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# The Application of Chatbots in Private Universities – A Critical Analysis of Economic Potentials and Challenges

Master Thesis
in partial fulfilment of the requirements for the degree of Master of Arts (M.A.)

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## Abstract

**Background:** Private universities are increasingly competing with their peers for both resources and students. Chatbots are digital communication programs that generate automated responses to users' concerns and questions using machine and deep learning-supported natural language processing. For private universities, chatbots offer a range of economic potentials in terms of customer value, time, and cost savings. However, the effective and efficient use of chatbots also poses challenges in terms of privacy as well as customer and employee acceptance.

**Approach:** First, the three central topics of the thesis – Artificial Intelligence, chatbots, and private universities – are defined and explained with the help of scientific literature. This is followed by a systematic presentation of the economic potentials and challenges of using chatbots in the fields of "Marketing", "Applicant Management", and "Service" of private universities. A self-developed chatbot prototype serves as a concrete illustration of possible applications. The contribution of chatbots to the success of private universities is then evaluated at a strategic and operational level. Finally, the elaborations are captured in six hypotheses, which are examined by means of a qualitative expert survey.

**Results:** The use of chatbots can provide students with significant additional benefits. Service requests can be made to the chatbot around the clock, every day of the year, and in different languages. Chatbots should not replace the existing service offerings, whose quality is often a differentiating factor for private universities compared to state universities, but rather expand them. From an internal perspective, chatbots demonstrate the potential to save time and costs. However, even sophisticated Artificial Intelligence-supported chatbots do not yet appear to be capable of autonomously carrying out processes and thus replacing employees. In addition, challenges regarding customer and employee acceptance and data protection must be addressed. Corresponding measures are associated with investments and costs. Accordingly, the use of chatbots is currently to be seen more as an opportunity for differentiation and less as an opportunity for cost savings with regard to competitive advantages for private universities.

## Zusammenfassung

**Hintergrund:** Private Hochschulen stehen zunehmend in Konkurrenz mit ihren Wettbewerbern um Ressourcen und Studenten. Chatbots sind digitale Kommunikationsprogramme, die mit Hilfe Natural Language Processing automatisierte Antworten auf Anliegen und Fragen der Nutzer generieren. Für private Hochschulen bieten Chatbots eine Reihe von betriebswirtschaftlichen Potentialen hinsichtlich Kundennutzen, Zeit- und Kosteneinsparung. Die effektive und effiziente Anwendung von Chatbots stellt aber auch Herausforderungen hinsichtlich des Datenschutzes sowie der Kunden- und Mitarbeiterakzeptanz.

**Vorgehensweise:** Zunächst werden die drei zentralen Begriffe der Thesis – Künstliche Intelligenz, Chatbots und Private Hochschulen – definiert und mit Hilfe der wissenschaftlichen Literatur erklärt. Darauf folgt die systematische Darstellung der betriebswirtschaftlichen Potentiale und Herausforderungen beim Einsatz von Chatbots in den Aufgaben „Marketing“, „Applicant Management“ und „Service“ privater Hochschulen. Ein selber entwickelter Chatbot-Prototyp dient dabei der konkreten Darstellung möglicher Anwendungen. Der Beitrag von Chatbots zum Erfolg privater Hochschulen wird dann auf strategischer und operativer Ebene bewertet. Abschließend werden die Ausarbeitungen in sechs Hypothesen festgehalten, die anhand einer qualitativen Expertenbefragung untersucht werden.

**Ergebnisse:** Der Einsatz von Chatbots kann Studenten erheblichen Zusatznutzen bieten. So können Serviceanfragen an den Chatbot rund um die Uhr, an jedem Tag im Jahr und in verschiedenen Sprachen gestellt werden. Dabei sollten Chatbots die bestehenden Serviceangebote nicht ersetzen, sondern vielmehr erweitern. Aus interner Sicht haben Chatbots Potential, Zeit und Kosten einzusparen. Jedoch scheinen selbst aufwendige KI gestützte Chatbots aktuell noch nicht in der Lage zu sein, Prozesse autonom durchzuführen und damit Mitarbeiter zu ersetzen. Zudem gilt es, Herausforderungen hinsichtlich der Kunden- sowie Mitarbeiterakzeptanz und des Datenschutzes zu adressieren. Entsprechende Maßnahmen sind mit Investitionen und Kosten verbunden. Demnach ist der Einsatz von Chatbots aktuell im Hinblick auf Wettbewerbsvorteile für Private Hochschulen eher als Möglichkeit zur Differenzierung und weniger als Möglichkeit der Kosteneinsparung zu sehen.

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## II List of Figures

## III List of Abbreviations

| | |
|---|---|
| AI | Artificial Intelligence |
| API | Application Programming Interface |
| CRM | Customer Relationship Management |
| eds. | Editors |
| e.g. | exempli gratia |
| etc. | et cetera |
| FAQ | Frequently Asked Questions |
| Fig. | Figure |
| GDPR | General Data Protection Regulation |
| GG | Grundgesetz |
| HRG | Hochschulrahmengesetz |
| i.e. | id est |
| IBM | International Business Machines Corporation |
| ID | Identification |
| IT | Information Technology |
| JPG | Joint Photographic Group |
| JSON | JavaScript Object Notation |
| KI | Künstliche Intelligenz |
| KPI | Key Performance Indicator |
| ML | Machine Learning |
| MVP | Minimum Viable Product |
| NLP | Natural Language Processing |
| NLU | Natural Language Understanding |
| PDF | Portable Document Format |
| pp. | Pages |
| STEM | Science, Technology, Engineering and Mathematics |
| STT | Speech-to-Text |
| STS | Speech-to-Speech |
| SVM | Support Vector Machines |
| TTS | Text-to-Speech |
| TTT | Text-to-Text |

# 1 Introduction

Current figures from the German Federal Statistical Office point to significant growth in the number of students enrolled at private universities in Germany since 1995. According to these figures, only approximately 16,000 students were enrolled at private universities in the winter semester of 1995, while approximately 270,000 students were recorded at private universities in the winter semester of 2019 (Statistisches Bundesamt 2021, p. 8). At the same time, the number of private universities in Germany at which the designated students are enrolled is also increasing. According to a study by the Stifterverband für die Deutsche Wissenschaft in cooperation with McKinsey & Company, Germany, there has been a wave of new private universities being founded, particularly between 2000 and 2010 (Frank et al. 2010, p. 10).

The reasons that favor private education fom the perspective of students are many and varied. However, scant research on the benefits of private education has been done to date. Since private universities can operate under conditions that differ from those that apply to non-private universities, there is a gap in the research on private higher education (Sperlich 2007, p. 20).

The challenges that face private universities from an economic perspective are as diverse as those that face state universities. Private universities receive little or no state funding, which is why dependence on tuition fees, third-party funding, and grants are central competitive factors. Changing socio-political conditions, the ongoing internationalization of the higher education landscape, increased student expectations, and intensified competition with state universities pose further challenges for private universities. In this context, private higher education institutions run the risk of losing competitive advantages – especially with regard to internationalization and service orientation – due to the deregulation of the state higher education system, study reform, and new competitive financing formats (Frank et al. 2010, p. 7 f.).

Ongoing digitalization is also having an increasing impact on the German higher education landscape. In this context, a study on the German innovation system

reveals that the requirements in terms of visions, strategies, and implementation concepts are growing in the direction of "digital universities". However, the respective strategic and organizational anchors in the overall concept of the universities differ considerably, and the degrees of implementation sought or already achieved in different areas also diverge significantly (Gilch 2019, p. 10). At the same time, digitalization has already proved its disruptive potential in some sectors of the economy in recent decades. Highly profitable tech companies of considerable size grew out of "garage startups" within a few years, while listed corporations sank into insignificance because the potential of digitalization was underestimated, misjudged, or ignored. Although the underlying conditions of the markets in which educational institutions such as private universities operate are different, they also must compete with increasing numbers of market participants for resources and students. It can therefore also be assumed that those universities that manage to successfully implement digital innovations will create competitive advantages over their rivals.

### 1.1 Objective of the Thesis

The use of new digital technologies offers more possibilities in communication and information processing with customers, as well as internal cost reduction and differentiation characteristics in the marketplace. Communicating with customers via live chat interfaces has become an increasingly popular means of providing customers with real-time service. Chatbots demonstrate great potential in human-to-computer communication and have enjoyed increasing interest over the past decade with contributions from international companies such as IBM, Google, Android, and Apple (Abdul-Kader 2015, p. 72).

Chatbots are computer programs that process natural language input from a user and generate suitable responses. These responses are based on predetermined scripts in combination with machine and deep learning. The technology behind chatbots is similar to that used in language-based assistants. All language-based systems have the added complexity of converting speech to text that any computer application can work with. Processing texts from a chatbot and a language-based system is done in a similar way (Khan & Das 2018, p. 2).

This technology enables new user touch points, improve convenience, reduce service, sales, and support costs, and permit both one-to-one marketing and new data collection. Customers can obtain information and answers anywhere and at any time by using chatbots. For companies, the use of chatbots offers potential in terms of process optimization, expansion of customer acquisition, and cost reduction. On the one hand, target groups are offered a digital contact point that can deal with several requests simultaneously at any time and place. On the other hand, service and support solutions are made possible, which represent potential cost savings in terms of personnel as well as information and communication processing. In particular, the automation of recurring processes can be promoted through the correct use of chatbots.

However, the use of chatbots also poses a number of challenges. In this context, it is important to keep in mind that employees and users often approach digitalization projects with a certain amount of skepticism. Moreover, in practice, it is hardly possible to provide an accurate assessment of the results of digitalization projects or to consider them in isolation, as they are typically carried out in a combination of several actions and are dependent on other measures. Furthermore, data protection is also a challenge that significantly influences the success or failure of a chatbot project.

This thesis, therefore, aims to investigate which economic potentials and challenges for private universities have to be considered when implementing chatbots. The aim is to illustrate the extent to which chatbots could influence the value creation process of private universities in such a way that processes are optimized and communication with the target group improved. The central research question of the thesis is therefore: How can the use of chatbots offer private universities a competitive advantage?

## 1.2 Methodological Approach

In order to answer the research question, Chapter 2 provides a theoretical background on the topics relevant to this thesis on the basis of scientific literature. In this context, chatbots and private universities, as central objects of investigation of this thesis, are put into context, delimited, and defined. For the purposes of this thesis, the author programmed a chatbot prototype for private universities in order to investigate the research question as close to practice as possible. This was done with the assistance of the IBM Watson Assistant, a conversational Artificial Intelligence platform provided by IBM (IBM 2021d, n.p.). Therefore, the functionality of the IBM Watson Assistant is also explained in more detail.

Chapter 3 first examines the potential of the use of chatbots at private universities. For this purpose, models and concepts based on economic literature are used to enable a systematic analysis. The chatbot prototype is used to present identified application examples. In addition, the challenges that private universities have to overcome when implementing chatbots are also listed. Taking into account the identified potentials and challenges, Chapter 3 goes on to present an economic evaluation of the use of chatbots at private universities on two levels. On the one hand, the strategic level is considered in an evaluation of the use of chatbots that takes the competitive strategies of cost leadership and differentiation into account. Furthermore, on an operational level, there is an evaluation of the extent to which chatbots could provide an increase in efficiency (from an internal perspective) as well as additional customer value (from an external perspective) for the three areas of private universities under consideration. Finally, with a view to answering the research question, six hypotheses about the use of chatbots at private universities are derived from the insights arrived at in Chapter 3. These six hypotheses include assumptions that summarize the findings of the research based on theory as well as the prototype.

In order to verify whether the assumptions made in the six hypotheses are applicable in practice, they are systematically tested in Chapter 4 by analyzing the outcomes of qualitative expert interviews. A total of seven experts were interviewed with the assistance of an interview guide. Four of the experts interviewed have practical skills

and experience with chatbots and were therefore asked specific questions about the general technological and business aspects of chatbots. In addition, three employees of the Fresenius University of Applied Sciences were interviewed, each of whom has special professional experience in the three thematic application areas of chatbots at private universities. The interview guide, which was created specifically for the qualitative study, was accordingly divided into questions directed at the chatbot experts and questions specifically for the experts in the application areas of private universities.

# 2 Theoretical Background

In Chapter 2, the central terms of this thesis will be defined and explained on the basis of the scientific literature. For a clear understanding of the potentials and challenges of chatbots, the functionality and aspects of Artificial Intelligence that are used in chatbots will be described first. The author programmed a chatbot prototype for private universities for this thesis in order to examine the research question as close to a practical application as possible. The prototype was created with the IBM Watson Assistant. Therefore, the functionality of the IBM Watson Assistant will be explained in more detail. Since the objective of the thesis is to examine the use of chatbots in the specific environment of private universities in Germany, the concept, goals, competitive environment, and success factors of private universities are explained at the end of Chapter 2.

## 2.1 Artificial Intelligence

Defining Artificial Intelligence (AI) is difficult for two reasons. Firstly, due to the breadth of the field, and secondly, because even a definition of "intelligence" proves to be difficult. It is generally agreed that AI is a sub-area of computer science that deals with the research and development of so-called "intelligent agents" (Franklin & Graesser, 1997, p. 1193). These are characterized by their ability to solve problems independently (Carbonell et al. 1983, p. 4). It is important to distinguish between “strong” and “weak” AI. Strong AI generally refers to all approaches that attempt to depict and imitate humans or the processes in the brain. Frequently, characteristics

such as consciousness or empathy are also mentioned as constitutive characteristics of such a strong AI (Pennachin & Goertzel 2007, p. 2 f.). However, research today is far from that point and we are not aware of any research projects that have come close to implementing this powerful AI (Buxmann & Schmidt 2019, p. 6). On the other hand, solutions that are now technically feasible and have been implemented in today's software solutions are examples of weak AI. Here it is no longer a matter of imitating human thought processes, considerations, and creativity, but rather of developing algorithms specifically for certain, delimited problems (Goertzel 2010, p. 19 f.). The ability to learn is an essential requirement not only for the strong, but also for this weak AI.

In recent years, AI has developed more strongly in the direction of machine learning. According to Erik Brynjolfsson and Andrew McAfee of Massachusetts Institute Technology, this is the most important enabling technology of our age (Brynjolfsson & McAffee 2017, n.p.). The following Figure 1 illustrates the connections between AI, neural networks, as well as machine- and deep learning in the broadest sense in a holistic model.

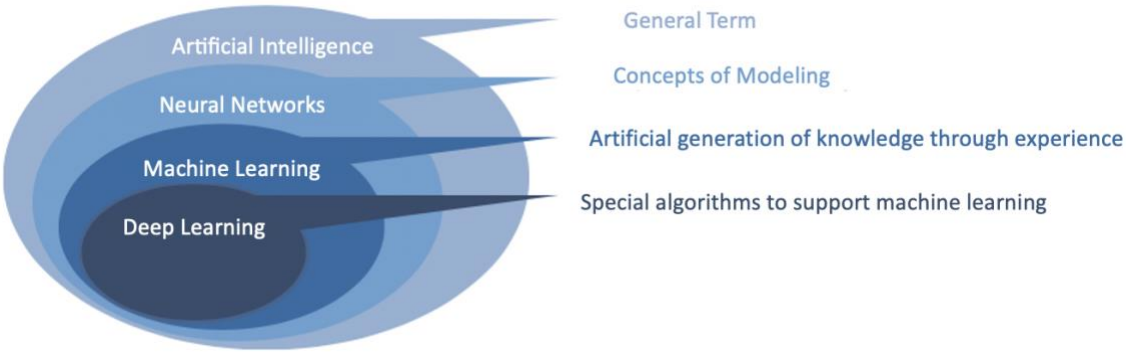



*Fig. 1:* Artificial Intelligence as a Holistic Model (Kreutzner & Sirrenberg 2019, p. 4).

To gain a deeper insight into the individual components of AI, the following subchapters define and discuss the terms “machine learning, “neuronal networks” as well as “deep learning”.

### 2.1.1 Machine Learning

In general, the term "machine learning" encompasses methods that use learning processes to identify relationships in existing data sets in preparation for making predictions based on them (Murphy 2012, n.p.). There are many different concepts of the term. Often the approach of Tom Mitchell is used, who defines the basic concept of machine learning as "a computer program is said to learn from experience ‘E‘ with respect to some class of tasks ‘T‘ and performance measure ‘P‘, if its performance at tasks in ‘T‘, as measured by ’P‘, improves with experience ’E‘" (Mitchell 1997, p. 2). Expressed in more simplified terms it means the ability of a machine or software to learn certain tasks based on trained experience. Software developers no longer have to code and explicate their knowledge. What sounds harmless is a paradigm shift.

An example of this could be the recognition of animals in pictures. To teach the algorithm a distinction, the developer no longer explicitly states in the software code that a cat has - for example - four paws, two eyes, sharp claws, and fur. Rather, the algorithm is trained with many different animal photographs, which it uses to learn independently how the respective animals look and how they differ from other animals. Another example to illustrate the basic principle are audio systems where an algorithm is taught with audio data containing a certain word, e.g., "destination" for the navigation system in a car. In this way, the algorithm learns how this word sounds, even if it is pronounced differently by different people or if different background noises exist (Buxmann & Schmidt 2019, p. 8). This is remarkable for several reasons. For one thing, people often know more than can be expressed. This, in turn, makes it difficult for software developers or analysts to code or specify certain issues. One also speaks here of the so-called “Polanyi Paradox”, named after the philosopher Michael Polanyi: "We know more than we can tell" (Polanyi 1966, n.p.). This principle is well illustrated in Figure 2. People usually do not find it difficult to recognize which pictures are a Chihuahua and which are a muffin. But explaining why the picture falls into a certain category is not trivial.


*Fig. 2:* Chihuahua or Muffin (Buxmann & Schmidt 2019, p. 9).

Arguably the greatest potential of machine learning-based systems lies in the fact that they already exceed the capabilities of humans in many tasks. The following Figure 3 reveals impressively how the error rate of machine learning algorithms in the recognition of images from the "ImageNet" database has decreased in the period from 2011 to 2017. In about six years, errors in the identification of photos with different motifs were reduced from over 30% to less than 4%. It should be noted that the error rate of humans is on average about 5%.

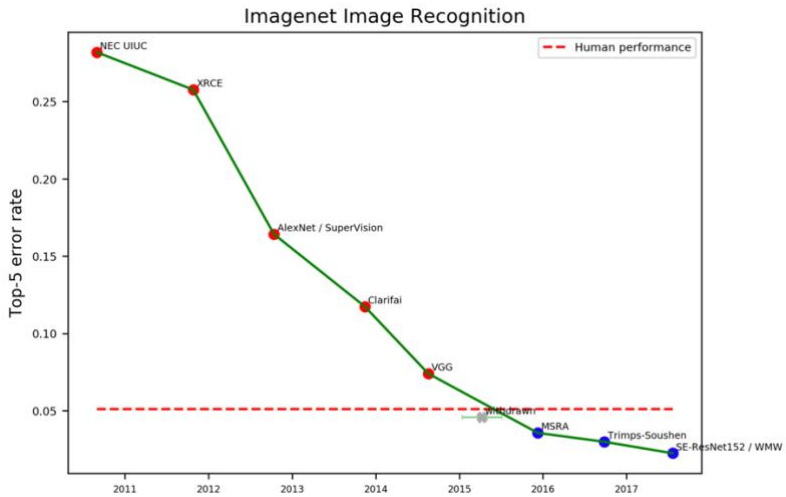



*Fig. 3:* Milestones of Machine Learning Models Error Rate in the Classification of Images (EFF 2018, n.p.).

The Figure illustrates how the error rate of different machine learning systems decreases over time. The machine learning systems shown with a red dot represent those systems that have a higher error rate than the average human error rate (shown as a dashed red line). Machine learning systems are marked in blue when the error rate falls below the 5% mark. The trend is particularly noticeable, which suggests that in the foreseeable future an error rate of machine learning supported systems that tending towards zero is conceivable. The development of increasingly powerful machine learning algorithms can be divided into different types of learning (McKinsey 2018, p. 2-6; Gentsch 2018, p. 38 f).

#### 2.1.1.1 Supervised Learning

During so-called "supervised learning", the AI system already knows the correct answers and only has to adapt the algorithms in a way that the answers can be derived as precisely as possible from the existing data set. The goal or the task of the algorithm is therefore already known here. In this approach to learning, people must be able to draw each element of the input data. Additionally, the output variables must be defined. The algorithm is trained on the input data to find the connection between the input as well as the output variables. Among others, the methods of linear regression, linear discriminant analysis, and the decision tree method are applied. Once the training is complete - typically when the algorithm is sufficiently accurate - the algorithm is applied to new data. The task of such an AI system could be to explain the known prices for different products by their characteristics. Here the system learns independently from a completely predefined data set to recognize the relevant explanatory patterns (Kreutzer & Sirrenberg 2019, p. 7).

#### 2.1.1.2 Unsupervised Learning

In contrast, "unsupervised learning" does not have predefined target values and must independently recognize similarities and thus patterns in the data. Consequently, the user is not aware of such patterns in advance; rather, it is the task of the algorithm to recognize them independently. The knowledge gained by the system can therefore also lie outside the previously "humanly imaginable". For this purpose, the algorithm

receives unlabeled data, in which the algorithm should independently recognize a structure. For this purpose, the algorithm identifies data groups that exhibit similar behavior or similar characteristics. Among others, the methods of hierarchical and k-Means clustering are used (Kreutzer & Sirrenberg 2019, p. 7). Exemplary animal photos would not necessarily have to be categorized according to animal species (dog or cat), but alternatively, depending on the data situation, clusters according to color (black or brown animals) could be produced. Another common application of unsupervised learning is compression methods to filter out the least important components of the data and thus achieve a reduction in file size (Saul & Roweis 2003, p. 120 f.).

#### 2.1.1.3 Reinforcement Learning

In this learning process, there is no optimal solution at the beginning of the learning phase. The system must iteratively try out solutions by a trial-and-error process to discard and/or further develop them. This iterative process is driven by "rewards" (for useful solution ideas) and "punishments" (for poor approaches). This learning concept is often used when there is little training data available or the ideal result cannot be clearly defined (Kreutzer & Sirrenberg 2019, p. 7). It is also used when something can only be learned from interaction with the environment. In this approach, the developer specifies the current state of the environment (e.g., the position in a chess game) and lists the possible action alternatives and environmental conditions (e.g. the possible moves based on the rules of the game). The algorithm must now find the moves that maximize its incentive function. In the case of chess, an incentive function would be specified in such a way that the objective is to win the game (Buxmann & Schmitt 2019, p. 11).

### 2.1.2 Deep Learning

To define the term "deep learning" sufficiently, first an insight into so-called artificial neural networks should be presented, which can be regarded as the basic structure for deep learning. The basic idea of artificial neural networks is to simulate the human brain. In general, an artificial neural network consists of nodes (neurons)

and edges (synapses). The network contains three different types of neurons (Input-, Hidden- and Output-Units), which can be seen in Figure 4 (Buxmann & Schmidt 2019, p. 13 f.).

Input-Units contain the input data, for example, pixels in an image recognition algorithm. These units are denoted as $x$ in Figure 4. The Hidden-Units are located between the Input- and Output-Units and thus represent the inner layers of the network. They are designated $h_1$ ... $h_n$ in Figure 4, since they can be arranged in several layers one after the other. Output-Units contain the output data, for example, classifications such as "apple" or "banana". In Figure 4, the output data are marked with $y$.

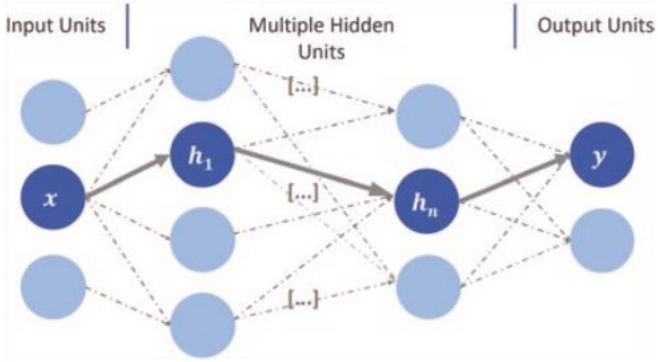



*Fig. 4:* Schematic Representation of an Artificial Neural Network (Buxmann & Schmidt 2019, p. 14).

Deep learning can process a wider range of data resources, requires fewer data pre-processing by humans and can often deliver more accurate results than traditional machine learning approaches. The "deep" refers to the large number of layers of the neural network. For this purpose, special neural networks are built that can take up very large amounts of input data and process it over several layers. Special optimization methods are used, which have an even more extensive internal structure than classical neural networks. Deep patterns and correlations are detected to connect the existing data points. To perform more demanding tasks, computers today can learn from their own experience and relate new input data to existing data. It is no

longer necessary for people to first formally specify this data. The machine gradually learns to assemble complex concepts from simpler elements.

The visualization of these relationships can be done by diagrams, which consist of a multitude of layers and thus gain depth. This is why the term "deep learning" is used (Kreutzner & Sirrenberg 2019, p. 8). In application examples, deep learning models such as the ResNet50 from the Massachusetts Institute of Technology can be integrated into the code of an application, program, or system using a machine learning framework. In this context, Apple, for example, provides the Core ML framework for developers, with which corresponding deep learning models can already be integrated into the developers' code relatively convenient. Core ML is also used for Apple's own machine- and deep learning supported programs such as Siri (Voice Assistant) or FaceID (Face Recognition) (Developer.Apple n.y., n.p.).

Figure 5 illustrates under "1." how the ResNet50 model for deep learning-based image recognition is first downloaded in an application programmed especially for this example and integrated into the respective development environment (in this case XCode from Apple). Image recognition can be tested with a sample image before integration into the code. For the chosen example a photo of several bananas was used, which the ResNet model identifies as bananas with a 99% confidence. This step is shown as "2." in Figure 5. In the last step, which can be seen under "3." in Figure 5, the Core ML model was configured in the self-created code to integrate the ResNet50 deep learning model.

