organisations
                1. Other praxis
                2. Hospitals
                3. Departments of Health
                4. Insurance companies
                5. ICT companies
                6. Consultancy firms
                7. Universities
                8. Nongovernmental organizations
            4. Events
                1. Conferences
                2. Seminars
                3. Fairs
            5. Trainings
            6. Professional and academic literature
            7. Media
                1. Television
                2. Newspapers, magazines
                3. Internet and online social networks
        2. Time and context: when? and how?
            1. The focus of the conversation or event
                1. On innovations and digitalization of healthcare
                2. On unrelated topic
            2. Readiness and maturity of the adopter for the innovation
                1. The potential adopter was already actively searching for potential solutions of his/her problems or needs
                2. The potential adopter was not searching for potential solutions of his/her problems
                    1. The problem or need is not urgent
                    2. Unawareness about the existing problem(s) or needs
        3. The nature of information: what? and how?
            1. Disadvantages and risks mentioned
            2. Advantages mentioned
            3. Good practices mentioned
        4. Challenges
            1. Limited information available
            2. Limited opportunities to find out about innovations
            3. Limited financing of awareness campaigns
            4. Lack of information sharing between various stakeholders

    2. Intention to adopt and learning more about the innovation
        1. Sources of learning
            1. Fellow peers and colleagues
            2. Organizations
                1. ICT companies
                2. Consultancy firms

            3. Nongovernmental organizations
        3. Events
            1. Conferences
            2. Seminars
            3. Fairs
        4. Trainings
        5. Professional and academic literature
            1. Books
            2. Manuals
            3. Magazines
            4. Internet
    2. Challenges
        1. Difficulties in finding information
        2. Complex information with new terminology
        3. Lack of time to learn
        4. Lack of information sharing between various stakeholders

3. Making decision to adopt
    1. Process
        1. People involved
            1. Individual
            2. Collective, organizational
        2. Time involved
            1. Careful decision
            2. Quick decision
    2. Incentives. Why to adopt?
        1. Efficiency, productivity
            1. Costs reduction
            2. Administrative burden reduction
            3. Reduction in time spent for each patient
            4. Coordination of treatment and care
        2. Quality of patient care
            1. Accessibility to health care
            2. Patient engagement
        3. Properties of the ICT innovation
            1. Low cost
            2. Broad functionality
            3. Protected security, privacy
            4. Easiness to use
            5. Compatibility with other systems
            6. Reliability (little system failures, fast system)
            7. Reputation of the ICT innovation and its company
        4. Urgency and nature of the problem or the need
        5. Praxis characteristics
            1. Previous adoption experience of ICT innovations
            2. Financial capacities
            3. Type of patients: privately or publicly insured
            4. Size
            5. Geography: rural area or city
            6. Specialization and types of services provided by the praxis
            7. Strong leadership
                1. Positive attitude towards innovation
                2. Active involvement in decision making
        6. Ecosystem and external pressures
            1. Peer pressure

2. Trends, fashion
3. Legal requirements
4. State incentive programs
    1. Tax cuts
5. Available additional funding
6. Geography
    1. High concentration of ICT companies
    2. High concentration of doctors and other praxis
    3. Good economic situation in the area
    4. Existence of „creative class“ in the area
7. Culture and values
    1. Benefit for the whole society
        1. Population health

3. Barriers and obstacles. Why not to adopt?
    1. Concerns regarding the patient’s data protection and safety of the systems
        1. Lack of resources to develop secure systems
    2. Lack of legal and policy regulations. Unclear regulations
        1. Unclear ownership of the system
        2. Data protection laws
    3. Cultural barriers
        1. Cultural concern for data privacy. Fear of data leakage.
        2. Negative attitudes from surroundings
    4. Poor quality of ICT systems
        1. Complexity of ICT systems
        2. Not user-friendly systems
        3. Lack of compatibility with other systems
            1. Lack of standardization
    5. Resources needed for compulsory or recommended training
        1. Financial resources
            1. No external funding available
        2. Time
    6. Poor quality of trainings
        1. A lot of new unknown terminology
        2. Poor quality of trainers
        3. Poor quality of training materials
            1. Little visuals
            2. Difficult language
            3. A lot of amount of material
    7. High costs associated with adoption and maintenance
        1. Lack of market competition between the suppliers
    8. Mismanagement and organizational issues
        1. Lack of the interest from the decision makers
        2. Conflict of interests
        3. Lack of engagement and poor communication between the stakeholders
        4. Lack of IT specialists within the praxis
        5. Lack of planning
            1. Lack of review of the innovative position of the praxis
            2. Lack of strategy on innovation or digitalization
        6. Poor decision-making
            1. Lack of costs-benefits analysis
            2. Lack of calculation of return on investment
            3. Lack of transparency in the decision-making
    9. Characteristics of the doctor and the praxis team
        1. Years of medical experience

2. Age
3. Gender
4. Insufficient knowledge or fear of technologies
5. Inability to think long-term
6. Negative attitude towards technologies
7. Organizational skills
8. Fear of change, need for certainty

4. Adoption
    1. Process
        1. Search among the providers
        2. Selection of the innovation provider
        3. Agreement with the innovation provider
        4. Installation
        5. Training

    2. Challenges and coping strategies. What makes it difficult to adopt?
        1. Complexity of ICT systems
        2. Lack of time
            1. For the search and selection stages
            2. For agreement stage
            3. For installation and training stages
        3. Lack of training or poor quality trainings
            1. A lot of new unknown terminology
            2. Poor quality of trainers
            3. Poor quality of training materials
                1. Little visuals
                2. Difficult language
                3. A lot of amount of material

5. Maintenance
    1. Challenges and coping strategies
        1. Costs for maintenance
            1. High fees for maintenance, support and/or update, as well as for additional feature like compatibility with other systems
            2. No external funding available
            3. Time
            4. Human resource
        2. Lack of expertise or training
        3. Dependance on externe experts
        4. The innovation is not updated or optimized
            1. Feedback is not provided from the user
                1. Lack of collaboration or quality communication between the ICT provider and the user
                2. Lack of trust
        5. Cumbersome maintenance
            1. Low quality maintenance service
                1. Long waiting times
                2. Communication issues between the ICT provider and the user
                3. Mode of the service consultation
                    1. Per phone
                    2. Per chat
                    3. Personal visit of the specialist
    2. Process
        1. Finding gaps in the ICT
        2. Feedback to the ICT provider
        3. Facing problems with the ICT

4. Contacting and receiving assistance from the ICT provider

6. Evaluation and confirmation
    1. Outcomes
        1. Types of outcomes
            1. Expected positive
            2. Expected negative
            3. Unexpected positive
            4. Unexpected negative
        2. Nature of outcomes
            1. Administrative burden
            2. Change of interactions and communications
                1. Within the praxis: between the team members of the praxis
                2. Outside of the praxis
                    1. Praxis-patient interactions
                    2. Praxis-praxis interactions
                    3. Praxis-hospital interactions
                    4. Praxis-insurance interactions
                    5. Praxis-ICT company interactions
                    6. Praxis-farmacy interactions
    2. Satisfaction

7. Communication
    1. Communication channels
        1. Peer-to-peer, mouth-to-mouth
8. Rejection
    1. Reasons
        1. Lack of intention to adopt
        2. Lost intention to adopt
        3. Challenges during the adoption stage
        4. Challenges during the maintenance stage

2. Six questions or identifying aspects
    1. The ICT innovation systems: what?
        1. Software systems
            1. New web and mobile applications for doctors or patients
            2. Health management systems for praxis
            3. Telematics systems
        2. Hardware systems
            1. New medical devices
        3. Complex hardware/software systems
            1. Federal electronic health record
            2. Electronic prescriptions
            3. Electronic health card (eGK)
        4. Artificial intelligence and pattern recognition systems
        5. Big Data

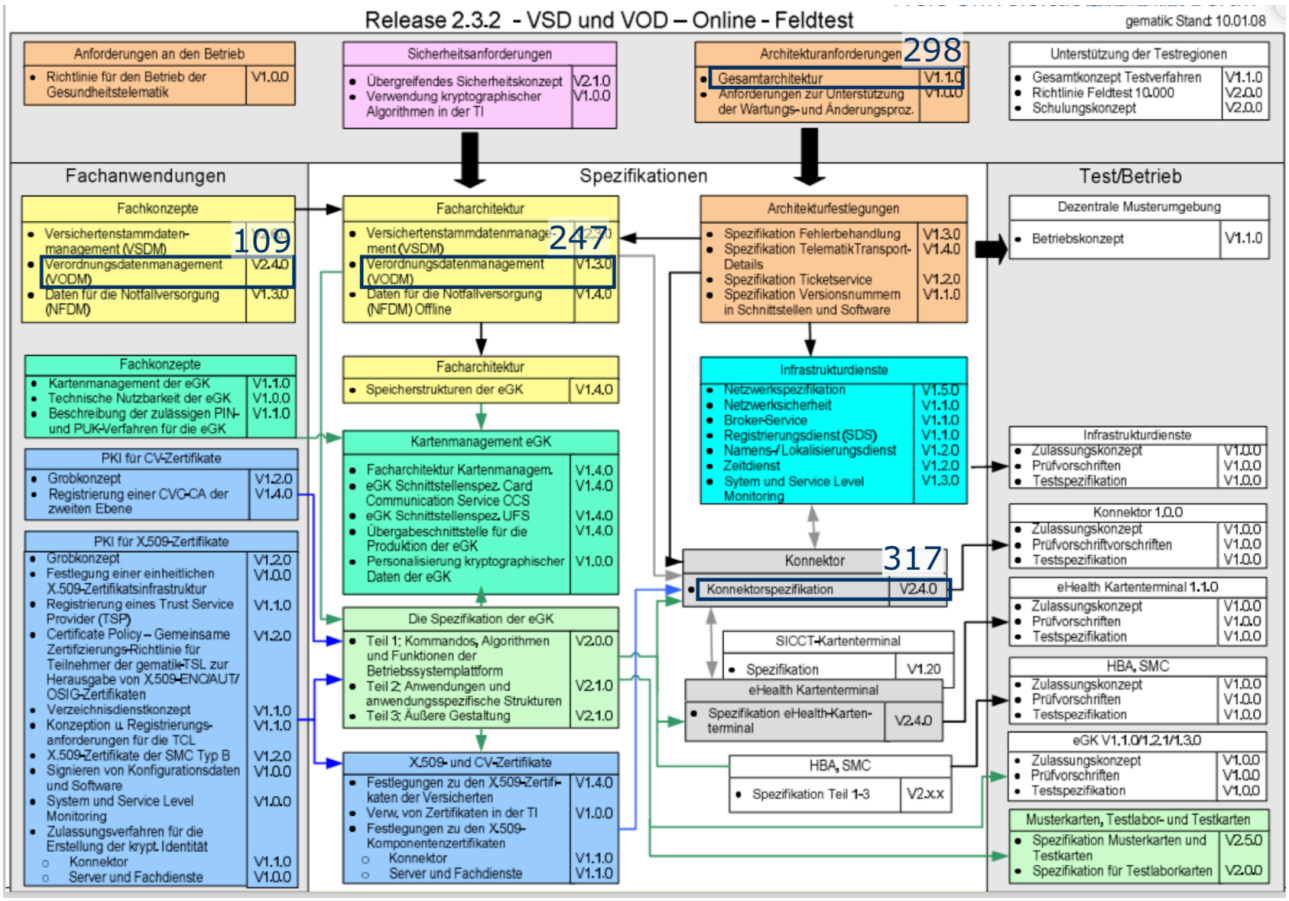
    2. The stakeholders: who?
    3. Time: when?
    4. Space: where?
    5. Reasons: why?
    6. Process: how?
3. Hierarchies
    1. Levels of hierarchies
        1. Macrolevel: state level; policies and laws

2. Mesolevel: industry level, relations between the organizations
3. Microlevel: individual and organization level, relation between the individual

2. Flows within and between hierarchies
    1. Resource flow: who pays whom for innovation adoption and dissemination?
    2. Influence flow: standards-setting, policy, decision-making.
    3. Information flow: information sharing, feedback, consultations, etc.

As seen from the conceptual/thematic framework shown above, there are many conceptual hierarchies and there is a profound complexity of the different aspects in the ICT innovation adoption and dissemination. Many less relevant aspects in the above-mentioned conceptual/ thematic framework were taken out in order to simplify the framework.

If we take one concept, like a software reliability for instance, we will face a new conceptual framework that will discover the issue itself (what is reliability? How to measure it? etc.), the challenges and possible influences/causes associated with it (how to make sure that the software is reliable? What may influence onto the reliability? Why are some systems not reliable?), the stakeholders (who is affected? Who is responsible?), the process, space and time considerations (what are time limitations? who builds the system? how to build a reliable system? how to test it?).



Pic. 24. The example of complexity: the documentation landscape of eGK. Copied from BMG, 2018.

For each concept in the Hiearchy of Themes these questions are to be asked: what? Who? When? Where? Why? How?

The great example of the complexity is electronic health card (eGK) in Germany that was suppose to make electronic subscription possible, save emergency data on the card, the history of prescriptions, and even the complete medical history. In 2002, the Government made a plan of action, but the introduction of the card was implemented in 2008 instead of planned 2005. The card has now only basic functionality: it saves the basic information about the holder: name, address, etc (BMG, 2018).

The failure to introduce the card with full expected functionalities was not possible, because of the complexity of many aspects: complexity of the healthcare system, complex legal environment, complicated requirements. The documentation landscape of this project is therefore extremely complex and totals to more than 2.000 pages as illustrated on the picture 24. The marked areas on the picture are given as arbitrary examples of how many pages the documents contain. For instance, the connector specifications document contains 317 pages (BMG, 2018).

The relations between the concepts are even more complex. The above-mentioned theoretical framework explores only hierarchical relations, but ignores complexity of relations across hierarchies.