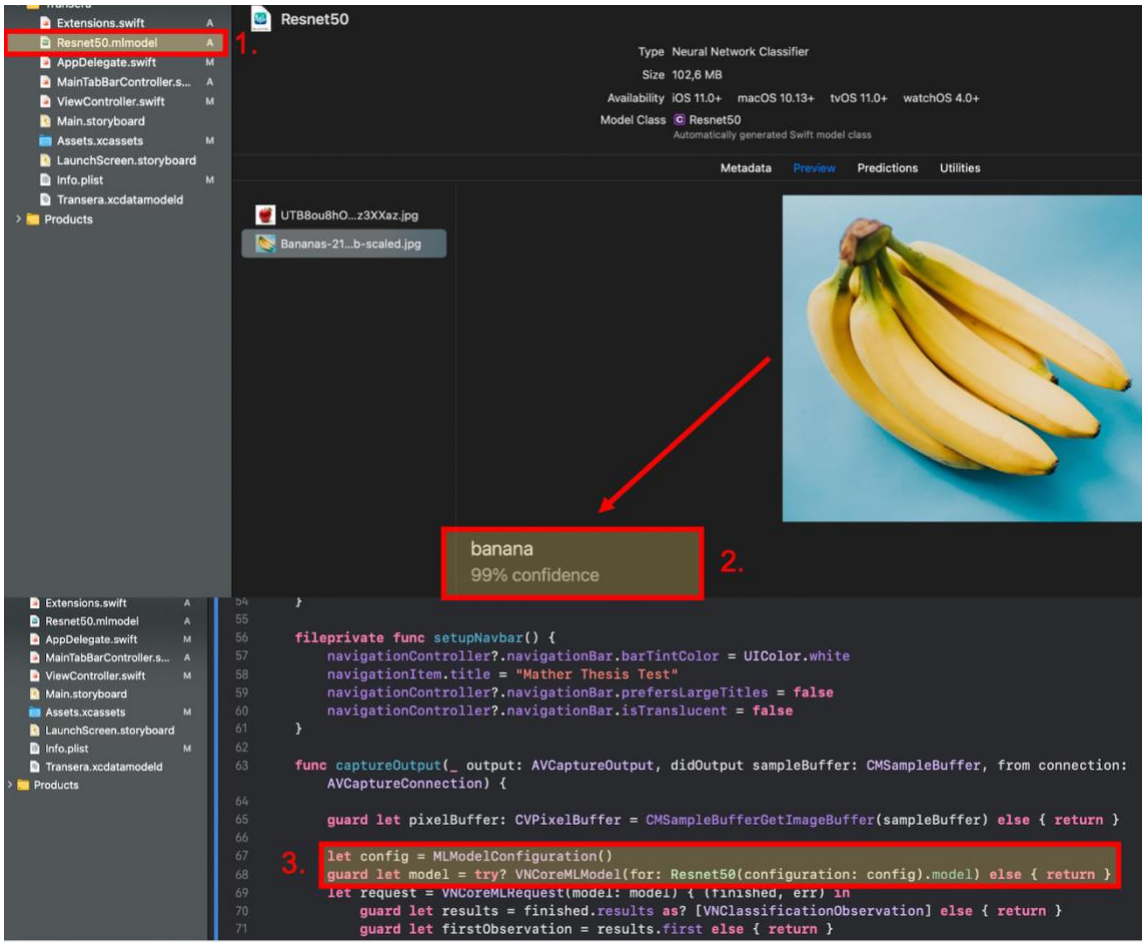



*Fig. 5:* Integration of the Deep Learning Model ResNet50 in an Application (Self-Created Code and Figure).

Thus, it is already possible today to integrate powerful deep learning models into the code of a wide range of professional and hobby programmers in a uncomplicated way according to the open-source principle. In the example above, deep learning based image recognition was made available (open-source) as an application for smartphones, whereby the smartphone camera provides the deep learning model with input images that can be displayed and identified in real-time. It should be noted that with multiple outputs per second, false identifications occur regularly (especially if the smartphone camera's vision is fixed).

## 2.2 Chatbots

In digitally transformed enterprises, more and more employees will communicate directly and immediately with instances of AI. Digitalized processes on the corporate side and digital products and services on the customer side are driving the development of human-machine communication. Natural language remains the only alternative medium for complex communication with human participants. The transfer of information and the presentation of knowledge via written or oral language must therefore be as free of obstacles as possible for man and machine. After all, a digital assistant is worth nothing if the system is limited in understanding human commands. And just as well, we humans are quickly overwhelmed and also unwilling when the machine counterpart confronts us with system messages that are difficult to understand. The further development of language technology is therefore an important strategic component in AI research. An example are so-called chatbots, i.e., self-learning algorithms that support human decision making (Hilbert et al. 2019, p. 178).

For some time now, science has been dealing with machine learning-based language technologies. To get an overview of the development of artificially intelligent speech technologies, the so-called “Turing Test” should be started. As early as 1936, Alan Turing designed a concept for a machine that bears an astonishing resemblance to today's computers and thus laid the foundations for everything that is described as AI. Later, he developed a test which, in his opinion, should make the intelligence of a machine measurable. For this purpose, a human should unknowingly communicate with a machine, for example, via writing, and thereby recognize whether the interlocutor is a human or a machine. If he considers the machine to be human, it is intelligent according to the Turing Test (Herbrich 2019, p. 64).

Nevertheless, it was not Alan Turing, but John McCarthy, a scientist at Stanford University, who introduced the term “Artificial Intelligence". In 1956, he invited to the "Dartmouth Summer Research Project on AI", a conference that is often seen today as the starting point of AI research. Already in the 1960s, the "mother of all chatbots" (Woelk 2016, n.p.) was created under the name ELIZA: the computer program could imitate people in a chat. Admittedly the system could not pass the

Turing test completely, because the machine failed on questions outside of its limited knowledge. Nevertheless, it should be noted that the ELIZA Chatbot already then demonstrated the potential of AI algorithms concerning the possibilities of communication between man and machine (Buxmann 2019, p. 4). In recent years, chatbots, with which humans and machines interact using natural language, have reached the end-user as a new type of application in many areas. This trend also manifests itself in the corporate environment. Today's quality of machine and deep learning enables us to develop systems that use natural language to guide users through complex business processes across domains, understand their own and domain-specific expressions that can be automatically adapted and personalized (Leukert et al. 2019, p. 56). So-called natural language processing as well as natural language understanding - which is to be understood as a sub-area of natural language processing - play a decisive role for the development of chatbots.

### 2.2.1 Natural Language Processing

Natural language processing (NLP) describes the ability of computers to work with spoken or written text by extracting meaning from the text or even creating text that is readable, stylistically natural, and grammatically correct. NLP systems enable computers to respond not only to formalized programming languages such as SwiftUI or Python but also to natural languages such as English or German (Gentsch 2018, p. 31). NLP is one of the AI disciplines that has celebrated the greatest breakthroughs in the past. Figure 6 reveals that, according to statista, global NLP revenue is expected to reach $7,125 million by 2024. Remarkably, this would correspond to an approximately tenfold increase of the global revenue of 2015 (statista 2015, n.p.).

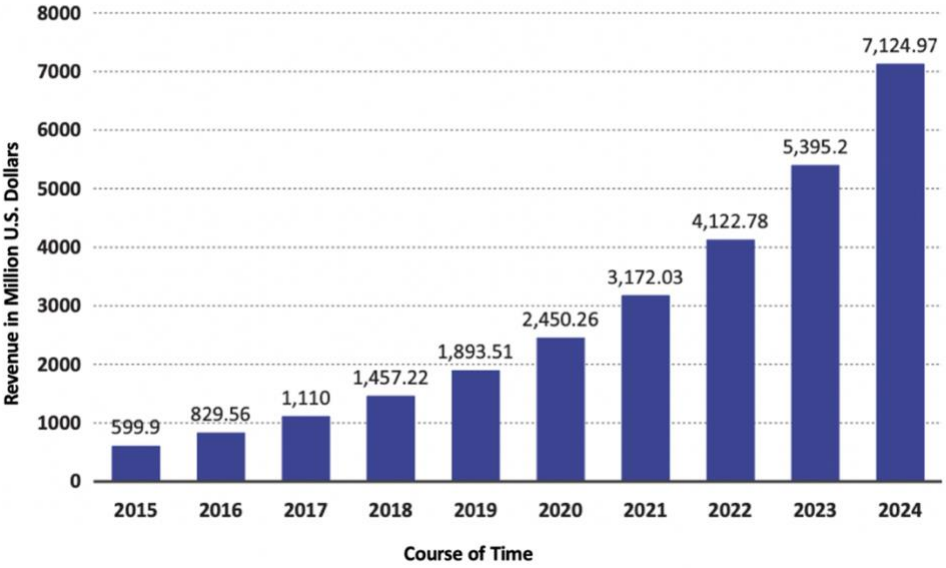



*Fig. 6:* Global Speech Recognition Revenue Forecast from 2015 to 2024 (Statista 2015a, n.p.).

The application forms of NLP must be differentiated. The "Speech-to-Text (STT)" application, in which the spoken word (input) is immediately converted into a digital text, is already widespread. This is the case when using Apple's Siri or Amazon's Alexa, when commands, messages, or notes are dictated directly into smart devices. Furthermore, the "Speech-to-Speech (STS)" application is already used by well-known, large technology companies like Google. The Google Translate application recognizes when voice input is made almost any human language and an immediate translation is generated, for example into English or German with voice output. Question and answer sequences when using digital personal assistants (like Alexa or Google Home) also use STS.

It should be seen more precisely in three steps: STT - Processing - TTS. This is because the digital assistants first convert the spoken language into a digitally available text, interpret and process it and generate a digital text as an answer that is presented linguistically - and all this within a few seconds. Based on the text as user input, there are practical examples of so-called "Text-to-Speech (TTS)" and "Text-to-Text (TTT)" applications. TTS creates a spoken version of the text-based on digital documents. E-mails, SMS and other content can be read aloud in this way. Moreover, acoustic announcements in speech dialog systems belong to this category. This function can be particularly helpful for blind and visually impaired people, who can thus “read” screen information in the broadest sense. In TTT applications, an

electronically available text is converted into another language - also in text form - using a translation program such as Google Translate (Kreutzner & Sirrenberg 2019, p. 28 f.).

The symbol languages used are human languages. A “Word-Object Mapping” is not the challenge; a pure dictionary can be implemented. However, the communicated meaning of what is spoken often lies in semantics, i.e., the rules of interpretation of what is said, which still poses a great challenge to machines today. For example, the semantics of our languages are not uniform and depend on the respective grammar, cultural imprint, intention, and further. Due to the semantics of human language and the multitude of synonyms and ambiguities, NLP is one of the so-called "hard problems" of computer science. In his work on the use of AI in sales, marketing, and services, Gentsch cites a famous example that illustrates the frequently underestimated complexity of human language. Every word in the sentence "Time flies like an arrow" is unique. But if one replaces "Time" with "Fruit" and "arrow" with "banana", the sentence will be: "Fruit flies like a banana". While "flies" in the first sentence still describes the verb "to fly", in the second, adjusted sentence it becomes the noun "(Fruit-) flies", and the preposition "like" - becomes the verb "like" in the second sentence (Gentsch 2018, p. 32). If language wit, irony, sarcasm, puns, and rhetorical phrases are still used in communication, a data dilemma arises that is difficult for many AI systems to overcome. The AI process responsible for processing spoken language is called natural language understanding. The special challenge lies not only in the pure meaning of a sentence but also in the multi-layered meaning that can be associated with it.

### 2.2.2 Natural Language Understanding

Schulz von Thun's so-called 4-Ears Model of Communication describes the challenges that the complexity of human communication presents. According to the model, each message can be divided into four different dimensions of communication. On the one hand, a message offers factual content that specifically expresses the pure information of a statement. On the other hand, the sender of a message simultaneously - whether intentionally or unintentionally - also transmits

information about himself, which is shared with the recipient. According to Schulz von Thun, this is called self-revelation. Furthermore, by choosing the terms used and the way they are emphasized, the sender also conveys something about what one thinks of the other person and the relationship the sender has with the recipient. The fourth dimension includes the appeal for action, which expresses the demand or request that the sender intends to make to the receiver (von Thun 2019, n.p.).

It can be correspondingly complicated for the recipient of a message to correctly identify and decipher the sender's intentions. In the context of chatbots, a large challenge is to integrate the ability of 4-Ear-Model of Communication into machine learning models in a perspective way - even if it is not fully developed in humans. Especially in this area, many NLP applications seem to be far away from the desired results (Kreutzer & Sirrenberg 2019, p. 32).

The natural language understanding (NLU) is a subset of NLP and refers in particular to the decoding of natural language or the machine processing of information input, which is available as text or spoken. The following Figure 7 illustrates NLP as a holistic model. It becomes clear that the interaction of different, partly overlapping tasks is necessary to process human language by machine.

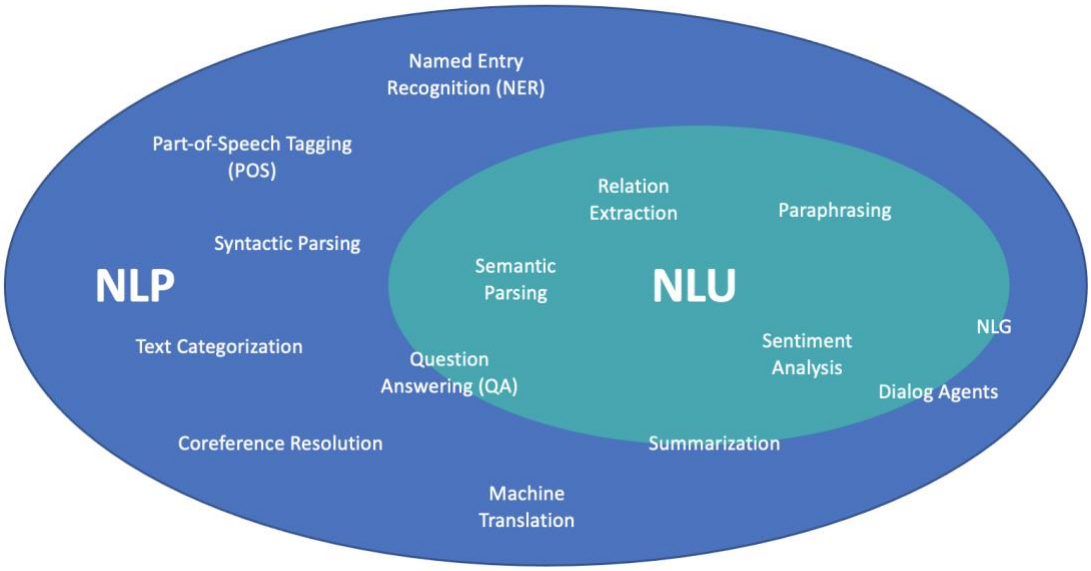



*Fig. 7:* Functions within the Natural-Language-Processing (Kreutzer & Sirrenberger 2019, p. 32).

The decoding of the input is done by semantic parsing or the extraction of information. Semantics is concerned with the meaning of linguistic characters and character strings; it is about the meaning and content of a word, a sentence, or a text. The term parsing is used to refer to the decomposition or analysis of information. Paraphrasing is also applied for this purpose. These are the paraphrases of a linguistic expression or multiple expressions using different words. The goal is to transform natural language information into a machine representation of its meaning. As the 4-Ears Model of Communication reveals, the extraction of partly multiple relationships within the entered sentences in context is an important aspect of language analysis. Thus, NLU uses the relation extraction. Accordingly, it can be deduced, for example, that "John Doe", who answers questions about the "Example Company Inc" as a press spokesman, is an employee of the company or at least acts on its behalf, i.e., has a relationship with the company in both cases (Kreutzner & Sirrenberg 2019, p. 33). For example, the NLU uses the so-called Support Vector Machine (SVM) method to generate classifications based on a database (consisting of training data and empirical values), which allows contextual and individual responses to people or questions. Remarkably, SVM models have considerable potential for generalization through data assignment to classes and the ability to identify dividing lines and areas. Thus, it is increasingly possible to familiarize machines with different dimensions of communication and to simulate human processing (Noble 2006, p. 1565). This is to offer an example that provides a deeper insight into the functionality and possibilities of NLU.

However, NLU-based programs and systems also offer solutions for further dimensions of communications. Sentiment Analysis is used to identify specific evaluative information from spoken or written text. Based on social media comments, it is possible to deduce how the writer feels about a company, a party, or a brand. The sum of many analyses, some of which are carried out simultaneously and independently, provides the basis for a comprehensive understanding of the message transmitted, on the basis of which information is generated. NLP programs analyze the text for grammatical structures, assign words to specific word-groups, or make other higher-level assignments that go beyond the actual content of the text. NLU deals - as a subset of NLP - with the pure content decoding of the text or the spoken word. Only the interaction of the different analysis steps makes a

comprehensive understanding possible - as the basis for successful communication of the chatbots (Kreutzner & Sirrenberger, p. 34).

### 2.2.3 IBM Watson Assistant

The word “chatbot” consists of the terms “chat” and “robot”. Originally, the term chatbot was used for a computer program, which simulates human language with the aid of a text-based dialogue system. Chatbots contain a text input and output mask, which allows mobile users to communicate with the software behind them, giving them the feeling of chatting with a real person (Zumstein & Hundertmark 2017, p. 98).

For the elaboration of the potentials as well as challenges of the use of chatbots at private universities, some applications are illustrated in some parts in this thesis by a prototype build by the author. These suggestions of the prototype "StudyBuddy" were elaborated with the IBM Watson Assistant. Therefore, in the following, the IBM Watson Assistant will be used to illustrate how chatbots work.

A chatbot program acts by taking advantage of the NLP. In this process, five steps happen while the chatbot is interacting with a user, which are shown in the following Figure 8.

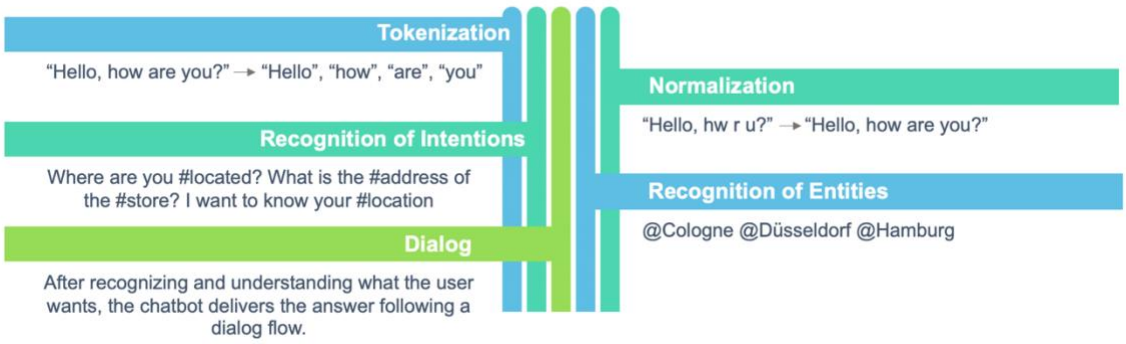



*Fig. 8:* Interaction with the IBM Watson Assistant in 5 Steps (Self-Created Figure).

First, the text entered by the user is tokenized. During this process, the text strings are divided into individual parts (tokens) to provide the program with a basis for

further action (Tam et al. 2020, p. 1). In the next step, the individual tokens are normalized. This step can be seen as an autocorrection of the tokens, where, for example, typos are automatically corrected or abbreviations become whole words. The underlying, already prepared text is then examined concerning the so-called "intents" of the tokens. Intents are purposes or goals that are expressed in a customer's input, such as answering a question or processing a bill payment. By recognizing the intent expressed in a customer's input, the Watson Assistant service can choose the correct dialog flow for responding to it (IBM 2021a, n.p.).

The individual intents are usually provided with a #-symbol in front of the word or token. In addition, the IBM Watson Assistant examines the individual tokens with respect to so-called "entities", which represent information of the user input that is relevant for the user's purpose. If intents represent verbs (the action a user wants to do), entities represent nouns (the object of, or the context for, that action). For example, when the intent is to obtain a weather forecast, the relevant location and date entities are required before the application can return an accurate forecast. Recognizing entities in the user's input helps to craft more useful, targeted responses. If there might be a #buy intent and a user formulates a request which triggers the #buy intent, the assistant's response should reflect an understanding of what the something is that the customer wants to buy. In this case, a @product (The @-symbol prepended to the entity name helps to identify it as an entity) entity would be useful to extract information from the user input about the product that the customer is interested in (IBM2 2021b, n.p.).

The created intents and entities are then inserted into the Dialog Nodes. The Dialog Nodes consist of Dialog Skills that contain the desired responses to recognized intents as well as entities during the conversation. IBM describes the Dialog Skills as "containers for the artifacts that define the flow of a conversation that (the) assistant can have with (the) customers" (IBM3 2021c, n.p.). In addition to pre-written texts, more complex, individualized response options can also be created. In addition, the IBM Watson Assistant can be networked with other programs that perform actions at selected points in the conversation. Figure 9 illustrates an example conversation with the training simulator. Here, developers of the chatbot can view which intents and/or

entities were captured by the chatbot and how quickly. Moreover, they can actively intervene in the NLP-based training of the chatbot.

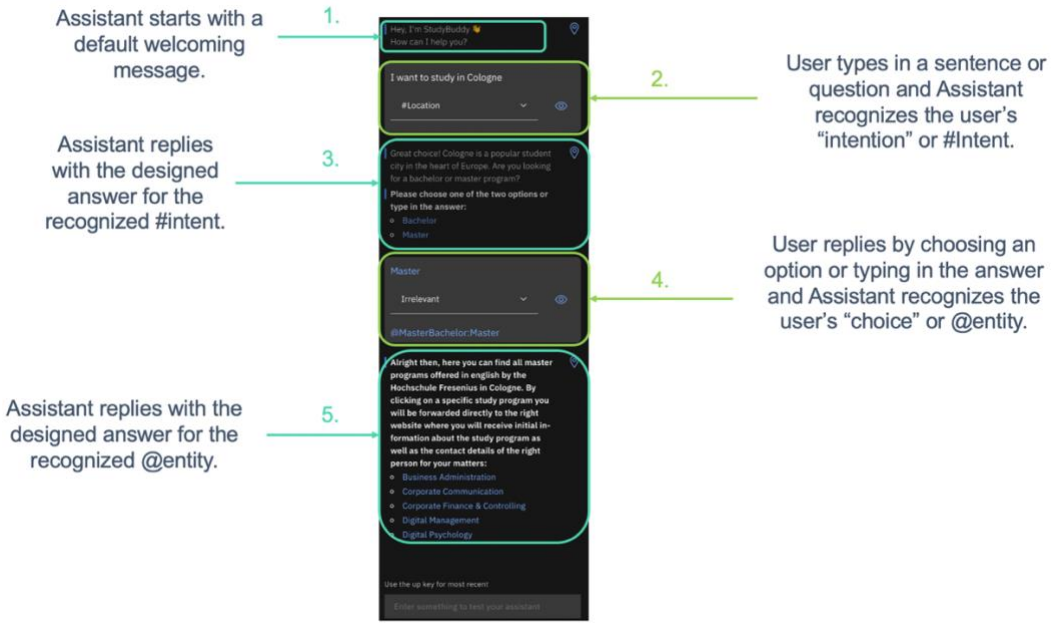



*Fig. 9:* How the IBM Watson Assistant Training Simulator works (Self-Created Figure).

As the basis for a powerful chatbot that supports machine and deep learning models, the IBM Watson AI system represents a modular platform. This platform contains a variety of AI-based Information Technology (IT) services that work with specific APIs (Application Programming Interfaces). Based on cognitive algorithms - i.e., "capable of learning" in the broadest sense - and thus solve specific tasks and problems with speech, image, and text analyses or translation services as well as conversation aids. Consequently, IBM Watson is to be regarded as an AI-based "toolbox" consisting of various cognitive software components that IBM makes available via the IBM Cloud.

In this context, IBM Watson should be viewed less as a ready-made solution and more as a modular system whose performance has been steadily increased in recent years. The modular structure allows various options for using the individual IBM Watson IT services. In addition to solitary solutions for specific tasks, larger "packages" in which various capabilities come together are also possible. Thus, in addition to the "chatbot construction kit", IBM Watson provides several IT systems

that can potentially be integrated into the applications of the chatbot (Hildesheim & Michelsen 2018, p. 130 f.).

### 2.3 Private Universities in Germany

To gain a better understanding of the university landscape in Germany, the term university must first be defined and the legal aspects - relevant for this work - listed. Within the education system, universities in Germany represent the most highly ranked institutional form. However, there is no clear definition of the term "university" in the German Higher Education Framework Law. Rather, a list of different types of higher education institutions is given (§ 1 HRG). Furthermore, the tasks of the universities are listed, the fulfillment of which can be considered a prerequisite for the status of a university in Germany (§ 2 HRG). The named tasks can be differentiated into primary and secondary tasks. Primary tasks are the tasks of scientific research and teaching mentioned in Art. 5 (3) GG, all others are secondary tasks. The former include the "cultivation and development of the sciences and the arts through research, teaching, study and further education" and the "promotion of young scientists and artists" (§ 2, paragraph 1 HRG).

Secondary tasks are understood to include among others: the promotion of continuing education for staff, participation in the social advancement of students or the promotion of international cooperation (cf. § 2, paragraphs 2 to 8 HRG). Since not every university is required to fulfill all of the above-mentioned tasks, in reality, there are various forms and emphases (Reich 2005, p. 55 & 67). The fundamental goal of universities is, without prejudice to this, to prepare students for a professional field of activity by providing them with the necessary specialized knowledge, skills, and methods (§ 7 HRG).

### 2.3.1 Term

The Higher Education Framework Act distinguishes between state and state-recognized universities, with the former group being considered the rule (Sperlich 2007, p. 27). The term "state-recognized universities" is to be understood as an umbrella term for church-run universities, federal universities, and private universities that fulfill the listed tasks and conditions of the Higher Education Framework Act. Since the Basic Law does not make any explicit provisions regarding the content of universities, it is not surprising that it does not mention private universities either (Thieme 2004, p. 55). However, many authors interpret the "freedom of art and science, research and teaching" (Article 5, paragraph 3 of the Basic Law) as guaranteeing a sphere of freedom that is protected against state intervention and including the basic right to realize it outside of state organizations (Wiedmann 2001, p. 42).

The criteria that ascribe a private character to a university are to be sought in its sponsorship and financing or a combination of these. In the case of state-run universities, the country in which the university is located is usually considered the responsible body. Privatization, on the other hand, means the transfer of public ownership to private individuals or companies (Sperlich 2007, p. 31). This can be seen as a transfer of state to private ownership of the university.