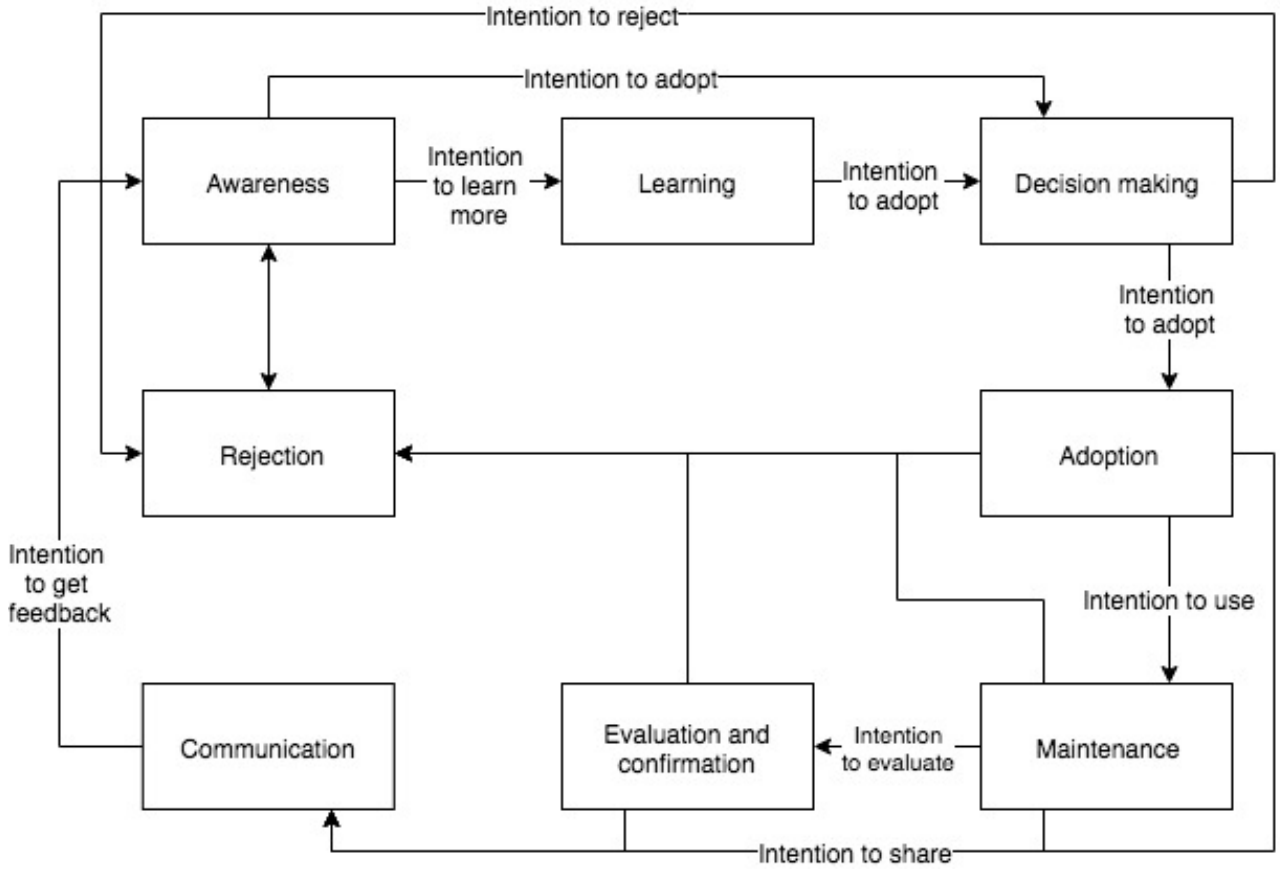
Taking into consideration the complexities in every concept and on every level of the conceptual framework discussed above, we can identify the following main conceptual frameworks:

1. Process of the ICT innovation adoption and dissemination (see picture 25),
2. Barriers and challenges in adoption, implementation and dissemination of ICT innovations
3. Incentives and needs in adoption of ICT innovations,
4. Hierarchal structures and the resource, information and influence flows between and within those structures.

The first conceptual framework (pic. 25) is similar to the Roger's theory on diffusion of innovation. It also shows the main stages of innovation adoption process. However, the main difference is that the new model incorporates and explains both processes: innovation adoption and, partially, innovation diffusion.

The first stage is awareness that is similar to the knowledge stage in the Roger's theory. As in the knowledge stage, a potential adopter gets to know about the ICT innovation. Unlike in the Roger's theory, the person is not only aware of the innovation, but has also a basic understanding

and opinion regarding it in the end of the stage. Also, the individual can reject the innovation immediately, but later he/she can get and build a better awareness of it and eventually develop the intentions to learn more or adopt.



Pic. 25. The ICT innovation adoption and dissemination model.

Like in the theories of planned behavior, reasoned action and of technology acceptance model, the potential adopter develops behavioral intentions after each stage. For instance after the awareness the potential adopter has an intention to learn more, or even to adopt immediately.

The awareness stage is followed by the learning stage which is similar to persuasion stage in the Roger's theory. The potential adopter had an intention to learn more about the ICT innovation, because he was interested in it. He actively searches for more information during this stage using various sources described in the hierarchical list of themes provided earlier in the text. In the end of active learning, the potential adopter develops behavioral intention to adopt.

The next stage, decision making, is crucial for the model. Like in the Roger's theory, the individual makes a decision based on a plethora of factors: his/her incentives, needs, potential barriers, risks, challenges environment, as well as external forces like peer pressure. Unlike the

Roger's theory, the individual is not a ration human being. His/her decision may be influenced by the the environment, external forces and his/her own characteristics such as values, attitudes, etc.

After the decision stage, the individual rejects or adopts the innovation. After rejection a new cycle begins with better awareness of the same ICT innovation or awareness of another new ICT innovation. There is no rejection stage in the Roger's theory, which makes it to look as a linear process model. Unlike, the Roger's theory, the proposed model have cycles, iterations and jumps within it.

The adoption stage is similar to Roger's implementation stage, when the individual makes first steps towards implementation of the ICT innovation. This stage entails its own process, namely searching among the providers - selection of the innovation provider - agreement with the innovation provider - installation of the ICT innovation - training. The training was highlighted as a key and important issue by the respondents in this research.

The challenges within adoption process such as low quality training or impossibility to reach the agreement with the provider leads to rejection. Otherwise, the individual develops intuition to use.

The maintenance stage is not present as a separate step in the Roger's theory. It is included within the implementation stage. The reason to make a distinct stage for maintenance was the set of peculiarities mentioned by the respondents during this stage such as optimization, updates, maintenance costs, etc. The challenges like low quality maintenance service or lack of updates and optimization may lead again to the rejection.

The next stage is evaluation and confirmation that is similar to the confirmation stage in the Roger's theory. During this stage the individual evaluates expected and unexpected outcomes of the ICT innovation. This is a stage when the individual usually shapes a strong opinion regarding the innovation. The evaluation can lead to rejection in case of many negative unexpected outcomes or to confirmation and intention to share.

After confirmation of the innovation, the individual actively communicates with others regarding the adopted innovation. He/she shares his/her opinion about the innovation with others. This is a stage, when the innovation diffusion actually occurs through communication channels. It is important to note that the individual can develop the intention to share already on earlier stages and the stage of communication happens in fact parallel almost to all stages. The cycle ends with a new awareness, when the individual gets a feedback from others, and a new cycle may begin.

The behavioral intentions in the discussed framework are simplified. In fact, the individual may experience several behavioral intentions at the same time: intention to learn more and intention to adopt; intention to use and intention to share the ICT innovation.

The stages in the framework are not linear: there are many jumps, cycles and iterations that are not fully shown in the model in order to avoid even bigger complexity. The model for instance simplifies the jump from maintenance to rejection, when the individual developed the intention to reject the implemented innovation because of unexpected challenges. The individual makes first a decision and then rejects the innovation. So there was supposed to be an intermediary stage of decision making before every rejection.

This conceptual framework has some limitations, namely, it was grounded in the data collected that is why it describes the specific type of innovations, ICT innovations, as well as in the specific area, primary health care.

The second conceptual framework of barriers and challenges in adoption, implementation and dissemination of ICT innovations may extend the first conceptual framework. This framework explains barriers and challenges at almost every stage of the ICT innovation adoption and dissemination. The barriers and challenges are listed hierarchically and divided into certain groups in the hierarchy of themes that was shown earlier.

The third conceptual framework discusses incentives and needs in adoption of ICT innovations. Like the second conceptual framework it extends the first one: almost every stage of innovation adoption and dissemination has its peculiar incentives and needs. The hierarchical list of the grouped incentives and needs is partially provided in the hierarchy of themes.

The fourth conceptual framework explains hierarchal structures in general and the resource, information and influence flows between and within those structures. It entails two main aspects: 1) levels of hierarchies and 2) flows within and between hierarchies. There are three levels of hierarchies:

1. Macrolevel that describes a state level and a level of policies and laws
2. Mesolevel describes an industry level and relations between the organizations
3. Microlevel examines phenomena on the individual and organizational level. It looks into relations between individuals.

There are constant flows within and between hierarchies that may also be grouped into three categories:

1. Resource flow depicts financial movements or gives an answer to the question: who pays whom for innovation adoption and dissemination?
2. Influence flow shows standards-setting, policy, and decision-making. It indicates the hierarchies and power relations within and between the levels.
3. Information flow describes information sharing, feedback, communication channels.

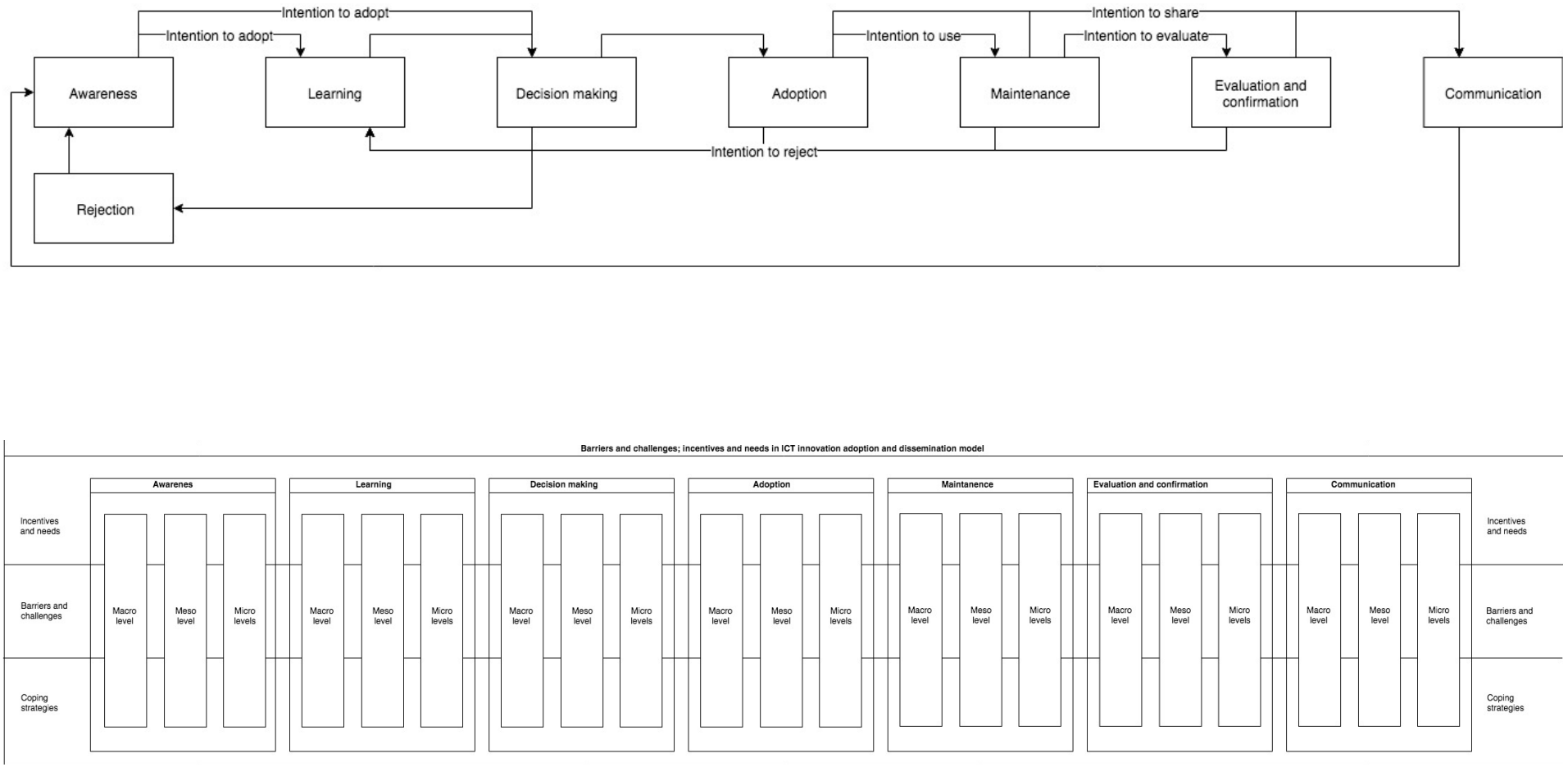
The final theoretical framework incorporates all four conceptual frameworks and generates the model as illustrated on the picture 26. The diagram on the top is the same conceptual model as on the picture 25, but illustrated differently and shows all stages of ICT innovation adoption and dissemination process.

The diagram below is actually the incorporation of all conceptual frameworks. It shows that almost all stages of ICT innovation adoption and dissemination (except of rejection) have their own peculiar incentives and needs, barriers and challenges, as well as coping strategies. Unlike in the Roger's theory, incentives and needs, barriers and challenges are present and crucial not only in the decision making stage. They may be applied to all stages.

All incentives and needs can be divided into three categories: macro, meso, micro. For instance, the incentives or needs on the macro level may represent the tax cuts for the ICT adopters or ICT companies, on the meso level - the better and easier communication or interaction between the stakeholders, and on the micro level - the feeling of satisfaction.

The same can be done with barriers and challenges: on macro level - restrictive legislation, on meso level - lack of feedback between the stakeholders, on micro level - fear of technologies or need for certainty.

The new theoretical model is complex and barely fits in one page, but this also reflects the real complexities that were mentioned by all respondents. The reality is of course more complex and the model can not describe everything. However, it provides a good basis to understand many aspects of that reality, in our case many aspects of the adoption and dissemination of ICT innovations.



Pic. 26. The final ICT innovation adoption and dissemination model.