In contrast, the financing of the university is somewhat more difficult to capture as a criterion for differentiation. In this context, university financing is concerned with the type of income sources a university has and the proportion of these sources. However, the threshold value above which a university should be considered private is not clearly defined. While Zimmerli in his work on this subject mentions a university as private if it is financed 70% privately (Zimmerli 1998, p. 565), Sperlich in her elaborations mentions a 50% mark, which must be private financing, as a defining criterion for private universities.

It should be noted that in reality, some hybrid forms of the two criteria for delimitation (carrier and financing) can be observed. A conventional state university is, however, a state-supported university with predominantly state funding. For

private institutions of higher education, the definition of Sperlich is to be used for this paper, which describes private institutions of higher education in Germany as "an institution recognized as a higher education institution that is supported by one or more private natural or legal persons and is predominantly financed by private funds" (Sperlich 2007, p. 35).

### 2.3.2 Factual and Formal Objectives

While the formal goals of commercial enterprises focus on "desired monetary states" (profitability and liquidity), the actual material objectives reflect "desired natural states" (Eichhorn & Merk 2005, p. 186). In the case of private universities, these actual factual objectives can be seen as the purpose, e.g., the education of students and research. Additionally, there are economic factual objectives that focus on participation in economic transactions as well as customer orientation and competitiveness. In the case of objective systems of state universities, the area of factual objectives (with the main factual goals in research and teaching) predominates, whereas the formal objectives (revenue goals and economic efficiency) are rather brief and are also not anchored in the corresponding laws (Sperlich 2007, p. 100).

Concerning the orientation and the objectives as well as the image of private universities, Sperlich can demonstrate four types of private universities in Germany within the framework of an empirical study: science-oriented, profit-oriented, and portfolio-oriented universities as well as the so-called "combiners", which cannot be assigned to anyone direction (see Sperlich, pp. 147 f. for details). According to Sperlich's study, type 1 private universities are dominated by science-driven objectives. Private universities classified as Type 2 are considered to be "portfolio-driven" higher education institutions, with a stronger focus on objective orientation about solving societal problems, training the workforce, and further developing teaching methods. Type 3 of the study includes private universities that show a relatively strong expression of the objective of profit orientation. Type 4 is called "combiner" and is characterized by a relatively low expression of each of the features "promotion of the scientific elite", "profit orientation" and "portfolio-driven".

### 2.3.3 Competitive Environment

Despite the de facto state monopoly on higher education in Germany, a rudimentary pluralistic higher education system has developed. Both state and private universities compete for applicants. Additionally, universities compete with each other not only on the sales market but also on the procurement market concerning resources such as personnel or funding (Bliemel & Fassot 2001, p. 270 f.). Spoun predicted already in 1998 that in the future there will be competition for outstanding students, young scientists, professors, state funds, and third-party funds (Spoun 1998, p. 44).

In the following, Porter's model of the 5-Forces is used to illustrate the competitive situation of private universities. The model assumes that the profitability of an organization is directly related to the market structure. Therefore, organizations should develop their strategies in light of a mature understanding of the competitive structures and rules of the markets in which they operate. Individual markets can be viewed in terms of five competitive forces. The strength of the five forces varies from industry to industry and determines the ability of players to make a profit (Porter 1985, p. 4). Figure 10 illustrates the 5 Competitive Forces of the University Education Industry.

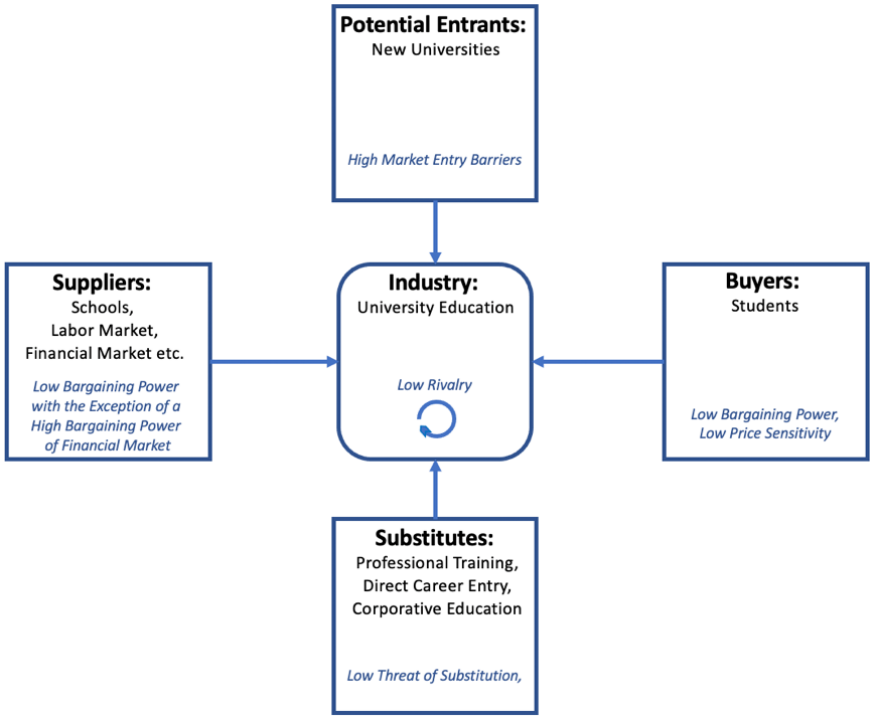



*Fig. 10:* The Five Competitive Forces of the "University Education" Industry (Self-Created Figure Based on Sperlich 2007, p. 68).

All providers of higher education are considered, regardless of the type of higher education institution and regardless of the diversity of their products and services. Rivalry among existing higher education institutions relates to the introduction of new programs and the improvement of existing services. Unlike in other industries, competition is considered to be rather low and "polite" or "genteel." Due to their heterogeneity, universities often find it difficult to understand each other's intentions and to agree on the "rules of the game" in the industry. The high barriers to exit due to political hurdles and sunk costs do the rest to ensure that less successful universities remain in the industry (Sperlich 2007 p. 65 f.).

However, since new entrants must also overcome high barriers to entry, the threat of new competition as a competitive force must be considered rather low. Established universities benefit from the name recognition and loyalty of their students. By contrast, enrolling at a newly established university entails great risk for a student, as it is difficult to predict how the university will develop. This can be applied for staff as well, for whom a transfer to a newly founded university also entails the aforementioned risks. High capital requirements for accreditation and state recognition also support the view that the threat from the competition can be regarded as rather low. The bargaining power of buyers must be viewed in a differentiated manner. It does not seem to be clear who is to be considered a buyer. While there are arguments in favor of students as customers, the state can also be regarded as a customer, since in many cases it pays for the services. The public as well as the business community, which may accept graduates, can also be considered a buyer. However, based on the classification of higher education institutions as service providers, the business community as an interested party in qualified personnel cannot be considered a customer in this sense, since one of the products of the higher education institution is the teaching service and not the finished graduate. Nevertheless, business enterprises are customers of universities in the corporate customer business, for example, in continuing education programs or contract research. A similar argument can be made for the state and the public so that ultimately the group of students remains as the purchaser of higher education services.

Their bargaining power is low, however, because their level of information is relatively low and they have not yet succeeded in merging into a powerful group, as evidenced by the broadly echoed protests against the introduction of tuition fees (Sperlich 2007, p. 66). The threat of substitutes is also difficult to identify. In 2004, Jacob primarily identifies direct career entry and traditional vocational training as substitute products of higher education (Jacob 2004, p. 142). But since both alternatives do not come close to the educational return of studying at a university, the substitution tendency is to be classified as unlikely (Sperlich 2007, p. 67).

The fifth competitive force, the bargaining power of suppliers, will also be considered. The suppliers in the market for higher education are schools, labor markets, and financial markets. However, as is common in other markets, none of the aforementioned can exert a bargaining power that directly affects the price or quality of services provided by German universities (Sperlich 2007, p. 67). However, if one models the institution as a financier and thus as a supplier of a production factor, a great deal of bargaining power becomes apparent. After considering market forces, Porter's model provides for the classification of the industry through typical situations (Porter 1999, p. 255 f.). The German higher education industry reveals characteristics of both a fractured and fragmented industry. This is indicated by the fact that, on the one hand, no competitor has a significant market share and, on the other hand, none of them significantly influences the industry result. This is due to the historical decentralization of the German higher education system. In addition, universities offer a personnel-intensive service and there are hardly any economies of scale to be realized. High exit barriers contribute to fragmentation, and some universities pursue a strategy of specializing in service types or segments and concentrating in geographic areas (Porter 1999, p. 268). In summary, fragmentation and market conditions act as a deterrent to potential entrants, and yet there has been an increase in the number of start-ups of private universities in Germany (Sperlich 2007, p. 69).

Driven by steady growth and the wave of new foundations, private universities in Germany are increasingly offer subjects such as art, technology, or medicine, subjects that were previously only taught at state universities. However, private universities also grew steadily in the number of business-related courses of study.

The main reason for this is the labor market-oriented approach, which offers students a practical education that is geared to the needs of the labor market through a strong output orientation. For example, a representative survey conducted in 2007 showed that graduates had an average of 2.3 job offers at a private university at the time they graduated in economics. Graduates of economics courses at public universities had 1.4 job offers at the time of their graduation, only about half as many (Frank et al. 2020, p. 21).

In summary, it should be stated that private universities are in competition with each other as well as with state and church universities on the sales and procurement markets (Bliemel & Fassot 2001, p. 270 f.). Competition exists in particular with regard to applicants and the resources personnel and financial means. In the student market, Sperlich sees the group of state universities as having an advantage "because it covers all subjects, is more active in research and enjoys a reputation for stability and reliability" (Sperlich 2007, p. 61). State backing contributes to this. "Real conditions for competition, according to Mannheim's rector Arndt, would not exist until state universities could also go bankrupt" (Hener 2005, p. 3). Private universities show a focus on economics and seem to distinguish themselves from their competitors especially through their practical orientation in these areas. As a result of the competitive situation and the - compared to state universities more pronounced - pursuit of formal business objectives, private universities must engage in active marketing and therefore invest in corresponding resources.

### 2.3.4 Success Factors

Despite the increasing popularity of private universities, the reasons for the success factors of private universities do not seem to be sufficiently studied in science. For one thing, there is little scientific work on the success factors of private universities (Sperlich 2007, p. 110). Furthermore, the concept of success factors is fundamentally controversial in business administration. The fundamental criticism by James et al. (James et al. 1997, p. 698 f.) leads, among other things, to fundamental doubts about the research design: the models are too simple to be able to represent the complexity of enterprises.

In an empirical study (Sperlich 2007, p. 116 f.), Sperlich uses the definition of a success factor according to Grünig et al. as a basis: "A strategic success factor is understood to be a variable that is capable of significantly influencing strategic success in the long term" (Grünig et al. 1996, p. 4). Accordingly, success factors are a few important areas: "The few key areas where things must go right for the business to flourish" (Rockart 1979, p. 85).

For private universities, Sperlich identifies four success factors "available resources", "room for maneuver of the university management", "communication and cooperation efficiency" and "market-adequate behavior" (Sperlich 2007, p. 118 f.). The elaborated success factors are then examined with regard to their correlation with university success. University success is measured in summary with the help of the indicators utilization success, self-assessment, external assessment as well as a university success index (Sperlich 2007, p. 130). While, according to Sperlich's empirical study, no significant correlation with university success could be demonstrated concerning the first three success factors, market-adequate behavior is to be regarded as the only significant success factor (Sperlich 2007, p. 145).

In this context, market-adequate behavior is understood as the university's acting on the market and reacting to the market (Sperlich 2007, p. 165). Participants process the markets in an adapted manner so that these markets accept their services (Tutt 2001, p. 275). In this context, the construct market-adequate behavior includes the four indicators of adaptability, distribution policy, product and program policy, and pricing policy of a private university. Private universities should consider the design of the courses of study (products) as well as the overall range of courses of study (program) and take into account which target group the courses of study are aimed at. Additionally, the distribution policy should consider the form in which the degree programs are offered (e.g. face-to-face versus distance learning). Adaptability addresses the question of how the products, programs, and administration of private universities change over time. The number of tuition fees as well as the payment conditions reflect the pricing policy of private universities in this context (Sperlich 2007, p. 166). Further analysis related to the measurement of university success reveals that students and student satisfaction, respectively, play a prominent role at private universities. Students lead both the ranking of significant stakeholders and

the hierarchy of goals deemed important and actually achieved (Sperlich 2007 p. 158).

From the preceding definition and analysis of private universities, the following relevant characteristics and aspects emerge for the present work. Private universities operate in a competitive market environment, pursue, in addition to factual goals - with varying weighting and characteristics - formal business goals, such as profit, revenue, and cost goals. Accordingly, private universities require and pursue business planning, control, and monitoring of the entire value chain - which is comparable to that of market-based service companies - with a particular focus on the success factor market-adequate behavior and accord high importance to the stakeholder "students" when measuring their success.

As will be shown in the following, chatbots can support the achievement of the success factor market-adequate behavior, the effective support of individual functions and processes of the value chain, and the realization of the formal goals of cost reduction and revenue increase.

# 3 Application of Chatbots in Private Universities

Based on the theoretical background, Chapter 3 will first examine the potentials that the use of a chatbot presents for private universities in Germany. To illustrate this, Porter's model for examining competitive advantages along the value chain of organizations will be adopted as a basis. The three primary value creation activities "Marketing", "Applicant Management" and "Service" are identified as those activities that indicate a significant economic potential for the use of chatbots at private universities. For each of the three mentioned application areas, potentials are identified and illustrated using the chatbot prototype as an example. In addition, a model is derived and presented that serves as a proposal for a framework for the implementation and development of a chatbot project at private universities. The challenges that should be considered when using chatbots at private universities are also explained.

Taking into account the elaborated potentials and challenges, an economic evaluation of the use of chatbots at private universities is then conducted. To answer the research question, this chapter concludes by deriving six hypotheses about the use of chatbots at private universities from the insights gained. These six hypotheses contain assumptions that summarize the results of the study based on the literature and the prototype.

### 3.1 Fields of Application in the Business Process

In his work "Competitive Advantages: Creating and Sustaining Superior Performance" Michael E. Porter presented the so-called Generic Value Chain for the first time. Porter described the value chain as a "collection of activities that are performed to design, produce, market, deliver and support its product" (Porter 1985, p. 36). The value chain can be divided into nine generic processes, which are shown in the following figure 11.

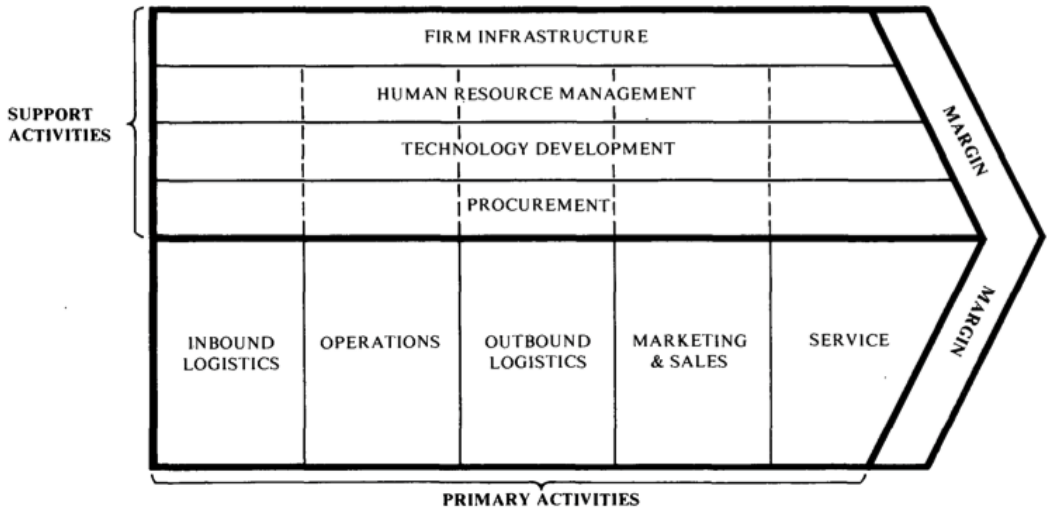



*Fig. 11:* The Generic Value Chain (Porter 1985, p. 37).

The five primary activities include the actual creation of the products and services, from purchasing materials to production and sales. The four secondary activities describe process elements that support the creation of supporting services. In each of these activities, a company can gain a strategic competitive advantage (Schawel & Billing 2018, p. 367). The value is the number of customers who are willing to buy the company's product or service. Therefore, according to Porter, value is expressed in terms of the revenue that a company generates. Margin is the difference between

the revenue generated and the resources used, which can also be seen as a collective cost of implementing value-added activities (Porter 1985, p. 38).

Of course, hundreds or thousands of individual processes run in a company, which are not described in this detail in the value chain. Especially the secondary activities are often called "overhead" by companies and are given little attention in the context of improvement measures. Other companies have managed to develop strategic competitive advantages from secondary activities as well. To identify or create strategic competitive advantages, the value chain can be used for an initial analysis. The processes that are decisive for the company can then be detailed and relationships to other processes within or outside the company are described. A relationship exists when the performance or costs of one process influence another (Schawel & Billing 2018, p. 368).

The analysis of the value chain supports companies to identify improvement potentials in service delivery and support activities. Additionally, it can be used, for example, in a make-or-buy decision, in which it is checked which value-added steps the company intends to cover itself and which should be purchased. Overall, Porter's value chain provides a transparent representation of the service delivery process and also serves to identify horizontal interfaces within the company as well as areas and vertical interfaces with cooperation partners. Porter emphasizes that the identification of value-added activities - as a basis for the optimization of individual process steps - requires an isolated view of those activities (Porter 1985, p. 39).

Therefore, in the following, a closer view of the creation of value activities of a private university is provided, which exhibit a special potential for the employment of chatbots. For this purpose, a model will be worked out which, based on Porter's value chain, considers, in particular, the primary activities of economically active private universities. The approach of the Fresenius University of Applied Sciences will be used as an example. The analysis will focus on the primary activities of Marketing, and Applicant Management (which is considered as a sales activity in the value chain) as well as the Service of the Hochschule Fresenius. Figure 12 demonstrates a model to illustrate the potential that the use of a chatbot offer could

provide for the respective primary activities on the way to customer acquisition - i.e., the transformation of interested parties or target groups to students or customers.

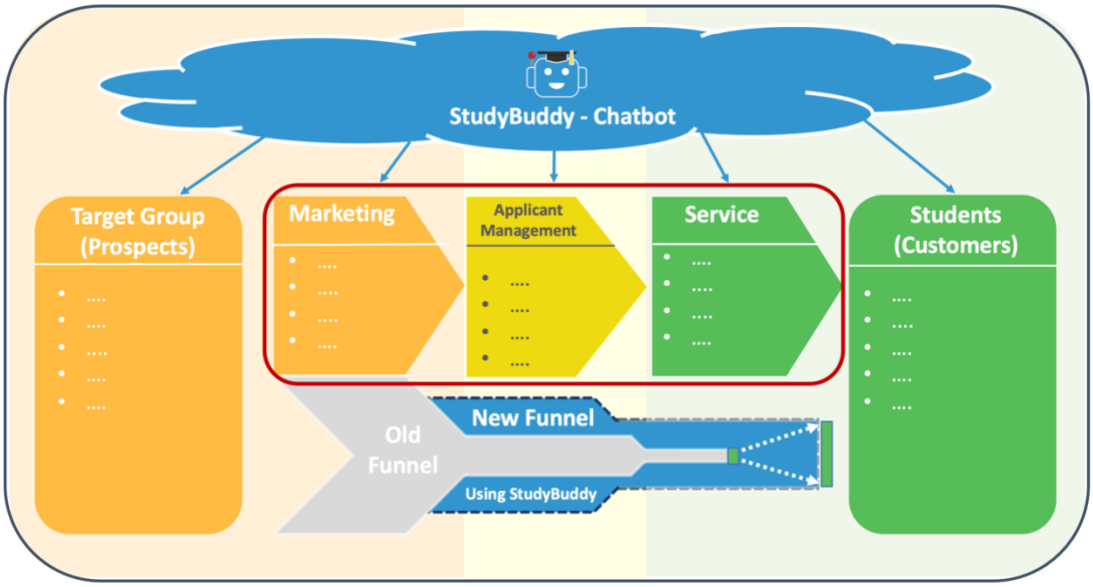



*Fig. 12:* Support through Chatbots in University Activities – Model Framework (Self-Created Model Based on Primary Activities of Porter's Value Chain, Porter 1985, p. 37).

The red marked area demonstrates the activities of private universities, which could be accompanied and supported by chatbots. Following Porter's value chain, the primary activities to be considered are analyzed by showing the state of research in each area, taking into account the respective potential of chatbots. The prototype "StuddyBuddy", which is programmed and worked out using IBM Watson Assistant, is to illustrate and clarify the potentials. In addition to the knowledge about the individual primary activities as well as the target group and customers of private universities, finally, the holistic potential of the use of chatbots in the three value-added activities will be considered. This is illustrated in Figure 12 of the model, in the form of an optimized funnel, which promises a wider range of customers at the end of the considered value-added activities through the use of a chatbot. Initially, this is merely a working out of the potentials, which are then contrasted with the challenges and critically assessed.

### 3.1.1 Marketing

Due to the increasing competitive orientation of private universities, the approach of marketing is increasingly being given importance in science (Frank et al. 2010, p. 76). From a marketing theory perspective, university marketing includes all targeted activities that universities undertake to establish, expand, and successfully design exchange processes with their various target groups. In this sense, the university marketing approach stands for a market and demand-oriented management of universities and consistent orientation of all university activities to the desires and needs of their target groups (Röttger & Laukötter 2019, p. 165). From a business marketing perspective, university marketing serves as a strategic instrument of the university management to secure the university's existence (Müller-Böhling 2007, p. 268).

Defining the subject of university marketing regarding an organizational perspective is challenging. In general, the boundaries between the functional areas of university public relations and university marketing are blurred in practice and there are also different understandings of the tasks of the respective areas. Activities that fall within the scope of Marketing at one university can be the subject public relations work at the next university and vice versa. Furthermore, some of the areas flow seamlessly into each other. (Friedrichsmeister et al. 2013, p. 26).

The changed governance structures in higher education and in particular the introduction of internationally comparable tiered Bachelor's and Master's programs within the framework of the Bologna Process have led to intense and increasing international competition for scarce resources. In addition, the need for public visibility is also increasing, with the online presence of universities, in particular, has gained massively in importance over the past decades (Röttger & Laukötter 2019, p. 170).

An important aspect of university marketing is to address and attract the target group on the channels on which they are regularly active. An ARD/ZDF online study from 2018 - 2020 showed that 95 % of 14 - 29 year-olds in Germany use the WhatsApp communication platform. Moreover, 65% of the same population group frequently

use Instagram as a social media channel, and 44% are active on Facebook. The percentage of the total population using all named channels except Facebook grew in the years studied (ARD/ZDF 2021, n.p.). In addition to the integration of a communication offer on the website of private universities, it is also possible to place a chatbot on these channels, which would allow the target group to be addressed online and mobile. The "WetterBot" of the weather forecast website WetterOnline has already reached a commitment of more than 90,000 daily users (out of a total of 220,000 users) and over 2.5 million requests per month in 2018. WetterOnline recorded an average growth of 20% per month of Messanger subscribers in 2018 (Mehner 2019, p. 161).

Already today, some best practice examples provide an insight into the potential that chatbots can offer companies in marketing. A representative BITKOM-survey provides information that among the Germans who already use chatbots or can imagine using a chatbot, 68% would use a chatbot to make appointments. Moreover, 58% of those surveyed would like to use chatbots to search for specific offers, products, and services (Mehner 2019, p. 154). A chatbot could do preparatory work in this area and, in addition to providing simple information on frequently asked questions, could also guide potential students to the appropriate university marketing staff. The following Figure 13 illustrates an example of a possible conversation between a prospective customer and the StudyBuddy chatbot prototype.

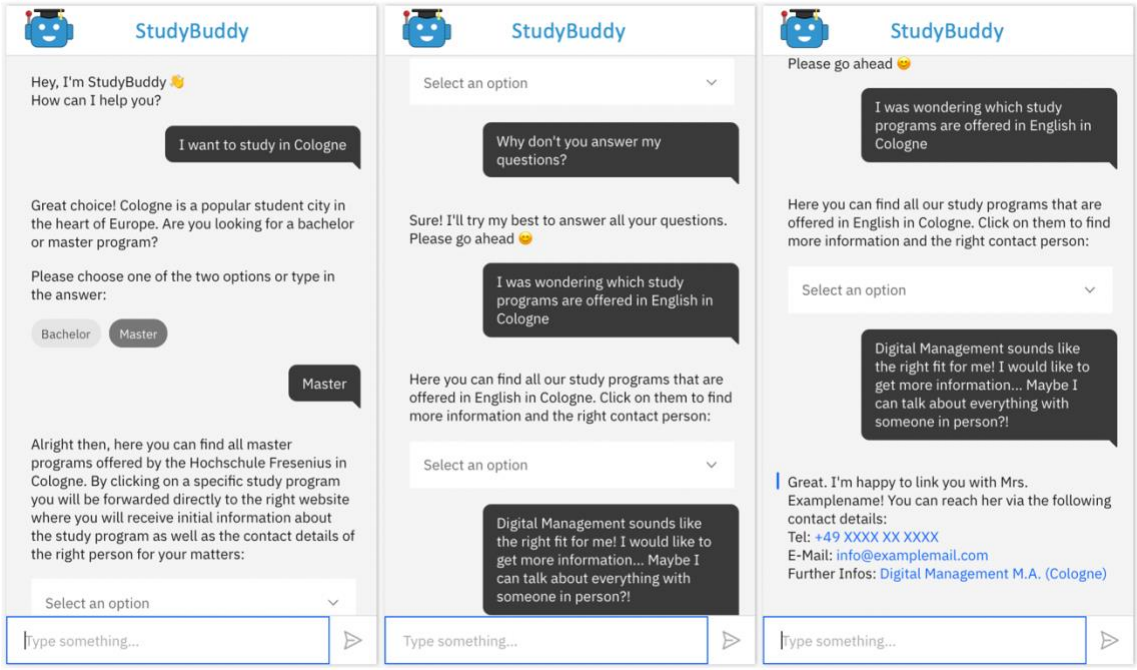



*Fig. 13:* Potential Conversation of a Chatbot with a Prospect (Self-Created Figure).