6. Study Limitations

METHODOLOGICAL LIMITATIONS

Some methodological limitations of methodological and analytical frameworks were already mentioned in previous chapters. To summarize, the main limitations are:

- *Impossibility to test the causalities* between various concepts within the methodology used in this research.
- The *cross-sectional research* was chosen because of the limited time instead of a longitudinal research that could better fit to explore the aims of this research.
- *Ethical issues* like protection of patients' and respondent's privacy and anonymity. The detailed information sheets for respondents, serious consideration of their privacy and the thorough discussion of the risk of accidental access to the private data of patients ensured that participation in the interview and observation did not inflict significant harm onto the participants. However, collecting information about the people could still make them feel uncomfortable and took some of their time.
- *The researcher's role* in introducing bias were discussed also in detail. It is important to repeat that the researcher has a profound interest in medical technologies, innovations and digitalization. This shaped his decision to conduct this research. However, his optimism in innovations as well as past experiences could create a *positive bias* and influence onto the data collection and analysis, and eventually onto the final theoretical framework. *Limited experience of the researcher* in applying methods and analysis could also potentially influence onto the findings.
- *Limited access*: outreaching to respondents and their willingness to participate in interviews was also problematic. The researcher received a lot of rejections.This led to another limitation:
- *Very small sample size* that makes it hard to gain perspective of many other stakeholders or of wider population.
- *Geography* of the research limited only to one city, namely Berlin.
- *Self-reported data* collected from the respondents had to be verified. However, sometimes it was not possible to find the confirmation to the facts and details provided by the respondents.
- *Limited theoretical literature review* was conducted. Some other theories, like lazy user model or self-efficacy, were not explored.

LIMITATIONS IN THE NEW THEORY

Limitations in the new methodological framework were already discussed in the discussion of findings. To sum up, there are the following limitations:

- The *complexity of the new model*
- The *model is grounded in the collected data only* and that is why focused only on ICT innovations and (primary) health care.
- The *specificity of every stage* is not discussed in detail, but the stages are described broadly.
- *Innovation properties* and change in innovation properties was not fully incorporated by the new theoretical framework.

GENERAL LIMITATIONS

Other important limitations include

- *Limited resources*: human, financial, organizational and time resources. There was only few months available to conduct the research. This influenced onto many aspects of the research, including the methods and analysis. The cheaper methods were picked up, the less people were interviewed, the less data was available for the analysis in the end. The researcher was also geographically in a different country that complicated the communication with his research advisor. This may potentially also influence onto the quality of the research because of less feedback collected regarding the methods and analysis. In order to cope with the limited time resources, the following research plan was established, but eventually not followed because of the researcher's work schedule and the pressure from the second studies/university:

Table 12. Research plan

Months	Major activities
June	Presentation of research proposal, collection of feedback, conducting deeper desk research and preparation of comprehensive literature review
July	Preparation of a final interview guide, information sheet for respondents, translation of guides into German
August	Identifying and outreaching to main respondents
September	Conducting interviews with respondents

Months	Major activities
October	Conducting interviews with respondents
November	Analysing collected data, translation into English if necessary
December	Conducting additional interviews if needed
January	Re-analysing data, applying theoretical frameworks, preparation of the draft
February	Feedback from the advisor
March	Finalising the draft
April	Receiving the feedback and re-writing, proofreading

- *Language*: interviews in Germany were conducted mainly in German. The researcher is proficient in German, but it is still not his mother tongue. The language barrier could potentially pose misunderstandings and result in poorer data.

- There is also very *limited available academic literature* on the topic, especially in German langauge. This makes the research valuable, however it also means more time spent for collecting and analyzing raw data by the researcher.

7. Recommendations

To the medical specialists:

1. To implement the comprehensive, independent and transparent analysis of costs and benefits before adoption of ICT innovations
2. To include as many stakeholders as possible into decision-making process
3. To allocate resources and to prioritize the training and learning before, during and after the adoption of ICT innovations
4. To prioritize and to ensure open communication with various stakeholders on every stage of the innovation adoption and diffusion process.

To the state legislative and executive authorities of Germany:

1. To introduce incentives for the users of ICT innovation through legal and policy measures, like tax cuts or waivers for praxis and ICT companies or additional public funding of the research and development of innovations
2. To facilitate better communication and discussion of ICT health innovations between various stakeholders

To ICT companies:

1. To use a user-centered approach and to prioritize feedback and needs of their clients in software engineering.
2. To encourage easy introduction and learning into the ICT innovations

To the researcher community:

1. To conduct comprehensive cross-national comparative studies of adoption and dissemination of ICT innovations
2. To conduct longitudinal studies to explore the outcomes of the ICT innovation adoption
3. To conduct quantitative studies to examine the causal influence of various aspects in the ICT adoption and dissemination model.

8. Conclusions

The research fulfilled its aims, namely exploring the current state of information and communication technologies (ICT) in primary health care, as well as its adoption and implementation patterns in Germany. The research looked into financial, sociocultural, political, legal and other challenges in introducing and implementing innovative information technologies, as well as gaps and needs in ICT health systems.

The Interpretivism and the Grounded theory were chosen as main methodological and analytical frameworks. Some aspects of other analytical frameworks such as interpretative phenomenological analysis, template analysis, framework analysis, and Multiple Perspectives Methodology were also applied. After careful examination two main research methods were chosen: semi-structured interviews and observations.

The chosen methodology has many limitations that could potentially have influenced onto the research findings and analysis. The careful consideration of limitations is provided and can be used as a basis to improve the current research and propose new studies with a different methodology.

Based on the collected data, a new theoretical framework was developed after identifying and integrating several conceptual models. The new theoretical model has some similarities with other existent models and theories, namely the Roger's theory on Diffusion of Innovation, Theory of Reasoned Action, Theory of planned Behavior and Technology Acceptance Model. The new model can be regarded as an extension and integration of those three theories.

The new theory describes the stages of adoption and dissemination of ICT innovations, barriers and challenges, incentives and needs in various stages of ICT adoption and dissemination, as well as hierarchal structures and the resource, information and influence flows between and within those structures.

The new theoretical model is complex and has a set of other limitations, but it suits to descriptions of the reality and attribution of complexity to every aspect of that reality by all respondents. The new model can be used as a main theoretical and conceptual framework to conduct further research on examining every stage and aspect of the model and relationships between them.

References

ABRAHAMSON, E. 1991. Managerial fads and fashions: The diffusion and refection of innovations. *Academy of Management Review*, 16.

ABRAHAMSON, E. 1996. Management fashion. *Academy of Management Review*, 21.

ABRAHAMSON, E., and FOMBRUN, C. J. 1994. Macrocultures: Determinants and consequences. *Academy of Management Review*, 19.

ABRAHAMSON, E., and ROSENKOPF, L. 1993. Institutional and competitive bandwagons: Using mathematical modeling as a tool to explore innovation diffusion. *Academy of Management Review*, 18.

AJZEN, I. 1985. From intentions to actions: A theory of planned behavior. *SSSP Springer Series in Social Psychology*. New York, NY: Springer.

AJZEN, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50.

AJZEN, I., and FISHBEIN, M. 1973. Attitudinal and normative variables as predictors of specific behaviors. *Journal of Personality and Social Psychology*, 27.

ALVESSON, M., and SKÖLDBERG, K. 2000. *Reflexive Methodology*. London: SAGE.

AUBERT, B.A., and HAMEL, G. 2001. Adoption of Smart Cards in the Medical Sector: The Canadian Experience. *Social Science & Medicine*, 53

AYASS, W. 2010. Sozialdemokratische Arbeiterbewegung und Sozialversicherung bis zur Jahrhundertwende. *Sozialstaat Deutschland. Geschichte und Gegenwart*. Bonn.

BAGOZZI, R. 1981. Attitudes, intentions, and behavior: A test of some key hypotheses. *Journal of Personality and Social Psychology*, 41.

BAGOZZI, R. 2007, The legacy of the technology acceptance model and a proposal for a paradigm shift. *Journal of the Association for Information Systems*, 8.

BAGOZZI, R., WONG, N., ABE, S., and BERGAMI, M. 2000. Cultural and Situational Contingencies and the Theory of Reasoned Action: Application to Fast Food Restaurant Consumption. *Journal of Consumer Psychology*, 9

BATRA, D. 2009. Unified modeling language (UML) topics: Cognitive issues in UML research. *Journal of Database Management*.

BAUR R., HEIMER A., WIESELER S. 2001. Gesundheitssysteme und Reformansätze im internationalen Vergleich. *Reformen im Gesundheitswesen. Ergebnisse der internationalen Recherche*. Gütersloh: Verlag Bertelsmann-Stiftung.

BEHKAMI N.A., and DAIM T. U. 2016. Introduction to the Adoption of Health Information Technologies. *Healthcare Technology. Innovation Adoption. Electronic Health Records and*

Other Emerging Health Information Technology Innovations. Switzerland: Springer International Publishing.

BENBASAT, I., and BARKI, H. 2007, Quo vadis, TAM?, *Journal of the Association of Information Systems*, 8.

BERGER, P. L., and LUCKMAN, T. 1967. *The Social Construction of Reality: A Treatise in Sociology of Knowledge*. New York: Irvington Publishers.

BERGER, P., and ZIJDERVELD A. 2009. *In Praise of Doubt: How to Have Convictions without Becoming a Fanatic*. New York: Harper One.

BERNARD, H. R., and RYAN, G. W. 2010. *Analyzing Qualitative Data: Systematic Approaches*. California, USA: Sage Publication.

BLACK, I. 2006. The presentation of interpretivist research. *Qualitative Market Research: An International Journal*, 9.

BMG. 2018. *Organisationsplan. Bundesministerium für Gesundheit* [Online]. Available: https://www.bundesgesundheitsministerium.de/ministerium/aufgaben-und-organisation/organisationsplan/ [Accessed 2017].

BMG. 2018. *Elektronische Gesundheitskarte (eGK) und elektronisches Gesundheitsnetz* [Online]. Available: https://www.bundesgesundheitsministerium.de/elektronische-gesundheitskarte/?L=0 [Accessed 2017].

BMI and MBJ. 2006. *Bundesministerium des Innern und Bundesministerium der Justiz: Zweiter Periodischer Sicherheitsbericht*. Paderborn: Bonifatius GmbH.

BROOKS, J., MCCLUSKEY, S., TURLEY, E., and KING, N. 2015. The Utility of Template Analysis in Qualitative Psychology Research. *Qualitative Research Psychology,* 12.

BUNDESDATENSCHUTZGESETZ. 2017. *Dejure* [Online]. Available: https://dejure.org/gesetze/BDSG [Accessed 2017].

CARSON, D., GILMORE, A., PERRY, C., and GRONHAUG, K. 2001. *Qualitative Marketing Research*. London: Sage.

CDU. 2018. *Ein neuer Aufbruch für Europa. Eine neue Dynamik für Deutschland. Ein neuer Zusammenhalt für unser Land. Koalitionsvertrag zwischen CDU, CSU und SPD* [Online]. Available: https://www.cdu.de/koalitionsvertrag-2018 [Accessed 2018].

CDU. 2018. *E-Health-Strategie für Deutschland: 12 Punkte für ein digitalisiertes Gesundheitswesen. Gemeinsamer Beschluss des Bundesfachausschusses Gesundheit und Pflege sowie des Netzwerks Digitalisierung* [Online]. Available: https://www.cdu.de/system/tdf/media/dokumente/170125_ehealth_bfa_gesundheit_digital.pdf?file=1 [Accessed 2018].

CENTOLA, D. 2011. An Experimental Study of Homophily in the Adoption of Health Behavior. *Science*, 334.

CHARMAZ, K. 2003. Grounded theory. *Qualitative Psychology: A Practical Guide to Research Methods*. London: Sage.

CHARMAZ, K. 2014. *Constructing Grounded Theory.* London: Sage.

CHURCHILL, G. A. 1996. *Basic Marketing Research,* Fort Worth. TX: The Dryden Press.

COOPER, R. B., and ZMUD, R. W. 1990. Information technology implementation research: A technological diffusion approach. *Management Science*, 36.

COUSINS, J. B., and Simon, M. 1996. The nature and impact of policy-induced partnerships between research and practice communities. *Educational Evaluation and Policy Analysis*, 18.

CRABTREE, B.F., and MILLER, W.L. 1999. *Doing Qualitative Research*. Thousand Oaks, Ca.: Sage Publications.

CHUTTUR, M.Y. 2009. Overview of the Technology Acceptance Model: Origins, Developments and Future Directions. *Working Papers on Information Systems*.

CRESWELL, J. W. 2003. *Research design: Qualitative, quantitative and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.

DAMANPOUR, F. 1988. Innovation type, radicalness, and the adoption process. *Communication Research*, 15.

DAMANPOUR, F. 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, 34.

DAMANPOUR, F. 1996. Organizational Complexity and Innovation: Developing and Testing Multiple Contingency Models. *Management Science,* 42.

DAMANPOUR, F., and EVAN, W. M. 1984. Organizational innovation and performance: The problem of "organizational lag". *Administrative Science Quarterly*, 29.

DATEV. 2018. *Jens Spahn gründet Abteilung für Digitalisierung im BMG* [Online]. Available: https://www.datev.de/web/de/aktuelles/trends-und-innovationen/jens-spahn-gruendet-abteilung-fuer-digitalisierung-im-bmg/?stat_Mparam=int_rss_datev-de_trends-und-innovationen [Accessed 2018].

DAVIS, F. D. 1985. *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. Cambridge, MA: Massachusetts Institute of Technology, Sloan School of Management.

DAVIS, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13.

DAVIS, F. D., BAGOZZI, R. P., and WARSCHAW, P. R. 1989. User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35.

DENIS, J. L., HERBERT, Y., LANGLEY, A, LOZEAU, D., and TROTTIER, L.H. 2002. Explaining Diffusion Patterns for Complex Health Care Innovations. *Health Care Management Review,* 27

DENZIN, N. K., and LINCOLN, Y. S. 2000. *Handbook of qualitative research*. Thousand Oaks, CA: Sage Publications.

DESTATIS, 2017. *Statistisches Bundesamt (Destatis), Zahlen & Fakten, Gesellschaft & Staat, Gesundheit*. [Online]. https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Gesundheit/Gesundheit.html [Accessed 2017].

DOBBINS, R., COCKERILL, R., and BARNSLEY, J. 2001. Factors Affecting the Utilization of Systematic Reviews. *International Journal of Technology Assessment in Health Care*, 17.

DOBING, B., and PARSONS, J. 2005. Current practices in the use of UML. *Perspectives in Conceptual Modeling*, 2.

DORI, D. 2001. Object-process methodology applied to modeling credit card transactions. *Journal of Database Management*, 12.

DOWNS, G. W., and MOHR, L. B. 1976. Conceptual Issues in the Study of Innovation. *Administrative Science Quarterly*, 21.

EAGLY, A. H., and CHAIKEN, S. 1993. *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich College Publishers Fort Worth.

EVELAND, J.D. 1986. Diffusion, Technology Transfer and Implementation. *Knowledge: Creation, Diffusion, Utilizatio,*. 8.

EVERMANN, J., and WAND, Y. 2006. Ontological modeling rules for UML: An empirical assessment. *Journal of Computer Information Systems*, 46.