The data already provided from interactions with prospects can be forwarded to the respective employee in compliance with data protection regulations. The appropriate Marketing employee can then enter into the conversation with the prospect already aware of the necessary information. Furthermore, there are potential time and cost savings through automated preparation and collection of relevant information from the prospective customer. Additionally, there is the possibility - bound to compliance with data protection regulations as well - to obtain valuable information about the target group of private universities from the course of the conversations that a chatbot has conducted. From a technical point of view, in contrast to conversations conducted in person, the conversation histories can easily be stored and subsequently viewed and analyzed. Recurring topics can be optimized, the customer journey through the different active channels of the chatbot can be investigated, and all in all, the potential to collect valuable information about the target group which can be integrated into the strategy of the university marketing is gained.

Chatbots can also be seen as interactive search engines, which enables content from the website or other webpages (also outside the own website) to be made available to users in a communicative way (Brandtzaeg & Følstad 2017, p. 9). Figure 14

illustrates how contents of the Hochschule Fresenius website could be accessed upon request during a conversation between a user and the StudyBuddy. Only content that is requested is displayed, which allows online counseling and information collection to be more individual and personalized for visitors.

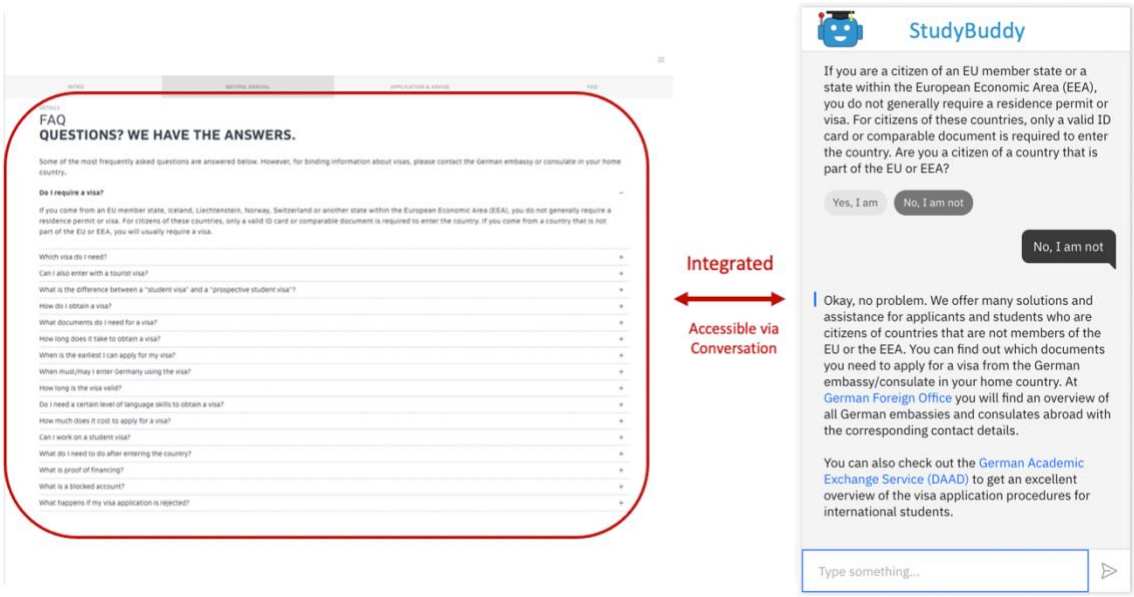



*Fig. 14:* A Chatbot as an Information Filter of the Contents on the University Website (Self-Created Figure Including Content of the Hochschule Fresenius Website, Hochschule Fresenius 2021a, n.p.).

Regarding university marketing, the use of chatbots could offer a scalable solution for internationalization (Leukert et al. 2019, p. 59). On one hand, a chatbot can be active around the clock and thus provide information and assistance to the target group independent of different time zones. Beyond that, the possibility exists to switch a multilingual chatbot online, which assists independently target groups from most different countries, without having to program and use thereby more than one chatbot. So for example prospective students outside of the European Union member states could attain information about visa conditions in their language and at the desired time. In addition to answering frequently asked questions, a chatbot can provide individualized and personalized answers to inquiries and tie in with previous conversations. The user-friendliness is also increasing, as interested parties no longer have to go through several steps on a website and app or check a whole list of frequently asked questions to get their request answered. By advancing sentiment analysis within the framework of NLP, chatbots can also react adequately to the

mood of their counterpart. The chatbot can be given a personality that is in line with the needs of the target group and can be adapted according to their choice.

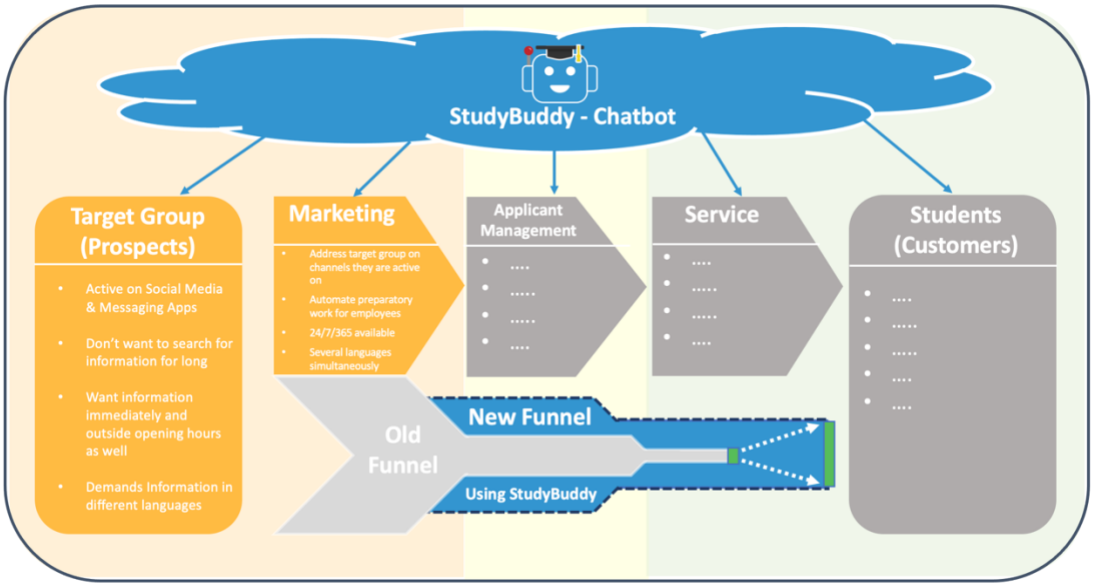



*Fig. 15:* Support through Chatbots in University Activities - Marketing (Self-Created Model Based on Primary Activities of Porter's Value Chain, Porter 1985, p. 37).

Figure 15 illustrates the summarized findings of the potential that the use of a chatbot in Marketing could provide.

### 3.1.2 Applicant Management

Applicant Management at private universities can be seen as the link between Marketing and Services. This section is responsible for informing prospective students about the admission requirements on their way to enrollment, arranging for the submission of documents, and performing any other administrative tasks in this context. On the one hand, potential students must prove that they meet the requirements for enrollment. However, the candidate experience of the prospective students must also be optimized in the process.

Candidate experience refers to the overall impression that a potential applicant receives of the university during the recruitment process. It refers to the individual experience in an application and selection process at all direct and indirect points of contact with an organization (Verhofen 2016, p. 11). Since higher education is a

sensitive and often complex topic that is crucial for the entire future career, there is a high need for explanation and communication overall (Kschesniak & Harwardt 2020, p. 393). According to Kscheskiak and Harwardt, the primary task of Applicant Management is to exert a positive influence on the decision-making process of prospective students and thus to create a secure and familiar environment.

For this purpose, private universities usually use so-called “Customer Relationship Management-systems” (CRM-systems), which categorize applicants with the help of machine learning. Basically, a distinction is first made between "leads" and "applicants". Leads are potential students who, for example, request information material, have already attended information events, or are active on the website. Applicants are more advanced on the path to enrollment. However, it is important to ensure that the requirements set by the university are met so that the applicant can be transformed into a student or rather a customer. Chatbots can help provide Applicant Management staff with an overview of the prospect data captured. This can include targeted queries for information captured by CRM-systems. Figure 16 reveals an example conversation between an employee and the StudyBuddy prototype in this context.

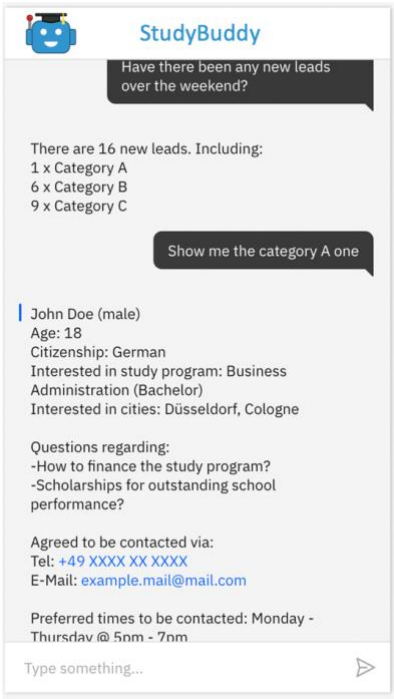



*Fig. 16:* Potential Conversation of an Applicant Management Employee with a Chatbot (Self-Created Figure).

Data that StudyBuddy has collected during marketing conversations with prospects can be processed and used as the basis for a successful initial contact of the Applicant Management with interested parties. The prerequisite for this is that the CRM systems are connected to StudyBuddy via the API. In general, all systems that use databases and data processing can potentially be connected with a chatbot via API. The chatbot could collect specific data as parameters from the databases and insert them into predefined data packages for responses. The data package sent (typically JSON files) would contain a predetermined text accordingly. In addition, parameters are created for all variables such as name, age, citizenship, etc., which are then extracted from the data packages of linked systems and programs (e.g., CRM-systems).

Figure 17 provides an overview of, how a chatbot could be connected via API to systems and programs, such as a CRM-system to retrieve relevant data. Furthermore, different communication channels could be connected to the user interface of the chatbot via API. This applies to end-users as well as to employees of the universities.

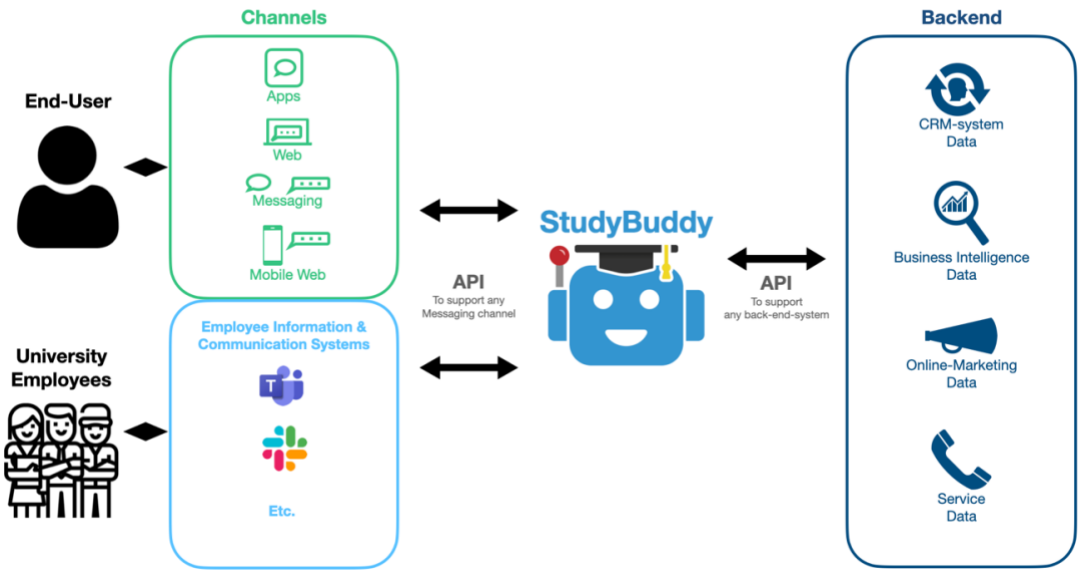



*Fig. 17:* A Connected Chatbot within the University Communication Network (Self-Created Figures).

Applicants can be guided and assisted by chatbots on their way to matriculation. In principle, for example, the status of an application could be queried or required

information obtained. In order to clarify user-specific and individual concerns, it would also be necessary to connect the chatbot to CRM-systems via API to provide the chatbot access to selected prospect and applicant data. Such a connection would enable the chatbot, for example, to integrate requested information as parameters in the prefabricated texts after querying an applicant number. In a further step, missing documents could also be submitted using a chatbot as PDF or JPG files around the clock and independent of location. Figure 18 illustrates an exemplary conversation in this context between an applicant and StudyBuddy.

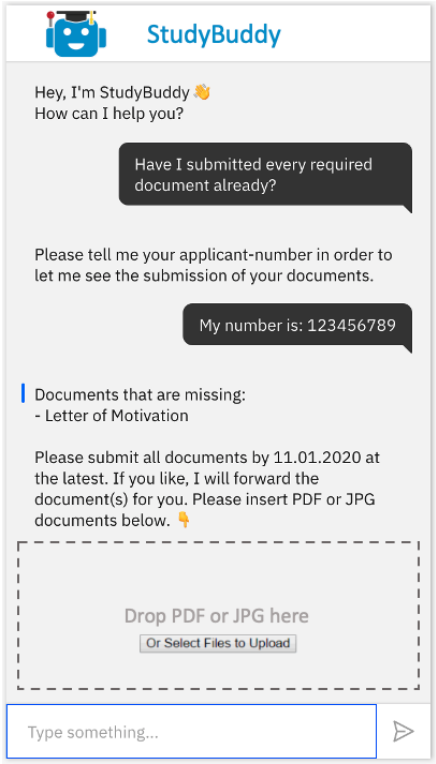



*Fig. 18:* Document Exchange Through a Chatbot (Self-Created Figure).

All in all, the use of chatbots in Applicant Management at private universities offers potential in terms of automation and time-saving. In addition, it could also succeed in improving the candidate experience, which can be classified as a potential for increasing quality. The potential of the use of chatbots in prospect and Applicant Management is summarized in the following Figure 19.

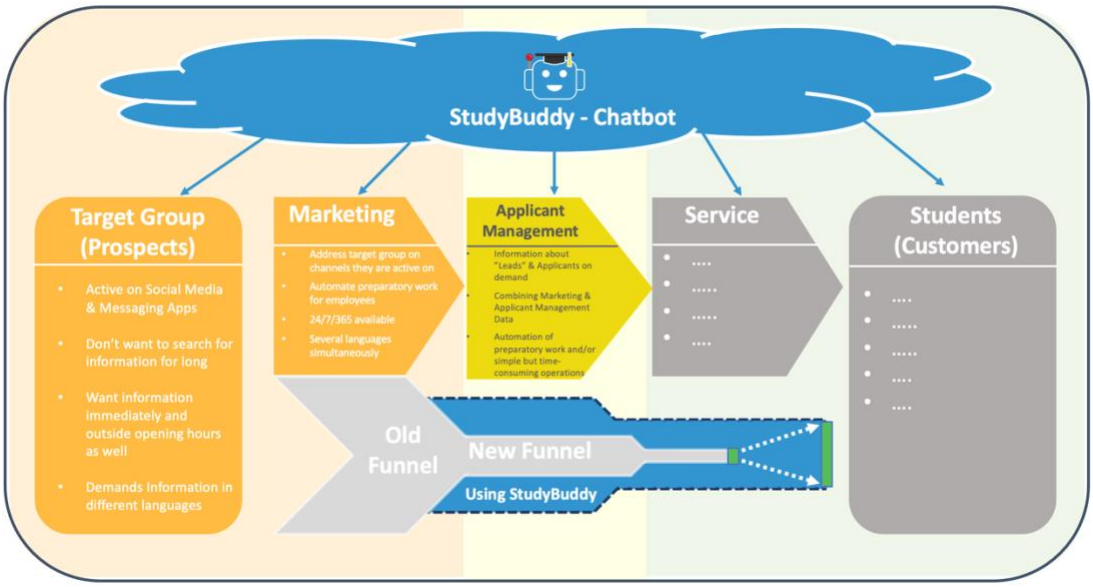



*Fig. 19:* Support through Chatbots in University Activities – Applicant Management (Self-Created Model Based on Primary Activities of Porter's Value Chain, Porter 1985, p. 37).

The degree of the added value of a chatbot depends on the depth of the programmed capabilities. Even simple FAQ chatbots could deliver out-of-hours value to applicants and prospects, making the overall information gathering experience more natural and easier. The possibilities that arise from connecting the chatbot with additional systems go beyond this. Personalized information for applicants as well as interested parties could support and even automate wide areas of the application process.

### 3.1.3 Service

The strong focus on services of private universities is considered one of the key competitive advantages over state universities (Sperlich 2007, p. 84). A study by the German "Stifterverband" in cooperation with McKinsey also emphasizes the uncompromising service orientation of private universities as a value proposition to students (Frank et al. 2010, p. 16). Private universities have historically set themselves apart from state universities by providing intensive student support and assistance. For example, in addition to providing information about everyday concerns, the services offered by private universities include library access, semester tickets, help with housing or job applications, and other individualized services. For international and new students, in particular, university services are usually the first

point of contact for a wide range of issues that have a significant impact on the overall student experience. The increasing pressure of state universities catching up with private universities in many areas of service calls for innovative solutions to maintain or regain competitive advantages (Frank et al. 2010, p. 16). Student satisfaction is significant for all universities, so the work of the administration and the Service area must be continuously developed due to the increasing quality demands of students (Sperlich 2007, p. 181).

Especially during Service activities, frequently recurring questions, so-called FAQs, occur. In this area, even simply programmed chatbots can create added value. Questions whose answers are usually the same and frequently recurring can be answered by chatbots outside of business hours and from any location. But chatbots could also clarify simple questions during business hours and refer customers to the appropriate Service employee in the event of increasing complexity. This hand-over-human principle creates time- and cost-saving potential through automation and can also improve the quality of the service provided by the human agents, as the information collected by the chatbot regarding the request is already transmitted when the contact to the student is made.

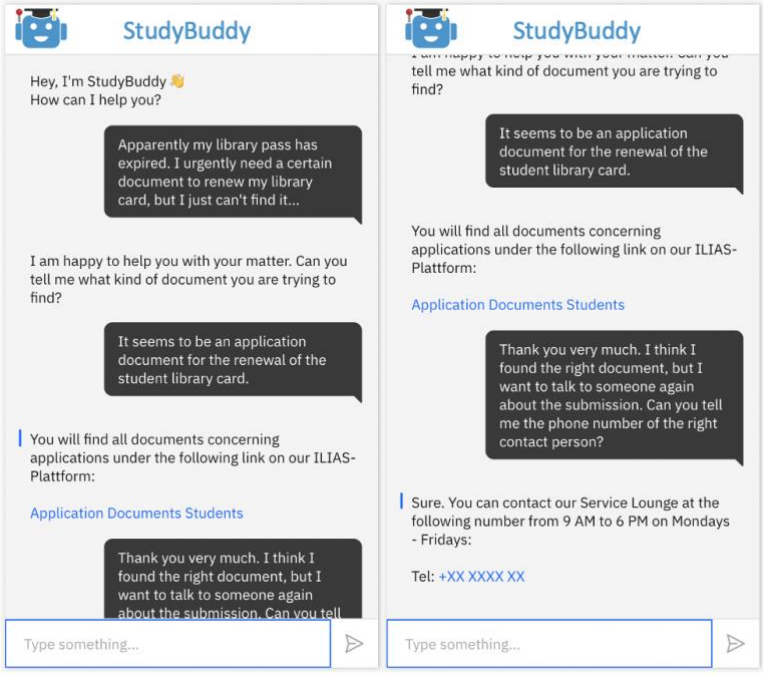



*Fig. 20:* Potential Conversation of a Chatbot with a Student Regarding Service (Self-Created Figure).

Figure 20 demonstrates an exemplary conversation between a student and the StudyBuddy prototype, which refers to a Service employee after answering simple requests. Furthermore, additional potential would arise by linking the chatbot to student portals. While the example, provided in Figure 20 only refers to a webpage of the student portal, the chatbot could also perform actions on the student portals through invokes.

More complex and far-reaching programming would be required, in the context of which the chatbot would be linked to the student service portals via API. It would be conceivable, for example, that a student could ask the chatbot to register for an exam. The chatbot could then ask for the relevant parameters it needs to register for the correct exam and carry out the registration accordingly. Individualized assistance would also be conceivable by integrating machine learning models into the backend of the chatbot. For example, categorization by Support Vector Machines (SVM) could classify students and respond in a personalized way accordingly.

Some studies on chatbots show that many users appreciate the anonymity of chatbots and even prefer to contact a robot with some concerns rather than a human (Keane 2016, p. 4). StudyBuddy could also provide increasingly individualized and personalized responses to concerns, especially for students who have been using the chatbot since the first contact in Marketing. Using the student's name or matriculation number, the chatbot can also incorporate past conversation history into the service response. Zumstein and Hundertmark write that "in a best-case scenario, the chatbot knows its users like a good friend and offers them appropriate offers, solutions and services at the right time" (Zumstein & Hundertmark 2017, p. 102). Thus, during the elaboration of a chatbot, it could be considered that a chatbot evolves into an increasingly individualized and personalized companion that always provides answers and assistance to students at any hurdle of their studies. Figure 21 demonstrates how a chatbot could provide assistance to a student who wants to register for the third attempt of an exam.

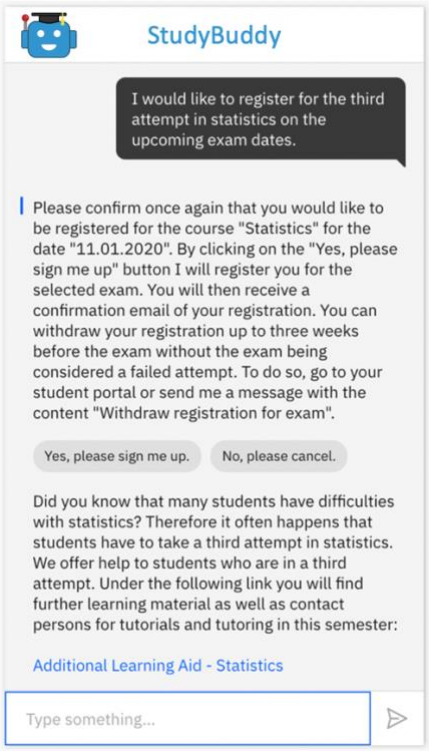



*Fig. 21:* Potential Conversation of a Chatbot with a Student Regarding Exam Information (Self-Created Figure).

In the example presented, the categorization would allow the student or rather the created profile of the student to be assigned to the class “Difficulties with Statistics” (for example, based on the matrix number). Besides the execution of the exam registration as well as information, instructions, advice about the procedure for exam registrations could be provided. The chatbot is able to notice that the student has a “Negative Relationship” to the subject statistics. Accordingly, the chatbot's response could also include information about tutorials, tutoring, and practice exercises on the subject of statistics.

Figure 22 illustrates how the backend of a chatbot SVM would help to generate contextual output. In this process, the input data is classified and information that could help students belonging to the “Difficulties with Statistics” class is offered in addition to the expected answer to register for the exam. For this purpose, the backend of the chatbot accesses a data pool consisting of Training Data and Experience Values. The messages of the chatbot illustrated in the frontend (user interface) contain the possible answers to the exemplary request that can already be

seen in Figure 21. The messages of the chatbot are displayed in the frontend or user interface.

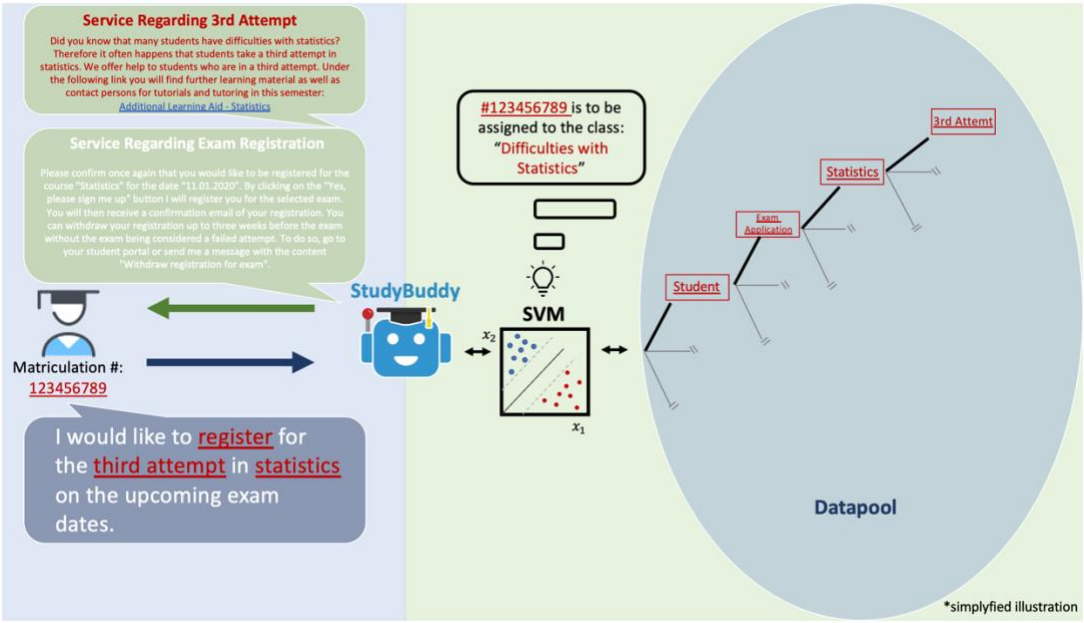



*Fig. 22:* Individualized Responses (Reactive Programming) by Categorizing the Student's Input Data (Self-Created Figure).

In addition to simple dialog notes that just generate prescribed answers to frequently asked questions, some chatbot programs also offer the possibility to invoke self-written code. The IBM Watson Assistant, for example, can be linked to so-called cloud functions. Codes can be written in these cloud functions via the IBM Cloud, which can then be executed by the IBM Watson Assistant using specific triggers. In this context, the possibilities are only limited to the programs for which access can be granted via API.

Furthermore, it is possible to link several applications that provide public APIs (usually open-source datasets). This also allows the integration of so-called "web crawlers". Web crawlers are computer programs capable of searching websites for predetermined information and data (Najork 2009, p. 3462). Probably the most famous example is the web crawler used by Google, which performs indexing of websites automatically. Conceivable applications for the service lounge and other areas of private higher education would be a web crawler that searches the university's website, as well as other public websites, for content that is relevant to

students or prospective students but also changes frequently. For example, a web crawler could be "tasked" each semester to search the semester end dates for exam periods, registrations, and further for parameters that are then inserted into pre-written information messages to students. Figure 23 below illustrates an overview of the API calls of an IBM Watson Assistant chatbot that can activate self-written code by linking to IBM Cloud Functions.

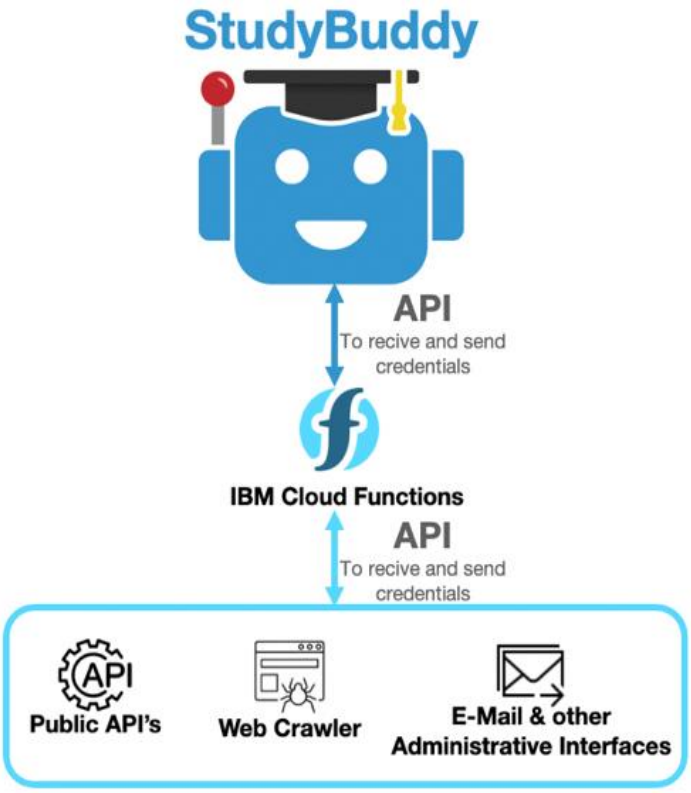



*Fig. 23:* Data Generation of the Chatbot via API Calls (Self-Created Figure).

In the Appendix, an example is presented of how StudyBuddy could send automated e-mails using a Cloud Function code. For instance, university room bookings could be requested by students through StudyBuddy (Appendix A). The elaborated findings regarding the potentials that chatbots could bring to the Service of private universities as well as to students (customers) are listed in Figure 24.

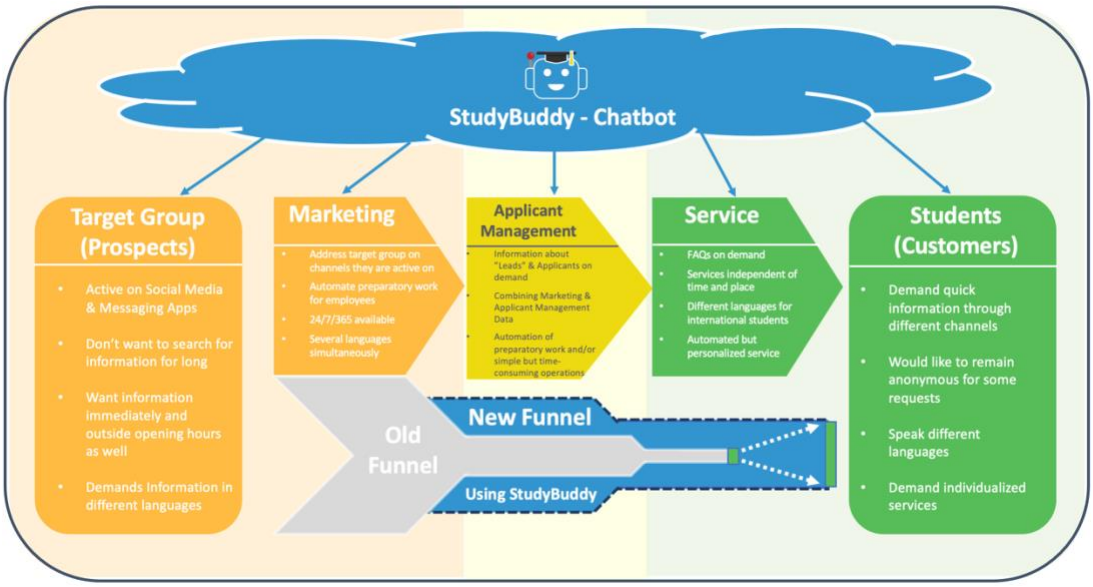



*Fig. 24:* Support Through Chatbots in University Activities – Potentials of Each Area (Self-Created Model Based on Primary Activities of Porter's Value Chain, Porter 1985, p. 37).

Furthermore, it can be stated overall that the use of chatbots can provide private universities with business-relevant potentials in various areas. Automation, which could lead to cost and time savings, provides measurable added value in all the areas discussed. Additionally, the quality of communication as well as interactions can be increased by chatbots. At this point, it should be noted that the application of innovative and new technologies could also have a positive influence on the target group already in Marketing. In particular, prospective students and applicants for technology and digitalization-oriented degree programs could react positively to the online communication service and be influenced in their decision. Moreover, the candidate experience can be improved through the use of chatbots.

Furthermore, it is valid for students that information is made available quickly, independent of location and time, on channels that they are familiar with from their everyday lives. These factors in all three areas listed could strengthen the respective filters of the sales funnels of private universities and thus lead to a greater "output" of students (shown as an enlarging green field in Figure 24).

### 3.1.4 Potential Implementation and Development

The successful implementation of innovative technologies at private universities with sustainable anchoring requires an organizational framework. The university must provide the resources that are necessary for a successful implementation in the long term. In particular, the transition of individual projects to a broad implementation and thus to a university-wide and cross-university digital application often does not succeed (Kehrer 2018, p. 238). For a long-term successful application of chatbots, private universities could provide expertise in the areas of technology, marketing, service delivery, communication, organization as well as economic efficiency. In this process, students could not only become users of the chatbot but also be seen as a resource of private universities. It would be conceivable that students would actively participate in the implementation and development of a chatbot. The same applies to employees, who, depending on the fields of application of a chatbot, could also be considered users.

Particularly in the context of master's degree courses, which often include case studies and project works as examinations, students could participate in the development of new functions and capabilities of the chatbot. Integration into the curriculum would be particularly suitable in business administration and technology subjects and specializations. However, private universities would also be able to generate valuable input for chatbots in subjects such as psychology at a low cost. From a student perspective, hands-on projects would lead to the development of valuable user experience as well as skills. For example, working with well-known IT programs such as IBM's Watson Assistant or Google's Chat over several semesters would help students develop practical skills. This could involve individual work or group projects that would challenge and develop skills regarding programming in different languages, working with cloud functions, API management, as well as machine and deep learning models. A 2017 study by McKinsey & Company on the job market of the future describes skills in technologies as highly beneficial for the future (Manyika 2017, p. 7) and identifies the development of education in so-called STEM skills (Science, Technology, Engineering & Mathematics) as the key takeaways of the study (Manyika 2017, p. 12 f.).

Students could therefore benefit from working on chatbots in terms of preparation for the professional world of the future. Moreover, from the point of view of universities, students are integrated as users in the process of service provision. Thus, action would be taken in the sense of customer-centricity, which places the customer at the center of a strategy (Latinovic & Chatterjee 2019, n.p). Here, a so-called "Minimum Viable Product (MVP)" is tested by the target group (Ries et al. 2013, p. 1). The idea is to create an interactive process based on continuous feedback obtained from the early adopters to achieve a product-market-fit at the lowest possible cost (Lenarduzzi & Taibi 2016, p. 112).

Just like students, employees from Marketing, Applicant Management as well as student services could actively participate in the design of the chatbot. Figure 25 below reveals a holistic model of the framework that could enable successful work on a chatbot for private universities. The core of the model is based on the MVP principles and Ries' Build-Measure-Learn Cycle (Ries 2011).

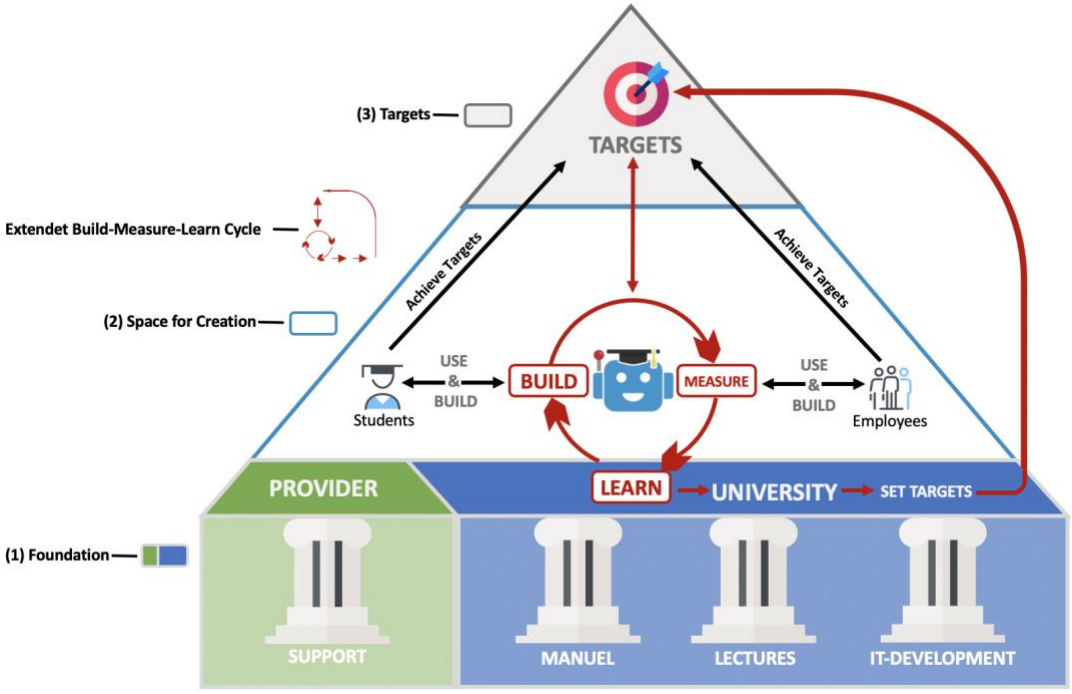



*Fig. 25:* Pyramid Model of the Implementation and Development of Chatbot Projects in Private Universities (Self-Created Figures).

The starting point is a solid foundation ((1) Foundation in Figure 25) that provides the students as well as the staff with the resources and support necessary for

successful work on the chatbot. The building-blocks, shown as pillars in Figure 25, should be ensured by the university as well as the provider of the chatbot program (e.g., IBM Watson Assistant, Google Chat, etc.). According to Leyh's and Meischner's research, software, hardware, and digital mindset, as well as corporate culture, can be identified as particularly important success factors for digitalization projects (Leyh & Meischner 2018, p. 36).

Accordingly, the supply and support of high-quality software for the chatbot program are essential. In particular, technical questions must be answered quickly and a regular exchange must take place. In addition to the hardware, the university could also provide tutorials as well as information on programming and creating chatbots. Manuals should be made available to students and employees. Moreover, professors, lecturers, guest speakers, and other experts could regularly offer new input on the topic in lectures and during the support of chatbot projects. Finally, the cooperation with the in-house IT staff is an essential support for the development of a chatbot.

Building on the basis, the foundation, students, as well as employees, could be provided with a space for the creative design of the chatbot ((2) Space for Creation in Figure 25). The extraordinary aspect that students as well as employees would simultaneously be users and developers of the chatbot shall be used as an advantage. Students as well as employees of private universities should be involved in the process and even drive it forward. In this way, employees' fears of change could be reduced and students would be given responsibility for practical projects while they are still studying.

The starting point should be a professionally developed prototype of the university in cooperation with the chatbot program provider. This prototype (for example the StudyBudy) is to be regarded as the MVP. The prototype is surrounded by a feedback loop, the so-called "Build-Measure-Learn Cycle". The fundamental activity should be to transform ideas into features or services, obtain user feedback, and decide where to pivot or change (Ries 2011, p. 7). In the context of project work, students are assigned examination tasks that are aligned with the goals of the chatbot. For example, project works and assignments could include new features, a new design for the user interface, or further optimization potential.

With help of the supports from the foundation, the students would then fulfill their examination performances (i.e., the goals set by the university) over one or more semesters in individual or group work. Thus, in single or many project works, the chatbot is further developed and "built" simultaneously. The results are measured by the professors, lecturers as well as employees from the relevant departments (Marketing, Applicant Management, and Service). Measurables represent pre-determined goals and KPIs (Key Performance Indicators) for the chatbot as a holistic concept. For this purpose, most chatbot providers offer detailed options for viewing and analyzing the history of the conversations held.

Together, students and staff achieve set goals and create progress. The thoroughly evaluated progress serves as valuable learning for future objectives of the university's chatbot. These learning effects provide the starting point for future goals for the university. Within the framework of the creative value creation, the overall success factors of digitalization projects: "analysis of data", "change management", and "introduction of digital mindset" should be covered and ensured (Leyh & Meischner 2018, p. 36).

The objectives for further projects can be extracted from the findings of the Build-Measure-Learn cycle. In this process, private university leaders decide from a strategic perspective, based on the findings, whether to maintain or change elaborated directions of the chatbot. Ries describes this step as an assessment, where the question must be asked whether the product or service is making sufficient progress to suggest that the direction taken is correct or significant changes need to be made (Ries 2011, p. 137). It must be examined in detail whether the current state of the product or service and the direction in which it is developing meet users' requirements. For example, a so-called "customer need pivot" could be undertaken. In this case, the university would be able to gain a detailed picture of the target group and to put itself in the target group's perspective. However, by being close to the customer, some new, related problem is identified that is important to the customer and could be solved by the product or service (Ries 2011, p. 159).

For a chatbot at private universities, there are three different users. The students who use the chatbot as a service assistant during their studies, employees who use the chatbot to address the target group, and prospective students who obtain information and services via the chatbot on their way to enrollment. The model considers customer centricity for the users "students" as well as "employees", since they are not only actively involved in the design and further development of the chatbot, but rather represent the core of this process. To ensure a corresponding customer centricity for interested parties, both students and staff will contribute their experiences of this target group. Students were themselves in the situation of prospects at a previous stage and staff interact with the target group regularly. Additionally, projects and collaborations with schools (to integrate high school graduates as prospects in the process) or even companies (to integrate possible part-time degree students) would be conceivable.

This systematic elaboration of further development goals for the chatbot is intended to cover the digitalization success factors "Customer-Centric Management" and "Unified Digital Corporate Strategy & Vision". The different areas of the model are not to be seen as delimitations. Rather, the steps Build, Measure, Learn and the elaboration of new goals are to be worked on holistically and jointly by all participants. The elaborated goals, which are either seen as an elaboration of the progress made or as reassessment and construction of new functions and customer benefits, can then be transferred as research questions for examinations and project works during the following semesters.

### 3.2 Challenges

After addressing the potentials that the application of chatbots could provide, the corresponding challenges and limitations will be outlined in the following. First, the potential problems that could arise for customers and employees are examined. The technological challenges and limitations are also addressed. Finally, data protection, which also poses challenges for private universities using chatbots, will be discussed.

### 3.2.1 Customers and Employees

Digitalization projects such as chatbots are currently leading to changes in many companies - but these are often not received positively by either employees or customers. Often, the benefits of digitalization projects for these target groups remain unclear and are overshadowed by fears - regarding job loss, monotonous work, data insecurity. According to a study in Germany, 40% of decision-makers in companies state that they have had negative experiences with digitalization projects (Falkenreck 2019, p. VII). Employees and customers view cloud functionalities or direct human-machine collaboration with a great deal of mistrust. Many have no experience at all with digitalization projects and therefore cannot assess what to expect in the future - ignorance and uncertainty are major hurdles in digitalization projects. Whenever people have to deal with innovations, it leads to a difficult acceptance of these technologies. In this context it is irrelevant whether the new technology affects handling, the service offered, or, more generally, habits in everyday life. In addition, the integration of digital systems and programs such as chatbots is not only linked to investments but also entails adjustments within the organization or to areas of responsibility or management behavior. In the following, the challenges that may arise in this process will be presented in a differentiated manner according to customers and employees.

#### 3.2.1.1 Customer Sensitivity

Customer sensitivity is a fundamental challenge with new types of technical applications. In addition to the fact that familiarizing a new technology such as chatbots with the target group usually leads to increased marketing expenditure, the attention span of users is generally low. Especially the first interactions of the chatbot with the target group must lead to the results desired by the users. According to a study by Brandtzaeg and Følstad, a large majority of respondents (68%) use chatbots for "productivity" issues. This refers to providing assistance and obtaining information (Brandtzaeg & Følstad 2017, p. 8).

These are usually concerns where the patience and frustration tolerance of users must be taken into account. If a chatbot does not provide the desired information and assistance services, a high bounce rate is to be expected. Additionally, it is unlikely that users who have jumped off will return to the chatbot as a service. Furthermore, the personal sales process is initially preferable to anonymous online services, at least for advising and supporting prospective students, if there is a great need for information on the part of the customer or if resistance to digital services is still relatively high (Falkenreck 2019, p. 16). Here, it should be ensured that a well-founded and qualified application of a chatbot is already used, whose competencies exceed those of an employee in terms of sales management and information provision in the best case. To minimize the risk of frustrating potential customers during important process steps on the way to enrollment by an insufficiently competent chatbot, chatbots should initially only support the employees at important sales process points in their work.

Overall, it will take some time to convince users of the new communication program. Private universities should be aware that customers are used to other communication channels and that it will therefore take some time to adapt. In a transition phase, most typical (offline and online) channels still must be provided and the customers should be motivated and incentivized to use the chatbot (Zumstein & Hundertmark 2017, p. 102). For the reasons mentioned, the creation of a chatbot according to the build-measure-learn method, which is presented in Chapter 3.1.4, is particularly challenging. Here, although non-published versions of the chatbot can be evaluated and elaborated by staff and students, publishing it on the website or other platforms should require extensive testing. The risk of losing users permanently due to an insufficiently "competent" chatbot prototype must be taken into account.

Scientists still disagree about the extent to which chatbots should identify themselves as such or whether they should aim for the impression of a conversation with a real person (Gentsch 2019, p. 123). However, the argument that no deceptions should be made, especially in the initiation or provision of services, prevails (Needleman 2017, n.p). It is also certain that currently, chatbots are not able to imitate human interlocutors (Stucki et al. 2018, p. 745). Complex communicative skills such as changing topics in the middle of communication continue to pose major difficulties

for programmers and developers of chatbots. For example, it is hardly or only with great effort feasible to briefly interrupt the conversation during a room booking to ask about opening hours and then return to the last state of the room booking. In technical terms, this means that it is difficult to jump from branch to branch within a dialog tree (Stucki et. al 2018, p. 744). However, such topic changes occur regularly in everyday services around private universities. Overall, chatbots only unfold their potential to master even more complex communications when, in addition to simple dialog nodes - consisting of predefined question options (intents) and corresponding answers (dialog skills) - machine and deep learning supported applications are integrated or developed in-house. However, especially in this context, challenges and limitations arise that need to be taken into account.

#### 3.2.1.2 Employee Acceptance

For employees, digitalization projects lead to fears that are not unfounded and should be taken seriously. In a 2017 study by Frey and Osborne, Carsten Brzka - chief economist at ING-Diba - estimated that machines will replace 18.3 million of 30.9 million jobs in Germany within the next 20 years, or 59% of all jobs (Frey & Osborne 2017, p. 254 f.). Inventing, designing, and programming these machines will not create the same amount of new work (example: only 5% of all new jobs created between 1993 and 2003 were in computer science, software development, or telecommunications). This fuels fears of loss without employees being able to assess what subsequently added from digitalization projects might look like. Employees anticipate what they will lose without knowing what they could receive in return (Falkenreck 2019, p. 14).

Falkenreck also points to a lack of preparation and employee involvement by German companies concerning digital transformation. As a result of extensive surveys conducted by Hof University of Applied Sciences in 2015 to 2017, 60% of the total of 5,305 employees and customers of German, Austrian and Swiss companies surveyed stated that their companies are not sufficiently prepared for the digital transformation. In the context of this thesis, however, it should be emphasized that, according to the study, employees at universities tend to have a positive attitude

toward networked technical systems, with 51% of respondents even indicating complete approval of digital systems (Falkenreck 2019, p. 10).

However, even at universities, decisions about digitalization projects that have a significant impact on the daily work of employees should not be made over the heads of the employees. Without employees and their know-how, no change can take place in the company. Fears of being overwhelmed, job losses, and employees' reactions to what digital technology is capable of depend on how the company explains future digitalization projects to its employees (Falkenreck 2019, p. 19). The most urgent goal of internal communication is to align the thinking, feeling, and behavior of internal stakeholders with strategic organizational goals, to cultivate core values, and to strengthen the reputation of the university brand (Falkenreck 2019, p. 20).

Concerning the implementation, integration, as well as the elaboration of a chatbot at private universities, the lack of information about the behaviors of the respective stakeholders and the different personnel, financial and technical requirements, presents a challenge. An essential challenge is to identify the tasks that need to be done to implement a change. A distinction should be made between tasks relating to content and tasks relating to personnel management. In order to better identify substantive tasks, it is helpful to know the flowchart and define substeps based on it (Hayes 2002, p. 78). Carstensen and Roedenbeck suggest a four-step approach in this context (Carstensen & Roedenbeck 2019, p. 35).
Accordingly, intensive research and analysis of the decision-making process of prospective students, employees, and students are recommended regarding the points at which ad hoc advice and assistance from chatbots could be usefully employed. Furthermore, a number of topics and the respective potential questions and answers have to be identified and evaluated in this context. In the next step, a basic structure must be derived to meet the needs of the chatbot's target groups and the questions and answers must be incorporated into the chatbot interface accordingly.

It is important to first identify the employees involved and potential supporters as well as challenges in this context. Jawahar and McLaughlin recommend a differentiated stakeholder management approach (Jawahar & McLaughlin 2001, p.

397 f.). In this context, qualitative interviews could be used to identify supporters as well as opponents of the chatbot projects. The interview questions could include topics such as experiences with chatbots, opinions on digitalization in the workplace, responsibility in change processes, or desires for digitalization projects. For the success of the methodology, it is essential to openly discuss the results with the employees after the evaluation of the interview has been completed. It is important to ensure that the anonymity of the data collected is always preserved. If the results of the interview show that resistance to a project is rather high within the surveyed group, the reasons presented by the employees should be discussed with them and a solution found together (Falkenreck 2019, p. 14). Based on the results of the interviews, the internal communication of the employees involved should then be prepared and tasks assigned. Furthermore, it is advisable to divide the tasks according to different implementation phases and to appoint project managers to monitor the processes.

A major organizational challenge is to involve employees in any processes at an early stage. Overall, it should be possible to develop a concept that sees the chatbot as a team member and not as a job displacement technology. In addition to internal influences, it should also be considered which stakeholders can influence the process from the outside. The composition of the stakeholders depends heavily on the structures and the resulting approach. For example, if a chatbot is not to be implemented in the area of study orientation, but in another area, the focus of the personnel implementation will differ in addition to other content-related tasks. Involved employees should therefore be prepared for these types of deviations in advance (Carstensen & Roedenbeck 2019, p. 38).

Once the stakeholders have been analyzed, the implementation of the established plans and activities by the project staff under the leadership of the project manager is no less challenging. As with any change project, success also lies in the commitment of those involved. No matter how well planned a project is, it can fail in day-to-day implementation management if, for example, the project opponents strengthen their faction through micropolitical measures and thus manage to withdraw project funds. Therefore, support from the highest possible authority is recommended for such projects.

In addition to project managers and support at the highest level, the use of employees who are already working with the new tool as so-called ambassadors of the digitalization project and contacts within the departments is also a sensible option. This offers employees contact persons on an equal footing, and the inhibition threshold to ask colleagues about the new projects is low (Falkenreck 2019, p. 25). Information and understanding go hand in hand. If employees are required to be willing to change, open-minded and adaptable, mobile and flexible, and capable of an entrepreneurial way of thinking and acting, they should behave accordingly toward the workforce. Opinions should be listened to and respected, fears should be taken seriously and the requirement for up-to-date, credible, appropriate and balanced information should be met.

### 3.2.2 Technology

The successful development, enhancement, and maintenance of a machine and deep learning supported chatbot require a high level of technical expertise and expenditure. Investments in IT infrastructure and chatbot tools as well as a possible extension of IT and analytics architecture must take place first (Zumstein & Hundertmark 2017, p. 103). Technical expertise should also be sought from third parties. Tasks such as programming of the back- and frontend, integration and programming of own machine and deep learning models, or the integration of further programs and databases can be supported by students of technical courses and modules but should be accompanied by professional, experienced assistance.

Challenges concerning modification management arise as soon as data necessary for the service quality of the chatbot changes. For example, a change in the curriculum of the degree programs would have to be immediately incorporated into the university's chatbot as well. In principle, it is possible to write the infrastructure of the chatbot code in such a way that changes, such as those of the curriculum, the timetable, etc. - like all data and information published on the university's websites, portals, or other online services - are automatically forwarded to the chatbot and thus integrated into the chatbot's responses. However, this requires a high level of programming skills, resources, as well as initial investments in algorithms and

networking. This sometimes results in high dependencies on the chatbot program providers, whose competencies, infrastructure, and services would have to be procured at high cost for universities. Simpler programmed, inflexible chatbots would have a lower dependency, but changes would have to be incorporated manually in a time-consuming and costly manner.

In addition to the integration of the university's own databases, calls from third-party systems via APIs are extremely helpful or even necessary for a autonomous, competent chatbot. A prospect, student, or employee may find it fascinating to chat with a chatbot, but ultimately, they have a request that needs to be addressed. As long as the request is purely for information, the chatbot can often draw answers from its knowledge base (i.e., pre-programmed content).

However, as soon as an employee needs CRM data, for instance, the chatbot must be able to access the relevant systems. Ideally, these interfaces would already exist in a reusable form, such as an accessible API. In terms of information queries, it would also be ideal from an architectural point of view if existing resources could be accessed. For example, the university's CRM-system or student service databases could be accessed. For individual structured queries such as "show me new leads that have arisen over the weekend?" or "which topics have ‘prospect-XY‘ already been discussed with Marketing?" a chatbot could partially reuse existing APIs. However, for user queries that will not be easily answered with a structured value, chatbots usually prepare specific answers because comparable resources for other channels could not be directly reused (Stucki et al. 2018, p. 744).