EPSTEIN, M. 2012. Chapter 2: Introduction to the philosophy of science. *Researching Society and Culture*. London: SAGE Publications.

EXWORTHY, M., BERNEY, L., POWELL, M. 2003. How Great Expectations in Westminster May Be Dashed Locally: The Local Implementation of National Policy on Health Inequalities. *Policy & Politics*, 30.

FERLIE, E., GABBAY, L., FITZGERALD, L., LOCOCK, L., DOPSON, S. 2001. Organisational Behaviour and Organisational Studies in Health Care: Reflections on the Future. *Evidence-Based Medicine and Organisational Change: An Overview of Some Recent Qualitative Research*. Basingstoke: Palgrave.

FISCHER, J.C., 1971. A simple substitution model of technological change. *Technological Forecasting and Social Change*, 3.

FISHBEIN, M. 1967. Attitude and the prediction of behavior. *Readings in attitude theory and measurement*.

FISHBEIN, M., and AJZEN I. 1975. *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

FLETCHER-WATSON, B. 2013. Toward a Grounded Dramaturgy: Using Grounded Theory to Interrogate Performance Practices in Theatre for Early Years. *Youth Theatre Journal*, 27.

GALE N. K., HEATH G., CAMERON E., RASHID S., and REDWOOD S. 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodology*; 13.

GHOSHAL, D., and BARTLETT, C. 1988. Creation, Adoption and Diffusion of Innovations by Subsidiaries of Multinational Corporations. *The Journal of International Business Studies,* 19

GIBBONS, D. 2004. Network Structure and Innovation Ambiguity Effects on Diffusion in Dynamic Organizational Fields. *The Academy of Management Journal*, 47.

GIDDENS, A. 1987. *Social Theory and Modern Sociology*. Cambridge: Polity Press.

GOULDING, C. 1998. Grounded theory: the missing methodology on the interpretivist agenda. *Qualitative Market Research: An International Journal,* 1.

GREENHALGH, T., ROBERT, G., MACFARLANE, F., BATE, P., KYRIAKIDOU, O., and PEACOCK, R. 2005. Storylines of Research in Diffusion of Innovation: A Meta-narrative Approach to Systematic Review. *Social Science & Medicine,* 61

GUBRIUM, J. F., and HOLSTEIN, J. A. 2002. From the individual interview to the interview society. *Handbook of Interview Research*. Thousand Oaks, CA: Sage Publications.

GUSTAFSON, D.H., SANFORT, F. M., EICHLER, M., ADAMS, L., BISOGNANO, M., and StEUDEL, H. 2003. Developing and Testing a Model to Predict Outcomes of Organizational Change. *Health Services Research,* 38.

HAMMERSLEY, M. 2008. Chapter 4. Assessing validity in Social Research. *The SAGE Handbook of Social Research Methods*. London: SAGE Publications.

HARVARD BUSINESS REVIEW. 2002. *The Discipline of Innovation* [Accessed 2017].

HENDERSON-SELLERS, B., and GONZALEZ-PEREZ, C. 2006. Uses and Abuses of the Stereotype Mechanism in UML 1.x and 2.0. *Model Driven Engineering Languages and Systems*.

HOLZMANN, R., and STEEN J. 2001. Social risk management: A new conceptual framework for social protection and beyond. *International Tax and Public Finance,* 8.

HU, P. J., CHAU, P. Y. K., and SHENG, O. R. L. 1999, Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems*, 16.

HUDSON, L., and OZANNE, J. 1988. Alternative Ways of Seeking Knowledge in Consumer Research. *Journal of Consumer Research*, 14.

HUNT, S. D. 1983. *Marketing Theory*. Homewood, IL: Richard D. Irwin.

KATZ, E., LEVIN, M., HAMILTON, H. 1963. Traditions of Research on the Diffusion of Innovation. *American Sociological Review,* 28.

KHALDOUN A., and CAROLE-LYNNE N. 2011. Philosophical Roots of Classical Grounded Theory: Its Foundations in Symbolic Interactionism. *The Qualitative Report*, 16.

KING N., BRAVINGTON A., BROOKS J., HARDY B., MELVIN J., and WILDE D. 2013. The Pictor technique: a method for exploring the experience of collaborative working. Q*ualitative Health Research*, 23.

KV BLATT. 2018. Bekanntes Gesicht in der Gesundheitspolitik. *Mitteilungsblatt der Kassenärztlichen Vereinigung Berlin*. Giessen, Germany: Brühlsche Universitätsdruckerei GmbH.

LINCOLN, Y., and GUBA, E. 1985. *Naturalistic Inquiry*. London: Sage.

LINSTONE, H. A. 1999. *Decision making for technology executives: Using multiple perspectives to improved performance*. Boston/London: Artech House.

MACIONIS, J. J., and GERBER L. M. 2011. *Sociology*. Canada: Pearson Education.

MARTIN, P. Y., and TURNER B. A. 1986. Grounded Theory and Organizational Research. *The Journal of Applied Behavioural Science*, 22.

MCCRACKEN, G. 1988. *The long interview*. Thousand Oaks, CA: Sage Publications.

MCPHERSON, M., SMITH-LOVIN, L., and COOK, J.M. 2001. Birds of a Feather: Homophily in Social Networks. *Annual Review of Sociology,* 27.

MEYER, A.D., and GOES, J.B. 1988. Organizational Assimilation of Innovations: A multi-Level Contextual Analysis. *Academy of Management Review,* 31

MEYER, B. 1997. UML: The positive spin. *Cutter IT Journal*.

MEYERS, P., SIVAKUMAR, K., NAKATA, C. 1999. Implementation of Industrial Process Innovations: Factors, Effects, and Marketing Implications. *The Journal of Product Innovation Management*, 16.

MILLER, K. 2004. *Interpretive Perspectives on Theory Development. In Communication Theories: Perspectives, Processes, and Contexts*. Boston, Massachusetts: McGraw-Hill.

MOORE, G. E. 1965. Cramming more components onto integrated circuits. *Electronics,* 38.

MOORE, G. E. 1975. Progress in Digital Integrated Electronics. *International Electron Devices Meeting*. Technical Digest.

MOORE, G. E. 2006. Chapter 7: Moore's law at 40. *Understanding Moore's Law: Four Decades of Innovation*. Chemical Heritage Foundation.

NEUMAN, L. W. 2000. *Social Research Methods: Qualitative and Quantitative Approaches*. USA: Allyn and Bacon.

NORBERG, P. A., HOrNE, D. R., HORNE, D. A. 2007. The privacy paradox: Personal information disclosure intentions versus behaviors. *Journal of Consumer Affairs*, 41.

NEWELL, S. 2001. Management Fads and Fashions. *Organization*, 8

NUTLEY, S., and DAVIES, H. T. O. 2000. Making a reality of evidence-based practice: some lessons from the diffusion of innovations. *Public Money & Management*, 20.

OECD. 2017. OECD Data on Germany. [Online]. *https://data.oecd.org/germany.htm* [Accessed 2017].

OGDEN, J. 2003. Some Problems With Social Cognition Models: A Pragmatic and Conceptual Analysis. *Health Psychology*,22.

OKAFOR, D. J., NICO, M., and AZMAN, B. B. 2016. The influence of perceived ease of use and perceived usefulness on the intention to use a suggested online advertising workflow. *Canadian International Journal of Science and Technology*, 6.