While the complexity of machine and deep learning models makes them extremely powerful, it also makes them extremely difficult to apply. The problem arises that these models may lead to the desired results, but their inner logic is difficult to comprehend by humans. In science, the term “black-box“ has been established in this context (Azodi et al. 2020, p. 442). Complex neural machine and deep learning networks consist of multiple layers of electronic synapses that process a given input and convert it into an output (Yu & Alì 2019, p. 4).

Two limitations of the application of these algorithms have to be taken into account. Firstly, these algorithms achieve outstanding results or decisions in many scenarios, although from a purely statistical point of view. However, this does not mean that it does not make wrong decisions, as shown in the example of the image recognition model ResNet50 in Chapter 2.1.2 of this Thesis. This can be problematic as machine learning approaches often work like a black box. They do not provide any information about why they came to a certain result.

However, if one does not know why an algorithm produces a certain result, such approaches should not be used in sensitive application areas. As an example, human resources management can be mentioned, in which AI has found its way into for some time. Today, algorithms are already being used to predict the probability of employees quitting or applying for other jobs in the future based on their behavior. Or companies use algorithms that make or prepare the selection of employees on the basis of applications. Assumed that the algorithm's selection process based on profiles or applications leads to the conclusion that certain employees are suitable or not for a position - and humans could not know why. This is problematic on the one hand because humans naturally have to and want to explain the selection decisions to the applicants. On the other hand, this lack of decision transparency can also be accompanied by ethical problems if the algorithm has included parameters such as gender, skin color, or religion in its decision. Humans could not know this because artificial neural networks behave to a certain extent like a black box. The decision is ultimately based on the calculated weights of the edges between the neurons (nodes) of the network, which are difficult for humans to interpret (Buxmann & Schmitt 2019, p. 16 f.).

In particular, the NLU of chatbots relies on machine and deep learning models. Black-box issues arise in this context, for example, when intents or entities (i.e., user inputs) are mismatched. The IBM Watson Assistant used for this thesis presents the performance of NLU tools black-boxes, which do not provide detailed information about how the meaning of the user input is predicted or estimated by the chatbot (Bapat 2017, p. 21). As soon as misjudgments of the chatbot happen, the problem solving turns out as " reverse-engineering".

However, these machine and deep learning models are often intentionally designed as a black box to protect intellectual property or sensitive data (Oh 2019, p. 121). Consequently, dependencies emerge, with private universities relying on the services of chatbot program providers such as IBM or Google. The frightening ways in which black-box issues can escalate are illustrated by examples such as that of Microsoft's chatbot TAY, which began tweeting insulting comments shortly after its release (Yu & Alì 2019, p. 5). And while Facebook denies reports that it has lost control over Facebook Robot - an agent-to-agent communication bot - Facebook has had to shut it down. At the very least, a report that Facebook published in this context reveals that the Facebook Robot has developed a language that the developers of the communication bot can no longer comprehend (Novet 2017, n. p.). These cases suggest that working with machine and deep learning models requires not only increasing expertise and expense but also a responsibility.

### 3.3.3 Data Privacy

From a technical perspective, there are further limitations concerning data sets. The NLP performance is highly dependent on the data - qualitative and especially quantitative - with which it is trained. In order to create and "train" a powerful chatbot, as much sensitive data as possible is needed. A similar problem arises when accessing sensitive prospect or student data. Some of the named potential added values of a chatbot require that the chatbot is allowed access to sensitive data. For example, if a chatbot is to perform a student's exam registration, access to the university's student portal, which contains highly sensitive data, is unavoidable. The first problem arises when the chatbot is to be integrated into messenger services and social networks in addition to the website. The technical integration is relatively unproblematic. Legally and financially, however, this route entails certain risks, as the private universities do not exercise any control over the channel and the channel owner can charge transaction fees or store data that could run counter to the terms and conditions of the private universities (Stucki 2018, p. 743).

In principle, the use of machine and deep learning-based applications must comply with the general principles of lawful data processing according to Art. 5 (1) GDPR,

which range from the lawfulness of processing, data minimization to the possible anonymization of personal data, storage limitation, and the protection of integrity and confidentiality (Conrad 2017, p. 743).

To generate a large amount of data as an organization, customers must not only be convinced of the usefulness of chatbots but also the security of their data. The research projects conducted by Hof University of Applied Sciences in various industries suggest that it is easier for customers to agree to digitalization projects if they maintain personal, trusting contact with the provider's sales or project staff. In the case of standardized products and anonymous purchasing processes, interest in - and trust in - digital service projects is lower and data protection concerns greater than in the case of personal sales discussions and customized products (Falkenreck 2019, p. 10).

When developing machine and deep learning-based chatbots, the purposes of data processing must therefore be clarified and narrowly defined as well as presented to the user in a comprehensible manner. The limitation of the objectives also applies to further processing. A change of objection according to Art. 6 (4) GDPR is only conceivable under strict conditions, for example by consent of the data subject or based on a legal provision. Further systems or new software must adhere to the purposes defined during development (Eichenhofer 2017, p. 139).

In addition, the principle of data minimization requires deletion routines that take place at regular intervals and prevent an endless database as well as comply with the "right to be forgotten" (Art. 17 GDPR) with regard to the rights of data subjects. The information collected by the chatbot must also be deleted if this affects the results of the chatbot or its further development (Schulte & Wambach 2020, p. 465). In general, the lawfulness of data processing is based on the consent of the data subject, for the existence of which the controller must provide evidence (Art. 7 (1) GDPR). In this context, the data subject must be informed in particular about the type and extent of the data processing "in a comprehensible manner" before it is put into operation (transparency requirement), as well as about its purpose and the responsible party (Art. 5 GDPR). Accordingly, transparent and comprehensible information about the

specific purposes of the data processing of the chatbot is required, which, however, must also be revocable at any time (Conrad 2017, p. 743).

In the case of electronic data processing - for example, by transferring data to CRM-systems at private universities - explicit consent is required in many cases, which should involve active and voluntary action on the part of the data subject. Implied consent alone, for example through the creation of a student profile upon enrollment, is insufficient. Certainly, the voluntariness of consent may be doubted when ubiquitous systems have become an irreplaceable part and are often mandatory for a student's "basic needs" (so-called "lock-in effect"). There would be real freedom of choice for privacy-friendly system settings and alternative (anonymous) systems, which legislators could enforce, for example, by requiring alternative systems and models (Albrecht 2016, p. 91).

Concerning the GDPR, the control instruments for automated data processing must already be taken into account when designing the chatbot. According to this, data processors should take appropriate technical and organizational measures designed to effectively implement the data protection principles (Art. 25 (1) GDPR - Privacy by Design). Furthermore, appropriate technical and organizational measures must be taken to ensure that, already by default, only personal data whose processing is necessary for the respective specific purposes are processed in principle (Art. 25(2) DS GDPR Privacy by Default). Overall, preventive as well as repressive requirements for data protection by technology can be derived from this (Bieker & Hansen 2017, p. 285).

In the future, however, increasing changes are also expected regarding data protection guidelines and requirements. Legal regulations or their loopholes will increasingly have to adapt the law to the growing, self-learning technologies. Uncertainties, as well as non-negligible expenses up to performance restrictions of machine and deep learning supported chatbots, cannot be ruled out from the perspective of private universities in this context (Conrad 2017, p. 744). Deletion of data can have a direct negative impact on the NLP performance of chatbots, since their training requires qualitative as well as quantitative data - for example, from conversation histories. A privacy by design as well as by default approach should be

applied from the beginning of the chatbot development but leads to increasing initial investments.

Additionally, while digitalization projects usually promise several business benefits, they almost always also imply risks in terms of hacker attacks. In principle, any system or program that is connected to the Internet can be accessed by unauthorized persons at any time. Through the link, every program, every application represents a potential door into all digital links (Pick 2020, p. 215). If the chatbot can be hacked, access to the CRM-systems or the student portal is also conceivable if these are linked. Therefore, expertise in cybersecurity is required. In addition to the initial investment in secure structures and links, private universities will also have to incur ongoing maintenance costs accordingly.

### 3.4 Economic Evaluation

The literature lacks proven methods for the economic assessment of digitalization projects, which means that it is not possible to resort to a closed concept for the assessment of chatbots (Neumeier 2017, p. 339 f.). The fundamental problem of evaluating digitalization projects may be rooted in the fact that they only indirectly and in combination with other measures affect the achievement of organizational objectives by supporting task fulfillment value creation processes. Similar to organizational or personnel measures, technological effectiveness and efficiency cannot be separated from the overall effectiveness and efficiency of an organization. Answering this question poses difficult challenges for academia at the measurement level (not necessarily at the conceptual level), since technological effectiveness and overall efficiency are ultimately constructed by the same conglomerate of data, means, and actions, and no technological component can be distilled out of this conglomerate (Fessmann 1980, p. 42). In Marketing, for example, chatbots only appear in combination with other marketing instruments, it is very difficult to "isolate" and measure the share of chatbots regarding the success of the university, apart from the costs directly associated with the use of chatbots (development costs, licenses, support, etc.).

Moreover, the economical assessment of technological innovations is typically a multidimensional issue. In addition to quantifiable criteria such as costs and time, qualitative benefit aspects such as student satisfaction and the image of the university must also be included in an overall evaluation. Individual criteria are interrelated and "trade-offs", i.e. conflicting, opposing goal attainments, can occur.

Therefore, this paper can only claim to systematically demonstrate economic criteria for the evaluation of chatbots against the background of theoretical concepts and to derive plausible, analytical assessments of whether and under which conditions chatbots can contribute to the success of private universities. In doing so, a distinction will be made between a strategic and an operational evaluation dimension.

### 3.4.1 Strategic Dimension

According to Malik, strategic management is about ensuring the sustainable success potentials of a company - "doing the right things" (Malik 2013, p. 48). Hence, digitalization has a very high strategic relevance. Based on consistent digitalization, new and disruptive business models have now emerged in many industries that have replaced traditional companies (e.g., digital versus analog photography - Kodak) or dominate the industry (e.g., retail - Amazon). The companies that have managed to define the rules of the markets through innovation, prevailed (Becker 2018, p. 20).

The use of chatbots in private universities initially only leads to a new, changed design of the value creation processes Marketing, Applicant Management, Service. Therefore, the use of chatbots can gain strategic significance as part of the competitive strategy of private universities.

According to Porter, companies have a choice between the two basic strategic types, the strategy of cost leadership and differentiation (Porter 2000, pp. 27 f.). They may pursue each of these in the overall market or in a submarket. Universities that serve a niche limit themselves to the segment with special customer groups (for example, working students), certain products (study programs with special curricula), or a

geographical market (Sperlich 2007, p. 62). The decision between the two basic strategic types must be made individually for each business field.

Businesses that strive for cost leadership try to achieve a cost advantage over their competitors by using efficient production facilities, for example. In universities, for instance, there is potential in the standardization and automation of administrative processes and in the examination system (written examinations instead of oral examinations, use of multiple-choice questions), if no quality-reducing influences are to be expected (Sperlich 2007, p. 63). With regard to the tasks of Applicant Management and Services, chatbots can support a strategy of cost leadership if it is possible to reduce personnel costs in these areas or to productively use time gains through the use of chatbots. When using chatbots in the context of Marketing tasks, the cost reduction potential does not seem to be given, especially if the potential of chatbots (machine and deep learning) is to be further developed and the challenges regarding the quality and limits of communication towards customers are to be cushioned and addressed. In addition to the costs for the chatbots, personnel costs may also be incurred for qualified employees who accompany the use of the chatbots in the context of these tasks.

With the strategy of differentiation, companies try to position themselves as unique in a criterion that is important to their customers. While in the case of consumer goods this singularity may concern, for example, product design, a specific technology, customer service, or the dealer network, universities mainly pay attention to image and the quality of teaching (Fritz 1996, p. 22). The small size of private universities and the resulting better interaction between professors and students, greater practical relevance as well as internationality can also be interpreted as differentiating features (Reckenfelderbäumer & Kim 2006 p. 12). This goes hand in hand with special support services such as a pronounced service orientation in administration, but also so-called value-added-services that affect the study environment (Reckenfelderbäumer & Kim 2006 pp. 111 f.). Differentiation does not necessarily have to be based on the range of services but is also conceivable through special quality standards.

The exclusivity gained through differentiation and the loyalty of customers to the brand reduce price sensitivity (Porter, 2000, p. 41). This is evidenced by the students who have chosen to study at a private university despite the fees, which are very high compared with state universities (Sperlich 2007, pp. 64 f.). Thus, it is ultimately not the price but the price-performance ratio that is decisive (Spraul 2006, pp. 277 f.).

Chatbots can contribute to the differentiation of private universities in competition in the fields of applications mentioned above. They can not only support the success factor "market-adequate behavior", which is very important for the success of private universities (see Chapter 2.3.4 of this Thesis) but also generate a unique selling proposition. Student satisfaction is important for all universities, so the work of the administration and in the service area must be continuously developed further due to the increasing quality demands of the students. Chatbots may make an important contribution here simply because of their 7-day, 24-hour availability. The use and continuous development of chatbots in Marketing, as well as the involvement of the students in the chatbot development process, could have a supportive effect on the image of the university - especially in a field of study such as "Digital Management".

In summary, the use of chatbots can support a differentiation strategy of private universities in the three fields of application. With regard to supporting a strategy of cost leadership, a more differentiated picture emerges. The relevant business feature of digital tools in general and chatbots, in particular, seems to be that considerable productivity and quality potential can be leveraged at relatively low cost.

### 3.4.2 Operational Dimension

While strategic management is supposed to provide potentials for the company's success, operational management has the task of realizing the company's success - "doing things right" (Malik 2013, p. 48). Operational potentials for companies commonly arise when costs can be reduced, productivity can be increased, time expenditure can be reduced, and quality and thus, in particular, customer value can be improved.

In many companies, therefore, digitalization projects are implemented even though managers cannot quantify exactly what value digitalization can deliver for their company (Neumeier 2017, p. 340). With this in mind, Neumeier develops an evaluation scheme for digitalization projects. For this purpose, the value drivers customer benefit (external view) and efficiency (internal view) are identified as metrics in the area of digitalization projects. The efficiency criterion takes into account the fact that a pure reduction in costs, for example through the elimination of services, can be accompanied by a loss of customer benefits and thus have a negative impact on the success of a company overall.

In addition, it was made clear in the presentation of the factual and formal objectives of private universities (see Chapter 2.3.2 of this Thesis) that costs alone as a criterion do not have a sufficient descriptive and explanatory function, since universities in particular often have to act irrationally from a cost perspective in order to fulfill their function (Sperlich 2007, p. 77). A digitalization project is therefore considered efficient if there is no possibility to perform an activity with the same result in the same quality at lower costs (Neumeier 2017, p. 343).

Each digitalization project can then be evaluated on the basis of the two value drivers, e.g., using a scale with three evaluation levels each (low, medium, high). Taking into account budget restrictions and the desired target state, a target project portfolio of digitalization projects could be created based on the criteria. Following Neumeier, the criteria "efficiency" and "customer benefit" are used to evaluate the use of chatbots in private universities.

#### 3.4.2.1 Efficiency

At first glance, chatbots replace human-human communication with human-computer communication. Therefore, the acquisition costs of the chatbot, which consist of payments for the software, licenses, and implementation, and the ongoing costs for support, service, data processing, and storage, which are incurred when using the chatbot, could be compared with the personnel costs to be replaced. At present, a complete replacement of humans seems most likely to be possible in the

Service task area, since this task area at the private university generally involves routine tasks. However, the extent of the cost savings is likely to be relatively small in this case, since these positions are relatively low-paid. A complete replacement of employees by chatbots in performing the tasks of Marketing as well as Applicant Management is probably out of the question due to the sensitivity and necessary high quality of communication. In these tasks, the complementary use of chatbots could significantly or disproportionately increase the customer benefit with a relatively low increase in costs associated with the use of chatbots.

With regard to the tasks of Marketing and Applicant Management as well as Service, a further cost aspect could be identified in the context of the transaction cost approach (the transaction cost approach was developed by Coase in the context of neoclassical theory - see in detail Coase, 1937, p. 386-405). Transaction costs are incurred in the interaction between the university and the students. Transaction costs are defined as "the costs resulting in the context of the determination, transmission, and penetration of rights of disposal" (Picot & Dietl 1990, p. 178) and are thus independent of the creation of value itself. The transaction costs can be divided into four cost types, which can be represented in chronological order (Mandewirth 1997, p. 37): Initiation costs, agreement costs, control costs, and adjustment costs.

The data acquisition and processing capacity of machine and deep learning supported chatbots can offer cost-saving potentials for the student as well as for the university in the initiation and agreement phase. Time-consuming information procurement, for example, regarding the curriculum, fees, study plans, and service offers for German and international students, can be organized in a targeted and efficient manner using chatbots. From the university's point of view, chatbots can also provide 7-day, 24-hour availability at a relatively low cost. Alternatively, mapping permanent availability through personnel would only be possible through a cost-intensive multi-shift model with overtime and weekend surcharges.

Transaction costs increase when communication-needs, -problems, misunderstandings, or conflicts arise between the parties involved in a transaction. One example in this context is the initiation of study contracts with international students. Here, language barriers, time differences, as well as the large bureaucratic

effort, usually lead to said problems. A chatbot could serve as a permanently available contact point that could provide potential students with information and assistance in their native language regarding upcoming appointments, outstanding documents, and other matters.

It is evident that the monetization of IT projects poses great challenges in practice (Kersten et al. 2006, p. 4 f.). For instance, the use of chatbots can lead to effective relief of employees from non-value-adding activities or to time savings, which the employees can use for value-adding activities. If, for example, the use of chatbots leads to a time saving of 30% and the personnel costs are of a fixed nature, no cost savings are generally realized because no personnel reductions take place. The expected change in the company's results then depends on the extent to which it is possible to use the potential time created for value-adding activities and to estimate the financial benefit (earnings value) of these activities.

In summary, it has to be stated that there is potential for cost and time savings through the use of chatbots in private universities, particularly in routine activities in the area of Service. However, a significantly higher contribution can be expected in terms of customer benefits - at a relatively low additional cost associated with the acquisition and operation of chatbots.

#### 3.4.2.2 Customer Benefit

In the following, some features of chatbots that can lead to an increase in customer value will be summarized (student benefits are explained in detail in Chapter 3.1). Students are to be understood as customers in this context. A conclusive economic evaluation of the benefits of chatbots cannot be carried out within the scope of this work. Here the work of Kesten et al. from the year 2006 is referred to, which illustrates the recording, evaluation, and uncertainty problem with the benefit analysis of IT projects (Kesten et al. 2006).

A benefit for students is essentially created by increasing the perceived quality of the service provided by private universities. One aspect of quality is the availability of the service. Chatbots are characterized by the fact that they are permanently

available, are available immediately, i.e., there is no need to wait for a response by callback, e-mail, mail, or busy telephone lines, and are available digitally, i.e., the target group of students can be picked up on the Internet regardless of location. If they succeed in establishing individual communication, chatbots provide a perceptible benefit in the areas of Marketing, Applicant Management as well as Service and thus contribute to customer satisfaction - or at least fulfill the expectations of digital natives.

In terms of the quality of communication, chatbots can also create perceptible benefits for students if, for example, communication can be offered to international students in their respective national language, the higher information processing and storage capacity of chatbots compared to humans can be used to provide more complex information quickly (e.g., which examinations are scheduled in which semester for different courses of study), and information filtering through chatbots leads to simpler and faster processing of administrative tasks (e.g., registration for exams).

In conclusion, chatbots have perceptible potential in terms of availability and quality of communication in the fulfillment of the tasks of Marketing, Applicant Management, and Service, which can contribute to a higher (although hardly measurable) satisfaction of prospects and students and thus also to differentiation in competition. If students are involved in the service creation process of the chatbot - as described in the Chapter 3.1.4 of this thesis - this can additionally contribute positively to the image of the university.

#### 3.4.2.3 Overall Evaluation

Sensible operational management of digitalization projects, such as that of a chatbot, requires an integrated view, on the basis of which framework conditions such as the budget are decided. In her studies on the value of digitalization projects for companies, Neumeier lists four steps that serve as an orientation for a sound evaluation scheme (Neumeier 2017, p. 344).

In the first step, separate consideration of the individual university areas must be carried out. Here, the three areas of Marketing, Applicant Management, and Service are considered as three digitalization (chatbot) projects to identify the effects which should be analyzed separately in terms of efficiency and customer benefits. The first step is to determine the status quo in the two areas of efficiency and customer benefit. This step is necessary to create a transparent basis for the examination of the respective areas under consideration.

Based on this, it is necessary to determine a definition with regard to the target state of the two dimensions in the area under examination. This target state is derived directly from the corporate objectives and results from the desired combination of the two dimensions of efficiency and customer benefit (Bharadwaj et al. 2013, p. 471 f.). In this context, reference should be made to the extended Build-Measure-Learn Cycle of 3.1.4 of this Theis, whose procedure involves deriving the objectives for the respective chatbot elaborations from the learning effects of the Build-Measure-Learn as well as the university objectives (Chapter 2.3.2 of this Thesis). Since it is very difficult to define exact combinations of efficiency and customer benefit for the areas under consideration, it is advisable to define a target corridor in which the target state for both dimensions should lie.

In the third step, investment plans, as well as alternatives of the respective projects, should be carried out. Due to the different degrees to which each individual project contributes to the two dimensions, budgeting must be done to approximate the desired target state within the target corridor (Neumeier 2017, p. 345). Figure 26 illustrates an exemplary representation of the combination of five digitalization projects that lead the company from the status quo to a possible target state within the target corridor.

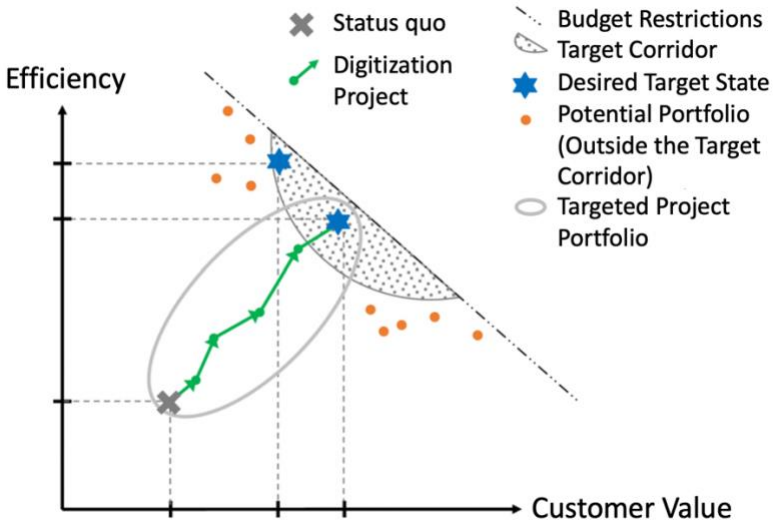



*Fig. 26:* Development of a Project Portfolio for the Target Achievement (Neumeier 2017, p. 345).

In the final step, a periodical evaluation of the target corridor, as well as the digitalization project portfolio, should be carried out. In this context, a regular review of the target corridor, as well as the project portfolio, is advisable in the sense of the Build-Measure-Learn Cycle for private universities. For this purpose, scheduled periodic reviews of the target corridor as well as the current product portfolio (at least once per semester for new project work), which examine the requirements for the target corridor and its compliance with the university objectives are recommended. New technological developments that promise competitive advantages for private universities in the context of the major changes and constant dynamics of the digitalization should also be included in the periodic evaluations of the target corridor as well as the project portfolio (Bharadwai et al. 2013, p. 473 f.).

Figure 27 illustrates the operational evaluation of chatbot projects at private universities in the areas of Marketing, Applicant Management as well as Service with regard to the dimensions of efficiency and customer benefit.

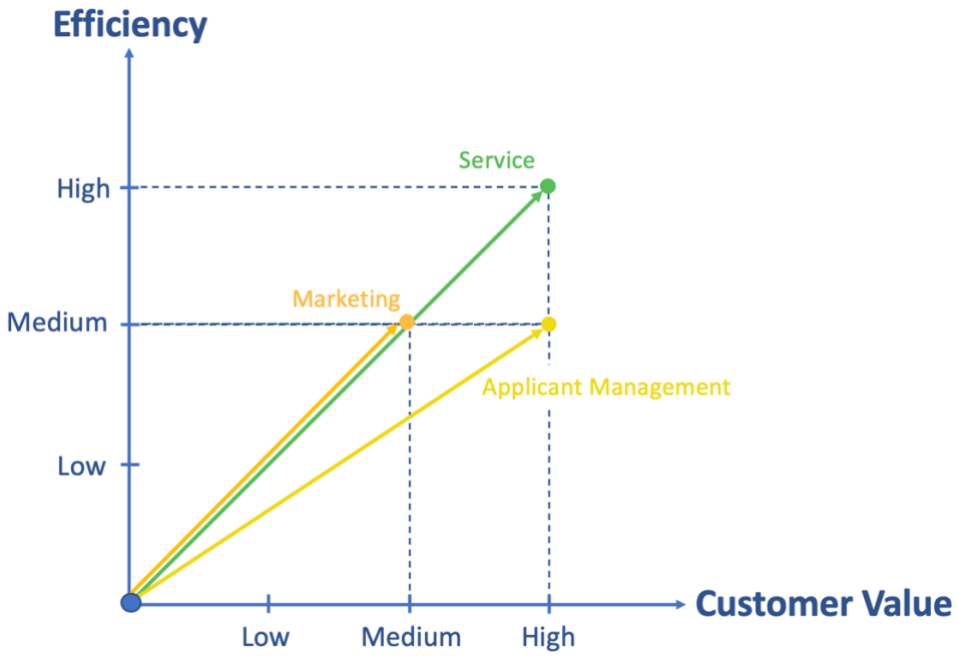



*Fig. 27:* Evaluation of Individual Projects in the Form of Vectors (Self-Generated Figure Based on Neumeier 2017, p. 344).

The potential efficiency gain of a chatbot in Marketing is rated as medium. The reason for this is that although automated conversations are held with prospects, which provides helpful information about the target group, the added value that a chatbot could deliver is more of a supplementary mechanism to the multi-layered marketing activities. However, the positive external impact that the use of innovative technologies can have on people looking for educational opportunities should also be taken into account.