O'NEILL, H. M., POUDER, R. W., and BUCHHOLTZ, A. K. 1998. Patterns in the diffusion of strategies across organizations: Insights from the innovation diffusion literature. *Academy of Management Review*, 23.

OSBORNE, S. P. 1998. Naming the beast: Defining and classifying service innovations in social policy. *Human Relations*, 51.

ØVRETVEIT, J., BATE, P., CLEARY, P., CRETIN, S., GUSTAFSON, D., MCINNES, K., MCLEOD, H., MOLFENTER, T., PLSEK, P., ROBERT, G., SHORTELL, S., WILSON, T. 2002. Quality Collaboratives: Lessons from Research. *Quality and Safety in Health Care*, 11.

PARK, H. S. 2000. Relationships among attitudes and subjective norms: Testing the theory of reasoned action across cultures. *Communication Studies*.

PATEL, K., and AYLOTT J. 2017. Assessing the Return on Investment (ROI) Through Appreciative Inquiry (AI) of Hospital Improvement Programmes. *Why Hospitals Fail*.

PATTON, M. Q. 2002. *Qualitative research & evaluation methods*. Thousand Oaks, CA: Sage Publications.

PELEG, M., and DORI, D. 2000. The model multiplicity problem: Experimenting with real-time specification methods. *IEEE Transactions on Software Engineering*, 26.

PIKKARAINEN, T., PIKKARAINEN, K., and KARJALUOTO, H. 2004, Consumer acceptance of online banking: An extension of the Technology Acceptance Model. *Internet Research-Electronic Networking Applications and Policy*, 14.

PKV. 2017. *Verband der Privaten Krankenversicherung. Service. Zahlen und Fakten* [Online]. Available: https://www.pkv.de/service/zahlen-und-fakten/ [Accessed 2017].

PLSEK, P., and GREENHALGH, T. 2001. The challenge of complexity in health care. *Complexity Science*, 323.

RALPH, N., BIRKS, M., and CHAPMAN, Y. 2014.Contextual positioning. Using Documents as Extant Data in Grounded Theory Research. *SAGE Open,* 4.

RALPH, N., BIRKS, M., and CHAPMAN, Y. 2015. The methodological dynamism of grounded theory. *International Journal of Qualitative Methods,* 14.

REID T. R. 2010. Health Care Systems - Four Basic Models [Online]. *Physicians for a National Health Program*. Available: http://www.pnhp.org/single_payer_resources/health_care_systems_four_basic_models.php [Accessed 2017].

RITCHIE, J., and SPENCER, L. 1994. Qualitative data analysis for applied policy research. *Analyzing qualitative data*.

ROBERTSON, M., SWAN, J., and Newell, S. 1996. The Role of Networks in the Diffusion of Technological Innovation. *Journal of Management Studies*, 33.

ROGERS, E. 1983. *Diffusion of Innovations*. USA: The Free Press.

ROGERS, E, and BHOWMIK, D. 1970. Homophily-Heterophily: Relational Concepts for Communication Research. *Public Opinion Quarterly*, 34.

ROSTILA, M. 2010. Birds of a feather flock together - and fall ill? Migrant Homophily and health in Sweden. *Sociology of Health & Illness*, 32.

RYAN, B., and GROSS, N. 1943. The diffusion of hybrid seed corn in two Iowa communities. *Rural Sociology,* 8.

SAVIN-BADEN, M., and MAJOR, C. 2013. *Qualitative Research: The Essential Guide to Theory and Practice*. London and New York: Routledge.

SEALE, C. et al. 2007. *Qualitative Research Practice*, London: SAGE.

SHEPPARD, B.H., HARTWICK, J., WARSHAW, P.R. 1988. The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, 15.

SIAU, K., and CAO, Q. 2001. Unified modeling language: A complexity analysis. *Journal of Database Management*, 12.

SIAU, K., and LOO, P. P. 2006. Identifying difficulties in learning UML. *Information Systems Management*, 23.

SILVERMAN, D. 2000. *Doing qualitative research: A practical guide*. Thousand Oaks, CA: Sage Publications.

SMITH, J., JARMAN, M., and OSBORNE, M. 1999. Doing interpretative phenomenological analysis. *Qualitative Health Psychology*. London: Sage.

SMITH, J.A., and OSBORN, M. 2003. Interpretative phenomenological analysis. *Qualitative Psychology: A Practical Guide to Research Methods*. London: Sage.

SMITH, J.A., FLOWERS, P., and LARKIN, M. 2009. *Interpretative Phenomenological Analysis: Theory Method and Research*. London: Sage.

SMITH, J.A. 2011. Evaluating the contribution of interpretative phenomenological analysis. *Health Psychology Review*, 5.

SNEED, A. 2015. *Moore's Law Keeps Going, Defying Expectations* [Online]. Scientific American. Available: https://www.scientificamerican.com/article/moore-s-law-keeps-going-defying-expectations/ [Accessed 2017].

SNIEHOTTA, F.F. 2009. An experimental test of the Theory of Planned Behavior. *Applied Psychology: Health and Well-Being*, 1

SRIVASTAVA, A., and THOMSON, S. B. 2009. Framework Analysis: A Qualitative Methodology for Applied Research Note Policy Research. *JOAAG*, 4.

STRANG, D., and SOULE, S. 1998. Diffusion in Organizations and Social Movements: From Hybrid Corn to Poison Pills. *Annual Review of Sociology*, 24

STRAUSS, A. L., and JULIET, C. 1994. Grounded Theory Methodology: An Overview. *Handbook of Qualitative Research*.

STRAUSS, A. L., and GLASER, B. G. 1967. *The discovery of grounded theory: strategies for qualitative research*. Chicago: Aldine.

TORNATZKY, L. G., and KLEIN, R. J. 1982, Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings, *IEEE Transactions on Engineering Management*.

TRANSPARENCY INTERNATIONAL DEUTSCHLAND E. V. 2017. [Online]. Themen. Gesundheitswesen. Available: https://www.transparency.de/themen/gesundheitswesen [Accessed 2017].

TRIANDIS, H. C. 1979. Values, attitudes, and interpersonal behavior. *Nebraska Symposium on Motivation*, 27.

VALENTE, T. W. 1996. Social network thresholds in the diffusion of innovations. *Social Networks,* 18.

VANDEVEN, A. H., and ROGERS, E. M. 1988. Innovations and organizations: Critical perspectives. *Communication Research*, 15.

VENKATESH, V. 2000. Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research*, 11.

VENKATESH, V., and BALA, H. 2008, Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, 39.

VENKATESH, V., and DAVIS, F. D. 2000, A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46.

VISWANATH, V., MORRIS, M. G., DAVIS, G. B., and DAVIS, F. D. 2003. User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27.

WHO. 2013. Planning an Information Systems Project: A Toolkit for Public Health Managers. *PATH*. Seattle: PATH.

WOLFE, R. A. 1994. Organizational innovation: Review, critique and suggested research. *Journal of Management Studies*, 31.

WU, J. H., and WANG, S C. 2005. What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. *Information and Management,* 42.

YASNOFF W. A., et al. 2000. Public Health Informatics: Improving and Transforming Public Health in the Information Age. *Public Health Management Practice,* 6**,** 67-75.

YIN, R. 2003. *Case study research: design and methods*. Thousand Oaks, CA: Sage Publications.