The chatbot can be considered as an informative communication channel to potential customers, which enables private universities to broadcast messages about the external representation of the university directly to the customer. For the customer benefit, there is also a potential medium gain. For example, visitors to the website can request specific information around the clock instead of having to click through many web pages. This means that the first contact with the university can be individualized and personalized. However, even a very competent chatbot would merely support the information and contact requests that the target group usually has at universities.

In Applicant Management, a chatbot would promise a potential medium gain in efficiency. Here, processes could be automated, which include the submission of documents, information about deadlines, and studies. On the other hand, advice and support for potential students should still be provided on a personal level, whereby a chatbot would solely provide assistance (Falkenreck 2019, p. 16). The potential gain in customer benefit for prospective students and applicants through a chatbot can be rated high.

A point of contact would be created that could be asked at any time especially for those questions that might be uncomfortable for some applicants in a conversation with a "real" person (questions regarding lower final grades in school or financial support, etc.). In addition, documents can be submitted easily at any time, dates and deadlines can be requested, and information about the course of study (such as the timetable or semester dates) can be obtained.

The use of chatbots in Service promises to be the most efficient. Here, large parts of the everyday questions and concerns that students have can be answered automatically, since the Service is usually visited by students for recurring questions, the so-called FAQs. The customer benefit can also be classified as high since information about the respective concerns would be made available to students 24 hours a day, 7 days a week, and every day of the year.

This provides students with an additional, digital point of contact that offers quick assistance, although more complex and advice-intensive concerns would still be handled by staff. In the long term, private universities' chatbot projects should be divided into individual projects that, upon completion, are reviewed and evaluated in terms of their progress along the two dimensions toward the targeted (long-term) goal corridor (Neumeier 2019, p. 345). The following Figure 28 illustrates a visualization of an example progression in this context.

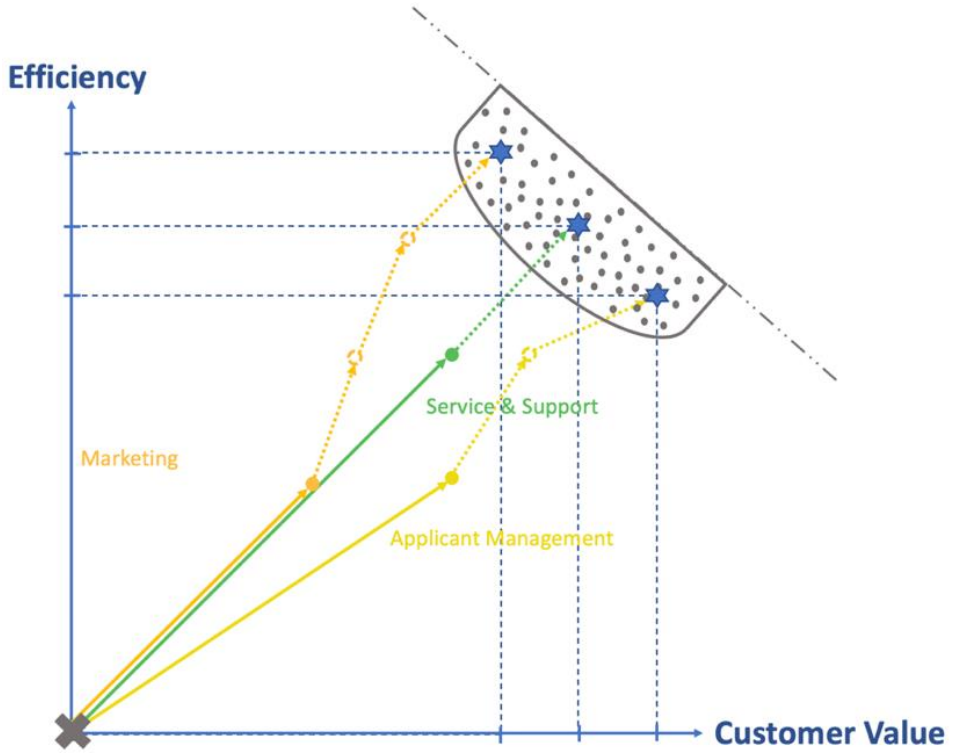



*Fig. 28:* Development of a Project Portfolio for the Achievement of Objectives (Self-Created Illustration Based on Neumeier 2017, p. 345).

In addition to the first steps of the chatbot projects in the three thematic university areas already listed, further future projects could thus take place on the basis of the progress achieved (marked as dashed lines in Figure 28), which adjust the path to the desired state in terms of efficiency and customer benefits (Neumeier 2019, p. 346).

As a basis for the evaluations of the respective chatbot projects, expert assessments are necessary for the areas in which the chatbot is to be applied. For this purpose, especially employees who have competence and experience in the listed three university areas should be included in the process (Neumeier 2019, p. 343). Accordingly, one employee from each of the three thematic areas of the Fresenius University of Applied Sciences was interviewed in the context of this thesis. A detailed explanation and evaluation of the expert assessments are provided in Chapter 4 of this thesis.

### 3.5 Derivation and Justification of Hypotheses

So far, this thesis presents the academic elaborations on the chatbot as well as individual application examples based on the prototype "StudyBuddy". The focus was set on the potential economic opportunities, challenges as well as a strategic and operational evaluation of the use of chatbots at private universities. These explanations will be summarized in the following in the form of six hypotheses. In order to answer the research question of this thesis, a derived subdivision of economically relevant objects of investigation shall be made possible. The elaborated hypotheses are first enumerated and thereby briefly explained in order to use them as a basis for the interview guide of the expert survey. The first hypothesis - chronologically oriented to the thesis - is directed at chatbots as a possible application technology for private universities. This is followed by three hypotheses based on the areas of application investigated in private universities. In addition, one hypothesis is intended to represent an assumption about the implementation and elaboration of chatbot solutions at private universities. Finally, the sixth hypothesis also presents the challenges to be examined as well as the limitations of chatbots at private universities.

*Hypothesis 1: Via interfaces, chatbots should be connected to university systems and programs, whereby relevant user data can be gained as well as utilized.* Via interfaces, chatbots can be connected to university systems and programs, whereby relevant user data can be utilized. Data obtained from user interactions can thus be better understood, evaluated, and used to create user profiles. In principle, chatbots can be integrated not only into social media channels and university websites but also into the front end and user interface of communications. In addition, the backend of the chatbot program of many providers (such as IBM Watson Assistants) can also be connected to the chatbot via a number of interfaces to the university's own systems and programs as well as external databases and sources. In this way, for example, the CRM systems of private universities could be in data exchange with chatbots, whereby valuable information about interested parties and students can be obtained, stored, and evaluated for future projects. Accordingly, it would also be possible to automatically transfer changes in data from linked systems that are relevant for the chatbot to the chatbot "knowledge pool".

*Hypothesis 2: Chatbots enable private universities to better understand the target group along their customer journey and to address them at the right touchpoints.* The target group of private universities can be actively addressed on channels where they are active as well as on the website and guided to the conversation-based assistance of the chatbot at the right points. In this way, it is also possible to create a clearer picture of the target group and their journey towards desired behavior from the interactions and sequences of guided conversations.

*Hypothesis 3 Chatbots simplify interdepartmental communication and can contribute to automating the application process.* For example, information that has already been collected about certain prospects during marketing activities can be forwarded automatically - in compliance with data protection guidelines - to employees in Applicant Management in order to make the application process increasingly individualized and personalized. In addition, customer benefits can be increased in that applicants could submit their documents via the chatbot in an uncomplicated manner (in the sense of being independent of time, day, and location) and information about appointments, studies, or deadlines could be obtained.

*Hypothesis 4: Chatbots offer the possibility of answering or processing Service requests from students automatically and multilingually, regardless of location, around the clock as well as every day of the year.* In Service, recurring requests, in particular, could be clarified by chatbots for students. A chatbot can answer a very large number of queries "on its own". In addition, language barriers would be reduced by a multilingual chatbot and a contact point for students would be created that offers assistance at any time and on any day of the year.

*Hypothesis 5: Chatbots should be elaborated as close as possible to the users and with the involvement of the employees in order to exploit their full potential.* Two critical success factors for the implementation and development of chatbots at private universities are user acceptance and employee support. Only chatbot solutions that actually solve existing user problems reliably and satisfactorily will be accepted by customers in the long term, and it can be assumed that users will have a low tolerance for frustration. The fears and biases of employees in digitalization projects

should be taken into account. Employees should be actively involved in the implementation process to create a chatbot that is seen by employees as a help and relief instead of a threat and unwanted change.

*Hypothesis 6: The realization of chatbot solutions that unleash their full potential requires a high level of technical expertise.* This expertise usually has to be outsourced, whereby prefabricated machine learning models in the form of black boxes are connected to the university's own IT, which means that the scope for action and control from the point of view of the private university is handed over to third parties. Technical expertise on the required machine learning models as well as API calls for networking the chatbot requires not only high initial investments but also ongoing external support. In addition to costs, this external technical expertise also leads to a loss of control and limitations with regard to sometimes sensitive fields such as data security and maintenance.

# 4 Qualitative Content Analysis of Expert Interviews

Since chatbots are a technology that has hardly been used in private universities to date, it is difficult to confirm the hypotheses that have been presented nor to provide a clear answer to the overarching research question based on the existing literature. For this reason, experts were interviewed whose experience and expertise is beneficial in clarifying the potentials as well as challenges that could arise for private universities in Germany as a result of the use of chatbots. In the following chapter, therefore, the research hypotheses will be examined through the insights gained from the expert interviews and thus confirmed or refuted. In the course, the methodological process is described first. Afterward, the individual interview partners are introduced. Finally, the arguments of the interview partners are summarized and analyzed.

### 4.1 Methodological Procedure

A total of seven expert interviews were conducted to gain a deeper and well-founded insight into the subjects researched. In each case, an expert was interviewed on the application areas "Marketing", "Applicant Management" and "Service" of the Hochschule Fresenius of Applied Sciences, as well as four experts who have practical experience with chatbots. The evaluation of the results is based on Mayring's approach to qualitative content analysis, which is detailed below.

An interview can be defined as a research instrument that is conducted according to a plan, taking into account a scientific approach. The interviewees are encouraged to verbally express relevant information. Interviews aim to provide personal opinions and general information (Reinecke 2014, p. 601). Differences can be found in interviews concerning the structure. Thereby, they differ into “strongly-”, “partially-”, and “less-structured” interviews. While each interview structure provides advantages and disadvantages, less-structured interviews were conducted for this thesis, using prepared questions as a guide. The interview is intended to be more of a conversation, whereby the sequence of questions may vary. For this purpose, the interview guide consists of open as well as closed questions. When answering open-ended questions, the interviewee is free to formulate the answer, whereas closed-ended questions provide certain options from which to choose (Mieg & Näf 2005, p. 16).

According to Mayring, the qualitative content analysis provides the basis for a well-founded evaluation of expert interviews, which can be understood as a systematic analysis of texts and interviews in the sense of structured qualitative content investigation. Mayring proposes four main steps for the procedure, which pursue the goal of summarizing the contents of the interviews in a structured manner. In the first step, the content-relevant components of the interview are translated into a uniform language. Additionally, the content is converted into grammatical short forms to create a uniform form. This first step is called "paraphrasing". In the following step, the content is filtered concerning the focus of the study and all statements that belong in the same category are generalized. The third step involves reduction, where identical statements are categorized and shortened, filtering out irrelevant responses.

The last step also provides for a reduction and is therefore referred to by Mayring as a "second reduction". In this way, a complete overview of the content and statements is created, which unites the various responses of the experts, allowing the research hypotheses to be evaluated (Mayring 2015, pp. 70 f.).

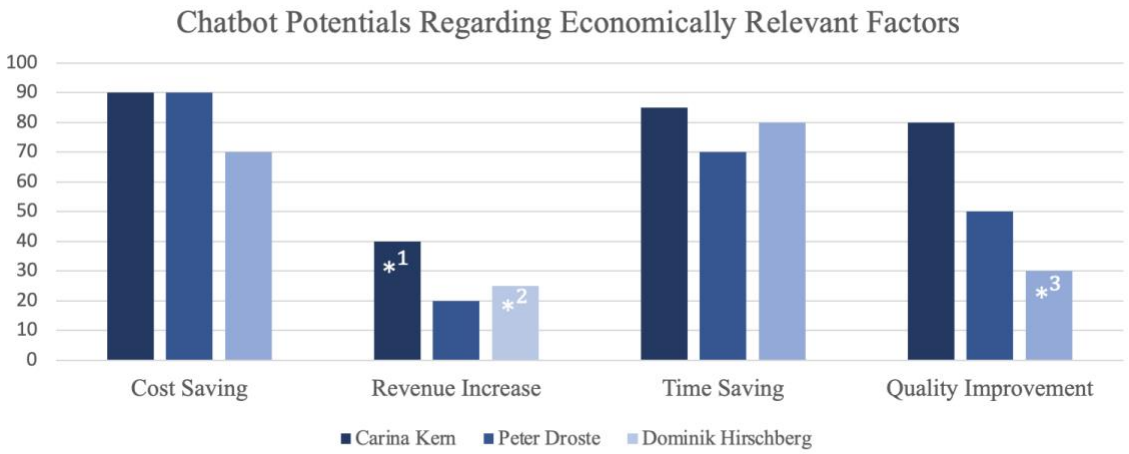
The interview guide, which was designed for this thesis, is attached as Appendix B. Appendix C contains a short introduction of the interview partners. Since all interview partners speak German, the interviews were conducted in German. The German-language interview guide can be found in Appendix B. During the introduction, the author and the interview partners each introduce themselves, with the interview partners additionally stating their expertise concerning the field of application under consideration.

## 4.2 Description and Interpretation of the Interviews

In the following, the insights gained during the interviews with the listed experts will be presented chronologically with the aim of testing the six elaborated hypotheses. For this purpose, the statements of the chatbot experts are listed first in order to test hypothesis one. Subsequently, those hypotheses that deal with the use in the three application areas of this thesis will be compared with the experts' statements. Finally, the same procedure will be used to examine the hypotheses regarding the implementation and challenges of chatbots in private universities.

### 4.2.1 Chatbots

The first step is to check whether the experts consider the use of chatbots to be economically viable in principle. For this purpose, the experts who have practical experience and knowledge regarding chatbots were asked to provide an assessment of the potential that chatbots offer for organizations in terms of cost savings, increasing sales, saving time and improving quality. In this context, Figure 29 illustrates the rating of the three experts listed for the closed question 3 of the interview guideline. The assessment is based on the expectations for the short to medium term (5-10 years).




*1 At this point, Carina Kern distinguishes between products and services that require explanation and those that do not. For products that do not require explanation, she sees a revenue increase potential of 60-70 points. However, since selecting a university to study can be seen important life decision that requires a great deal of consultation due to the large number of factors and influencing variables, the rating of "40 points" for products and services that require explanation was selected.

*2 Mr. Hirschberg points out that he currently sees a strong focus among many chatbot providers as well as customers in this area and that he can anticipate that chatbots will create higher revenue increase potential in the near future (5-10 years).

*3 Mr. Hirschberg currently estimates a quality improvement potential of 30 points for products and services using chatbots. For the near future (5-10 years), however, he predicts a potential of 60 points.

*Fig. 29:* Chatbot Potentials Regarding Economically Relevant Factors (Self-Created Figure).

It can be observed that the experts seem to agree that the arguably greatest economic potential of chatbots lies in the cost and time savings of processes of various kinds. In this context, Carina Kern mentions that, in her experience, chatbots are used to relieve employees but also to replace them (C. Kern, pers. comm., 18. November 2020, Appendix C 00:08:10-00:08:50). For private universities, time savings are generally considered to have greater potential due to the consulting-intensive processes. Although costs can also be saved here through process optimization, there is currently hardly any possibility of achieving far-reaching employee savings through chatbots. Dominik Hirschberg adds to his assessment of the cost savings that the costs should not be considered in isolation. Rather, he suggests looking at the cost-benefit ratio that chatbots promise for organizations (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:07:50-00:08:34). An increase in quality results for users from the use of chatbots at private universities, in particular by creating an additional digital service (C. Kern, pers. comm., 18. November 2020, Appendix C 00:04:57-00:06:20).

The experts rated the potential of chatbots to increase a company's sales and improve the quality of its products and services itself as less significant (P. Droste, pers. comm., 5. November 2020, Appendix C 00:22:26-00:22:45).

To gain the maximum possible benefit from a chatbot, it is essential for private universities to integrate the chatbot as seamlessly as possible into the existing university IT infrastructures. Thereby, those interfaces that enable the chatbot to create additional networking and linking of databases increase the potential for data acquisition and further processing by chatbots. The autonomy of the chatbot - and thus also the automation potential - is directly related to the linking via existing interfaces. For example, it should be made possible that via API calls those changes that are made to the curriculum or timetables of the study programs digitally (for example in the student portal of the university) can be captured by the chatbot (reactive programming). This should prevent everyday changes - such as those to a timetable - from being entered manually and effortfully into the chatbot. In addition, the chatbot could actively contribute to the acquisition of data and use the data from the CRM systems (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:16:02-00:18:23).

Dominik Hirschberg also emphasizes the relevance of these interfaces in this context. The first hypothesis states: *Via interfaces, chatbots should be connected to university systems and programs, whereby relevant user data can be gained as well as utilized.* According to the experts, this assumption is fundamentally correct. According to the experts' experience, sufficient interfaces exist, but it often proves challenging to provide the technical expertise for this (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:17:10-00:19:03). This aspect is therefore also listed among the challenges in the investigation of hypothesis six in Chapter 4.2.6.

Felix A. refers to the most frequent application areas of chatbot projects in which he actively participated or is currently participating as guided customer journey, internal chatbots in connection with CRM systems, and customer service (F. A., pers. comm., 27. November 2020, Appendix C 00:09:01-00:10:32). Transferred to private universities, this would suggest an application in Marketing, Applicant Management,

and Service. The statements made by the experts in the three fields will therefore be examined below.

### 4.2.2 Marketing

Hypothesis 2 states that *chatbots enable private universities to better understand the target group along their customer journey and to address them at the right touchpoints.* Danja Müsch-Hupach describes the activities of university Marketing as highly data- and customer-oriented (D. Müsch-Hupach, pers. comm., 20. November 2020, Appendix C 00:11:50-00:12:35). According to her, it is important to address the target group as a "buyer persona" and to proceed in a targeted manner (D. Müsch-Hupach, pers. comm., 20. November 2020, Appendix C 00:08:02-00:09:43). Chatbots would thereby gain data from the interactions with the target group, which would enable Marketing to meet the demands of the target group. Data evaluation and data reading are mentioned by Danja Müsch-Hupach as tasks of Marketing that are associated with a high expenditure of time and money and could be simplified by chatbots. In addition to a high potential for automation, the expert also mentions the potential to clarify initial questions from the target group on the university's website and also to filter the excess supply quickly and easily (D. Müsch-Hupach, pers. comm., 20. November 2020, Appendix C 00:09:50-00:10:30). In this way, prospects would have to click and work their way through less of an overabundance of information, while still receiving individualized and personalized answers. With a regard to the operational evaluation - the basis of which should be created by expert opinions (Chapter 3.4.2.3) - Danja Misch-Hupach rates the potential for increasing efficiency through chatbots high (D. Müsch-Hupach, pers. comm., 20. November 2020, Appendix C 00:15:40-00:16:45). Her classification of the automation potential through chatbots supported by AI can be seen in Figure 30.

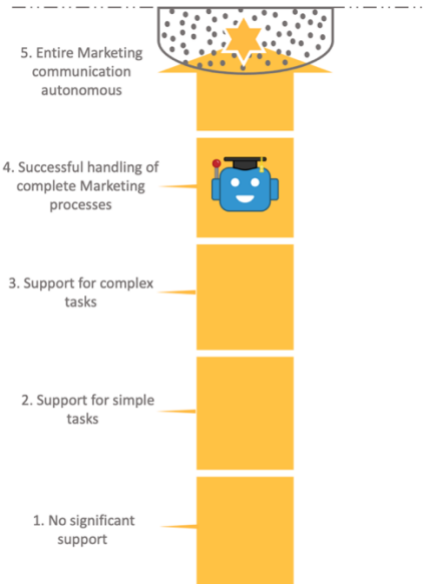



*Fig. 30:* Expert Assessment of the Automation Potential of Processes - Marketing (Self-Created Figure).

The expert's classification with regard to closed question 13 of the interview guide is only linked to the online activities of Marketing (D. Müsch-Hupach, pers. comm., 20. November 2020, Appendix C 00:15:45-00:16:10). According to the classification, it will be possible in the foreseeable future to carry out Marketing processes automated by chatbots through initial chatbot projects, which relate to answering initial questions, filtering information procurement, and obtaining data. Furthermore, Felix A. confirms in his statements that chatbots are often already being successfully applied to understand customers and to create an accurate buyer persona (F. A., pers. comm., 27. November 2020, Appendix C 00:05:21-00:06:12). Peter Droste mentions that, in his experience, the implementation of chatbots on social media channels can be classified as a rather uncomplicated technical undertaking (P. Droste, pers. comm., 5. November 2020, Appendix C 00:18:40-00:19:15). Thus, according to Felix A., the target group (young people looking for a suitable course of study) can be addressed on several channels (touchpoints) on which they are regularly active (F. A., pers. comm., 27. November 2020, Appendix C 00:23:02-00:24:45). Hypothesis 2 can therefore be confirmed according to the experts' statements.

### 4.2.3 Applicant Management

With regard to the use of chatbots in Applicant Management, it is important to evaluate whether Hypothesis 3, which states that chatbots simplify interdepartmental communication and can contribute to automating the application process, is applicable. During the interview, Kadèra points out the great potential of chatbots to carry out processes in which coordination with prospects and the Applicant Management must be carried out (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:09:10-00:09:17). For example, required information from applicants could be automatically obtained by the chatbot, but also forwarded. In principle, chatbots could also be used to further promote the networking of departments. Felix A. also points out the potential that chatbots offer organizations to automate and simplify internal communication processes (F. A., pers. comm., 27. November 2020, Appendix C 00:09:53-00:10:07). Since Applicant Management is a communication-intensive department of the university, where information needs to be obtained and forwarded as seamlessly as possible from different departments, a sophisticated chatbot could thus improve the efficiency of employees' day-to-day work (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:10:03-00:16:20). Figure 31 reveals the classification of expert Marie Kadèra regarding the automation potential through the use of chatbots in Application Management (regarding question 19 of the interview guideline).

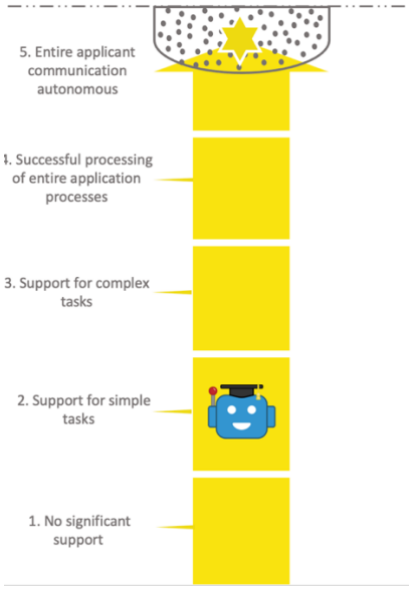



*Fig. 31:* Expert Assessment of the Automation Potential of Processes - Applicant Management (Self-Created Figure).

Marie Kadèra says that it would be possible to support simple Applicant Management activities with chatbots (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:17:57-00:18:50). However, she refers to the consulting-intensive tasks, whereby applicants, in her experience, particularly value the personal contact offered by the Fresenius University of Applied Sciences (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:18:25-00:18:35). Regarding the operational evaluation of the potential increase in efficiency through chatbots in Applicant Management, this can be seen as a starting point for future projects. In particular, NLP and further sentiment analysis models as well as extensive linking of the chatbot with the CRM systems will be required in order to further grow on the efficiency axis. Marie Kadèra states that in her opinion chatbots could be a very helpful tool in Applicant Management, which has great potential. However, it should be offered as an additional medium for applicants and employees, which takes care of simple concerns for applicants in an automated way (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:21:15-00:21:30). In addition, employees should find it easier to carry out their daily work without sacrificing too much personal contact with applicants (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:18:20-00:18:47). The hypothesis can therefore only be partially confirmed. It is important not to hope for significant efficiency gains in the short term. Nevertheless, chatbots show the potential to create additional benefits for prospects during the application process by creating an additional point of contact.

### 4.2.4 Service

According to Ulrike Koch, the daily work of the Service Department at the Fresenius University also focuses on personal contact with students (U. Koch, pers. comm., 8. December 2020, Appendix C 00:02:05-00:03:05). In this area of application, the Hypothesis 4 states: *Chatbots offer the possibility of answering or processing Service requests from students automatically and multilingually, regardless of location, around the clock as well as every day of the year.* The expert points out that, in her experience, students often need to be accompanied and delegated in their search for information (U. Koch, pers. comm., 8. December 2020, Appendix C 00:07:27-00:08:25). Furthermore, she describes the availability of the Service Department as a

particularly important aspect. In this regard, she expresses that it would be helpful if a point of contact were provided for students around the clock (U. Koch, pers. comm., 8. December 2020, Appendix C 00:05:13-00:05:50). According to the experts surveyed, chatbots offer great potential for answering frequently asked questions in the service department around the clock. In addition, it is possible to assist international students with a multilingual chatbot. The following Figure 32 demonstrates the classification of expert Ulrike Koch with regard to the potential increase in efficiency through chatbots in University Service.

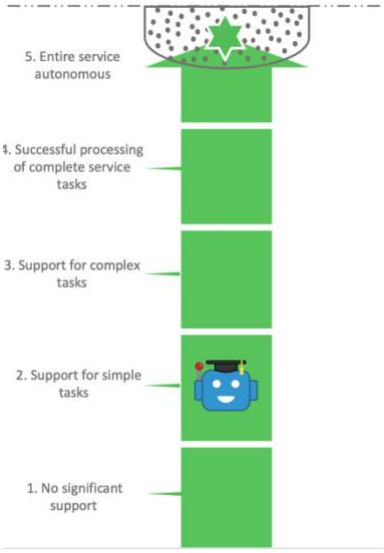



*Fig. 32:* Expert Assessment of the Automation Potential of Processes – Service (Self-Created Figure).

Ulrike Koch anticipates potential in using chatbots to support simple tasks in Service. Personal contact, as well as a contact person on site, must absolutely continue to exist in order to offer students a satisfactory service (U. Koch, pers. comm., 8. December 2020, Appendix C 00:13:22-00:13:50). Peter Droste mentions that since the establishment of the chatbot TOBi at Vodafone GmbH, simple recurring concerns, in particular, can be handled around the clock and every day of the year. In doing so, the company has succeeded in relieving employees and in promoting them to a large extent (P. Droste, pers. comm., 5. November 2020, Appendix C 00:41:05-00:44:15). Ulrike Koch also points out that currently delegating students to the right departments and contact persons take a much time. Here, even the first stages of a chatbot project could relieve employees. Less complex issues - such as the delegation of students - could be automated. On the one

hand, efficiency could be increased through automation. And on the other hand, employees could also increase their service performance by creating more time (with the same number of employees) for more complex concerns. Further projects should build on this aspect, which could also create new services and new customer benefits. Overall, the experts' statements confirm Hypothesis 4. However, a chatbot in Service - at least in the first step - should definitely be seen as an extension of the Service portfolio to support the work of the employees and not to replace it.

### 4.2.5 Implementation

The chatbot experts agree on the aspects of implementing chatbot projects. It is essential to create a user and employee acceptance (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:14:40-00:15:30). The experts' statements largely reflect the approach discussed in Chapter 3.1.4 of this thesis. For instance, expert Felix A. suggests a regular test procedure based on the build-measure-learn principles (F. A., pers. comm., 27. November 2020, Appendix C 00:06:04-00:07:30). In addition, he points out that in his experience the "fail fast" principle is helpful, as insights from errors are gained in the early stages of development. Agile development of the chatbot would thus lead to lower adaptation costs. During this agile development the customer should represent the center of the process (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:02:20-00:02:50). According to Carina Kern, user-friendliness and acceptance should be a central component of a chatbot (C. Kern, pers. comm., 18. November 2020, Appendix C 00:05:15-00:05:50). Dominik Hirschberg explicitly refers to customer centricity and also mentions the MVP listed in Chapter 3.1.4 as a helpful way to test new ideas on users and work them out with them (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:27:00-00:18:20). However, the experts also consider the involvement of employees to be an important success factor for the implementation of a chatbot project. Overall, therefore, Hypothesis 5, which states that *chatbots should be elaborated as close as possible to the users and with the involvement of the employees in order to exploit their full potential*, can be confirmed by the expert opinions.

### 4.2.6 Challenges

The assumptions of Hypothesis 6, which state that *the realization of chatbot solutions that unleash their full potential requires a high level of technical expertise*, will also be considered. The technical challenges are addressed by Dominik Hirschberg. The expert points out that a sophisticated chatbot requires a solid implementation and networking in existing systems and programs (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:16:20-00:20:00). According to Carina Kern, the capabilities of the chatbot are directly related to the AI in the backend of the chatbot (C. Kern, pers. comm., 18. November 2020, Appendix C 00:16:00-00:17:05). Felix A. also points out that machine and deep learning models must be used to develop a chatbot that is as independent as possible and whose NLP learns independently - not based on rules - through continuous improvement by training (F. A., pers. comm., 27. November 2020, Appendix C 00:17:40-00:19:13). In his opinion, this requires the work of professionals whose skills in areas such as data science also determine the quality of the chatbot (F. A., pers. comm., 27. November 2020, Appendix C 00:18:50-00:19:10). With regard to integration and networking with potential interfaces in existing IT systems, Dominik Hirschberg also refers to required expertise, which in his opinion is rarely found at present (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:17:20-00:19:00).

Overall, the involvement of professional third-party providers seems unavoidable under these circumstances. However, this means that the private university loses influence and control over the project and the chatbot itself. Additionally, additional costs, the involvement of third parties also poses challenges in terms of data protection. Dominik Hirschberg emphasizes that careful handling of user data is absolutely necessary (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:23:10-00:23:30).

Dominik Hirschberg also provides an example of the black box problem. If chatbot solutions are obtained from third parties, the university would no longer be able to trace the matching process between the user inputs and the programs' intents (D. Hirschberg, pers. comm., 19. November 2020, Appendix C 00:24:10-00:25:10).

According to the experts' statements, the listed assumptions about the challenges of Hypothesis 6 can therefore be confirmed.

### 4.3 Evaluation of the Survey Results

The evaluation of the expert interviews conducted reveals that chatbots offer economically relevant potential, particularly in the areas of time savings and quality improvement. While processes could be automated in many of the areas examined, the cost savings that a chatbot would deliver are limited to the resulting process optimization. It has to be taken into account that the costs that would be incurred by a chatbot at private universities have to be contrasted with the savings. Due to the nature of the services in the portfolio of a private university, a direct effect on increase in revenue is less likely. Since a study program is a decision that has a massive influence on the life of the "customer" in the medium to long term, it cannot currently be assumed that a chatbot would actively “sell" study programs autonomously. However, revenue increases would possibly occur indirectly, since, for instance, a broader mass of the target group could be additionally advised and advertised. An increase in quality or customer value is created through additional service. Applicants and students are offered the opportunity to obtain information on demand during or outside business hours.

For private universities in Germany that operate commercially, experts believe that implementation is technically feasible to an extent that would allow the chatbot to be networked with existing IT systems and programs. Thus, chatbots could contribute to the economic success of private universities.

The goal of the evaluation was to compare and examine the assumptions made in this study based on the existing literature and the examples of the StudyBuddy prototype in the form of six hypotheses with the statements made by the experts. Overall, it can be concluded that chatbots have the potential to support the work of employees by automating recurring processes. In addition, data is obtained that enables the departments to act more effectively in the future through evaluations. For each of the reasons listed, the experts also expect efficiency gains, although the extent of these

varies. According to the experts, chatbots should initially be used to support simple processes.

With regard to increasing customer benefit - which is the second variable in the operational assessment of Chapter 3.4.2.2 - users should be involved in the process of service creation. At several points in the interviews, the chatbot experts refer to an elaboration strategy for the chatbot that focuses on the user, takes their feedback into account and implements it in a cooperative manner.

In addition, the employees concerned should also be involved in the process so that a digital tool can be developed that makes the employees' work easier instead of creating fear and resistance. However, according to the experts, this also requires technical expertise, particularly in the areas of machine and deep learning as well as IT implementation and networking. For most private universities, this technical expertise will only be provided with the support of third parties. The experts confirm the assumption that, from the point of view of the private university, dependencies, loss of control and challenges with regard to data protection are to be expected in this context.

# 5 Conclusion

The following chapter presents the conclusion of this thesis. For this purpose, the findings of the studies listed are first summarized. In addition, the research question of the thesis is answered. Finally, an overview of the thematized fields of investigation is presented, which includes assessments by the author.

## 5.1 Summary

The continuous technological development of AI is increasingly creating fields of application that present economic potential. Artificial neural networks enable machine and deep learning models to process and utilize large amounts of data ever more independently. Therefore, as far as computer-human and human-computer interaction and communication are concerned, it is also becoming possible to

program applications that demonstrate increasing contextual and sentiment communication potential. Chatbots are considered a promising application area in this context. Certain existing chatbot applications already include capabilities that enable considerable communication between humans and computers.

Private universities in Germany are state-recognized institutions of higher education whose funding and sponsorship – in contrast to state universities – are provided primarily by private individuals or organizations. Private universities compete both with each other and with state universities for students, staff, and financial resources. Moreover, in order to survive in the market, private universities must ensure that they act in a way that is appropriate for the market, and are positioned in such a way that the target group accepts the services offered.

Chatbots offer concrete added value for private universities. Wherever possible, chatbots should be connected to the university's own systems and programs via interfaces. This essential requirement is directly related to the autonomy of chatbots. Thus, linking with programs and systems of the university would provide valuable data for the chatbot, allowing changes relevant to the chatbot's responses to be updated automatically. This would significantly reduce chatbot overheads, especially in maintenance. The information does not have to be updated manually on a regular basis. Rather, the data (as variables or parameters) in the responses can be autonomously adopted by a change in the university's systems and programs (reactive programming). Overall, an IT infrastructure should be implemented at the beginning of the investment – with the involvement of expertise – with as much foresight as possible. At the outset this would involve regular expenses for private universities in addition to initial investments. However, cost savings through chatbots will only be possible if they are managed to realize automation, time savings, and process optimizations in such a way that employee numbers are reduced or costly processes are replaced more cheaply by the chatbot.

The findings of this thesis, based on scientific literature, the prototype, and the expert interviews, suggest that chatbots have the potential to increase quality from the perspective of private universities. It is especially applicable to private universities that their services represent a competitive advantage over state and other private

universities. In this context, it is suggested that existing services in the three activities of the value creation processes discussed – Marketing, Application Management, and Service – should continue to be provided in person wherever possible. As a first step, chatbots should help to support the task fulfillment of the employees concerned. Employees are thus relieved by automating time-consuming, repetitive, and simple tasks through the use of the chatbot wherever possible. This would free up employees' time for more individualized, complex, and consultation-intensive concerns, thus creating a potential for increasing customer value.

For prospective applicants and students, the service capabilities of a chatbot supported by machine and deep learning should initially serve as an additional point of contact. This can provide both prospective applicants and students with an additional communication medium that is easily accessible on multiple channels (e.g., university website, student portals, or even social media channels). In addition, it would be possible to obtain information for at least a range of concerns outside of business hours and on any day of the year. Since international students represent a target group in which some private universities seek to build or expand a competitive advantage, it should be mentioned that chatbots can also bridge barriers relating to time zones and language. From a technical perspective, it is relatively straightforward to create a multilingual chatbot in this context, as long as it features a sufficient AI infrastructure. In addition, chatbots allow prospective applicants and students to receive information about concerns where anonymity is desired. For example, information can be obtained anonymously about issues such as financial aid, failing grades, and failures regarding registration for exams.

From a strategic point of view, chatbots would therefore promise competitive advantages, especially for private universities that strive for differentiation through quality. However, from an operational perspective, the aspects listed with regard to the criteria of efficiency gains and additional customer benefits should be considered by the individual private universities in their specific context when implementing a chatbot project. It will be of great importance to involve employees in the planning process at an early stage. In order to create concrete competitive advantages in the thematized application fields, it would also be helpful to ensure as much user involvement as possible in the service creation process. Only functions that appeal to

the target group (interested parties, applicants, and students) in such a way that the desired competitive advantages are created should be prioritized. In this context, it is promising that digital programs such as chatbots fundamentally enable extensive and precise evaluation of the additionally acquired data. For example, ongoing development of the chatbot could benefit from the fact that it is possible to regularly check which concerns are addressed most frequently during user-chatbot interactions or at which points conversations are abruptly terminated. These findings would then provide a basis for further improvements. In addition, information can be gathered from the interactions that will allow private universities to capture a more accurate picture of the target group. These target groups could then be addressed more effectively in the future.

However, in order to realize the competitive advantages offered by chatbots, a number of challenges must be overcome. User data must be stored and processed with great care and in compliance with the legal framework. Limitations also arise with regard to the control of chatbot construction kit systems that are obtained from third parties. External expertise for the integration of the chatbot into the IT infrastructure of a university and with regard to the machine and deep learning models to be applied must also be taken into account. Provided that the identified challenges are solved and the affected employees are involved in the implementation and development process, it can be assumed that a chatbot project can lead to competitive advantages. In this context, it will be crucial to identify the user needs in the application areas addressed in order to create added value that increases customer benefit and efficiency.

### 5.2 Outlook

While digitalization is steadily gaining ground in many areas of society and the economy, the education sector should keep pace with changes in this field or even anticipate them. In Germany, private universities are under increasing competitive pressure to adopt innovative approaches in order to set themselves apart from the state universities that dominate the market. The aim is to offer the target group added value that distinguishes private universities from the others.

While private universities have been able to create competitive advantages in the past, particularly through intensive support for prospective and current students, the potential of digitalization should also be taken into account. In this context, chatbots provide the potential to combine the aspects of service and digitalization that are relevant for private universities. An AI-supported digital communication medium could create added value that goes beyond simple service optimization. At this point, in the author's opinion, the image enhancement that private universities could create through the use of innovative technologies should not be underestimated either. However, these effects are very difficult to grasp or measure. It can be assumed that the labor market in particular, which increasingly demands skills relating to digitalization-relevant topics, has a major influence on the target group of private universities. When choosing what to study, potential students embarking on higher education generally set their priorities with a focus on the advantages they expect to gain in the labor market as a result. In this context, the author believes it would be unsurprising if the innovative digital presence of a private university were to positively influence the decision-making of the target group.

The active involvement of students would enable private universities to leverage three potentials in particular. First, it could be advertised that students could actively learn skills that are in great demand in the job market by working on practice-relevant projects with innovative technologies as part of their course of study. Second, the continuous development of the chatbot could be carried out at least partially by students at a lower cost than by external parties. In addition, this would imply a customer centricity, since the student – as a user of the chatbot – would actively participate in its development, and thus their requirements and desires would be included.

However, it is recommended that private universities should develop an initial prototype as professionally as possible and with the involvement of experts. In this context, it will be crucial to integrate such a prototype into the existing IT infrastructure as far as possible. The initial investment should ensure that a solid technical basis is created that imposes as few limitations as possible on future ideas. In the author's opinion, it will be problematic in the context of such a digitalization

project to bundle all influencing energies in the same direction. It can be assumed that employees in particular – whose daily work would potentially be strongly influenced or even replaced by a chatbot – will initially be very critical of the project. Prospective applicants and students could also turn against the chatbot after only a few negative experiences. If a chatbot repeatedly presents wrong, insufficient, or irrelevant answers to a prospective applicant or student, it is not unlikely that this user will stop using the chatbot in the future.
The issue of data privacy should also be mentioned as an important challenge. It should be noted that young people, in particular, are becoming increasingly skeptical about algorithms that process a large amount of personal data. However, the capabilities of the machine and deep learning models integrated and linked in chatbots are based on the quantity and quality of the data collected. On the one hand, this also results in benefits for users. For example, the captured data allow the chatbot to train its algorithms on its own, optimizing future interactions for users, or enable university Marketing to capture valuable data that is helpful in communicating with target groups. However, negative examples from the past have made the topic of data protection extremely sensitive. It is important to ensure that data are handled responsibly from the very outset.

Overall, if the challenges referred to above are successfully overcome, the use of chatbots can create digital added value that promises competitive advantages, especially for those universities that identify potential fields of application early on – as "first-movers". Human-computer interaction and communication have already made impressive progress, and chatbots offer economically relevant potential that should also be taken into account by private universities.

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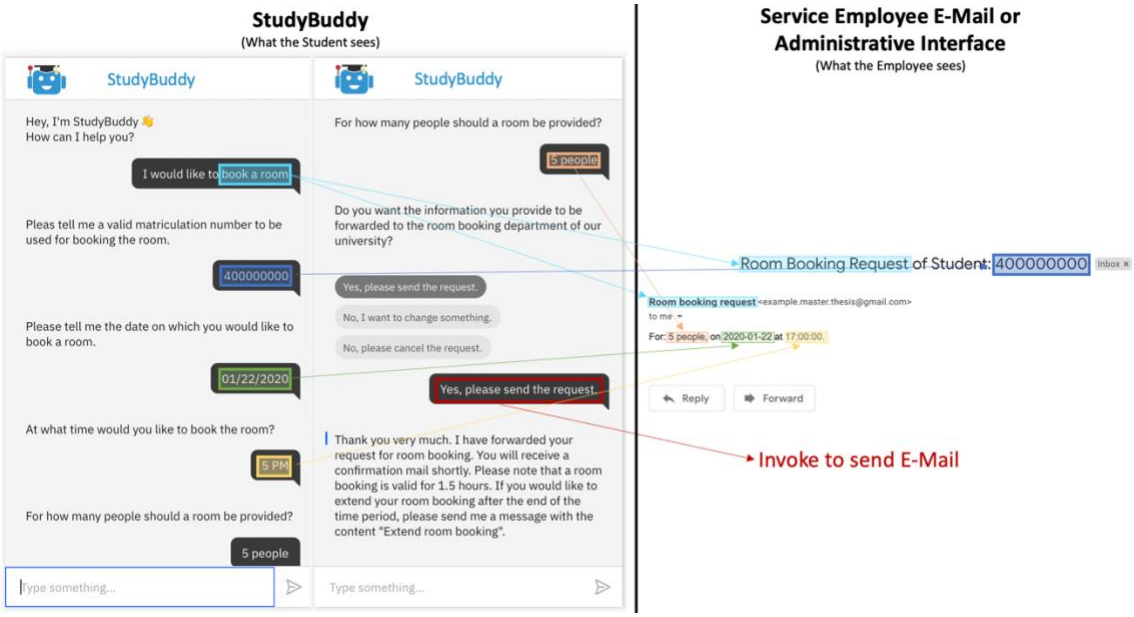
# V Appendix

## List of Appendices

## A Booking a Room via StudyBuddy

Students could contact the chatbot when they need a room for study groups or to work on projects. Illustration a demonstrates an example conversation in this context on the right side. Here, StudyBuddy asks for the relevant data needed to book a room in slots. Only when all the required data has been collected the StudyBuddy asks whether the request should be forwarded to the university's room booking department. By clicking the "Yes, please send the request" option, the linked cloud function is invoked. The requested data is stored as entities and can be answered in individual messages or specified in just one message. The right side of Illustration a demonstrates how the requested entities are inserted as parameters in the precoded e-mail text to the responsible employee and how the mail is sent.

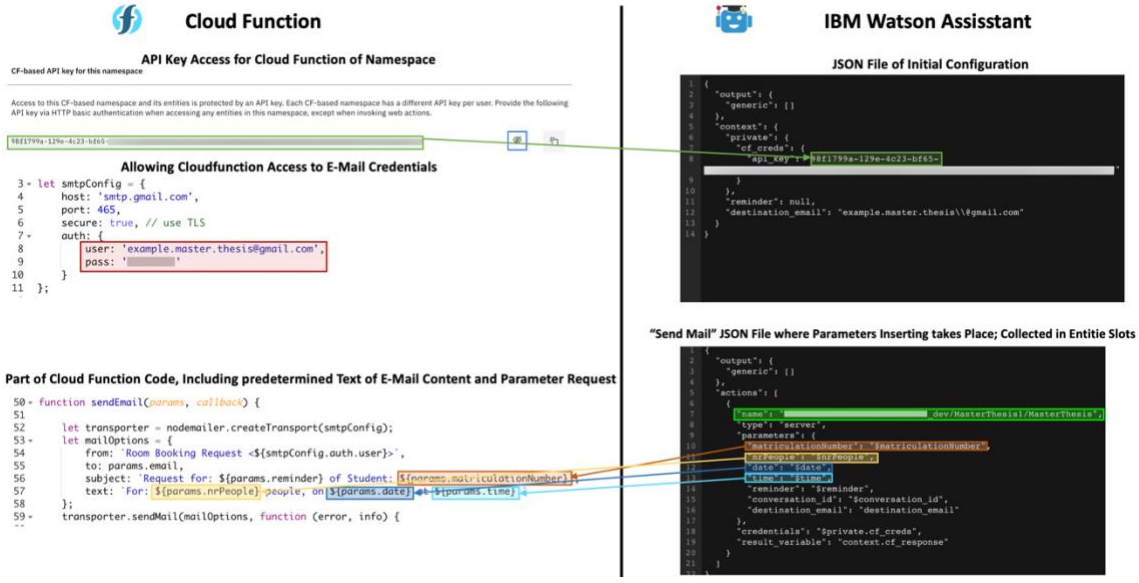
***Illustration a:*** Transfer of Captured Input Data (Entities) as Parameters into Predefined E-Mail Text.




In the backend of the illustrated process, a code is connected to StudyBuddy as a Cloud Function via API. For this purpose, the generated API key of the cloud function account namespace is inserted into the JSON file of the initial configuration of StudyBuddy (IBM Watson Assistant). This will allow StudyBuddy access from the Cloud Functions, which is illustrated on the top of Figure 26 highlighted in green.

In the Cloud Function code, access is first granted to the email account that will be used to send the emails. For this purpose, the login data of the e-mail account are stated in the code (in lines 8-9 of the Cloud Function code; marked in red on Illustration b). The Cloud Function code contains pre-written text that includes the matriculation number of the student requesting the room booking in the subject of the email as a parameter, and the other data needed to book the room (lines 56-57 of the Cloud Function code on Illustration b). The data required by the Cloud Function is retrieved as entities by StudyBuddy in slots and collected into the JSON file of the "Send Mail" dialog node. When the user then presses send by selecting the "Yes, send the request" option, the required parameters are inserted into the Cloud Function and the code is invoked; sending the email (highlighted in color in the lower half of Illustration b) Since StudyBuddy has already been granted access to the cloud functions of a namespace through the API key link, all that is now missing is the "lead" that tells StudyBuddy which of the cloud functions the parameters should be inserted into as well as being invoked. For this purpose, the name of the intended cloud function is also stored in the JSON file of the "Send Mail" dialog node (marked green in the lower half of Illustration b).

***Illustration b:*** Configuration of the Cloud Function with the Watson Assistant via Credential Exchange (API key) and Transfer of the Captured Parameters.




It would also be conceivable to execute the room booking directly via the chatbot. The prerequisite for this is that the room booking is controlled via a computer

program that can be linked to the chatbot via API. Further information such as room number, room plan, room availability, and the booking process could be communicated directly via the chatbot. In the example presented, the request would be forwarded to an employee, who would then have to manually check and confirm the availability.

## B Interview Guideline

The interview guideline is be divided into two parts. For the first part (outlined in blue), questions were developed that are directed at experts who have special knowledge and experience with chatbots. The goal is to gain knowledge about the technical topics of chatbots and their economic relevance. Therefore, the guide is designed with the purpose to gain insights on economically relevant areas of application, success factors, and the respective potentials and challenges. The second part (outlined in grey) focuses on gaining results from experts in the fields of Marketing, Applicant Management, and Service. In this context, the aim is to provide a sound basis for the elaborations regarding the potentials, challenges, and evaluation of the use of chatbots in these three areas (Neumeier 2019, p. 343). Accordingly, open as well as closed questions for a partly-structured interview process were elaborated, providing insights into the potential application areas, the limitations as well as critical success factors for a possible chatbot application at private universities in Germany. Accordingly, the second part can be divided into the three subordinate categories: Marketing, Applicant Management as well as Service. Open questions are marked with "(O)" and closed questions with "(C)". The questions of the interview guide regarding the first part as well as the three subdivided areas of the second part are illustrated in the guideline of the Expert Interviews. The English version of the interview guide (Illustration c) and a German version (Illustration d) can be found on the following pages.

***Illustration c:*** Interview Guideline (English).

## First Part

| 1. Chatbots | | | | | |
|---|---|---|---|---|---|
| 1. (O) | Please name criteria that provide information about the economical success of new technologies? | | | | |
| 2. (O) | Please name the currently most popular areas of use for chatbots. | | | | |
| 3. (C) | Please name the potentials in points (from 0 - 100 each) that chatbots deliver regarding the following four economically relevant factors (short to medium term): | | | | |
| | | 1. Cost saving | 2. Revenue increase | 3. Time saving | 4. Quality improvement |
| 4. (O) | Please name the biggest challenges chatbots are facing to date. | | | | |
| 5. (O) | Please name the challenges that arise when implementing chatbots in existing IT systems. | | | | |
| 6. (O) | On the topic of chatbots connected to machine and/or deep learning models, please name the respective: | | | | |
| | Potentials | | | Challenges | |
| 7. (O) | Please name the economic success factors and requirements of chatbots. | | | | |

## Second Part

| 2. Marketing | | | | | |
|---|---|---|---|---|---|
| 8. (O) | Please name everyday tasks of University Marketing. | | | | |
| 9. (O) | In which areas of University Marketing do you currently identify potential for automation? | | | | |
| 10. (O) | Please list frequently asked questions. What is important to prospective students? | | | | |
| 11. (O) | Please list the University Marketing tasks and processes that are time- and/or cost-intensive. | | | | |
| 12. (O) | What are the critical success factors of University Marketing. | | | | |
| 13. (C) | Based on the given options, please estimate how automated communication programs supported by artificial intelligence (machine learning as well as deep learning) could influence the tasks of University Marketing in the future: | | | | |
| | 1. | 2. | 3. | 4. | 5. |
| | No significant support | Support for simple tasks | Support for complex tasks | Successful handling of complete Marketing | Entire Marketing communication |
| **3. Applicant Management** | | | | | |
| 14. (O) | Please name everyday tasks of Applicant Management. | | | | |
| 15. (O) | In which areas of Application Management do you currently identify potential for automation? | | | | |
| 16. (O) | Please list frequently asked questions. What is important to applicants? | | | | |
| 17. (O) | Please list the Applicant Management tasks and processes that are time- and/or cost-intensive. | | | | |
| 18. (O) | What are the critical success factors of Applicant Management. | | | | |
| 19. (C) | Based on the given options, please estimate how automated communication programs supported by artificial intelligence (machine learning as well as deep learning) could influence the tasks of Applicant Management in the future: | | | | |
| | 1. | 2. | 3. | 4. | 5. |
| | No significant support | Support for simple tasks | Support for complex tasks | Successful processing of entire application | Entire applicant communication |
| **4. Service** | | | | | |
| 20. (O) | Please name everyday tasks of University Service. | | | | |
| 21. (O) | In which areas of University Service do you currently identify potential for automation? | | | | |
| 22. (O) | Please list frequently asked questions. What is important to students? | | | | |
| 23. (O) | Please list the University Service tasks and processes that are time- and/or cost-intensive. | | | | |
| 24. (O) | What are the critical success factors of University Service. | | | | |
| 25. (C) | Based on the given options, please estimate how automated communication programs supported by artificial intelligence (machine learning as well as deep learning) could influence the tasks of University Service in the future: | | | | |
| | 1. | 2. | 3. | 4. | 5. |
| | No significant support | Support for simple tasks | Support for complex tasks | Successful processing of complete service | Entire service autonomous |

***Illustration d:*** Interviewleitfaden (Deutsch).

## Erster Teil

| | 1. Chatbots | | | | |
|---|---|---|---|---|---|
| 1. (O) | Nennen Sie bitte Kriterien, die Aufschluss über den wirtschaftlichen Erfolg neuer Technologien liefern? | | | | |
| 2. (O) | Nennen Sie bitte die aktuell häufigsten Einsatzgebiete von Chatbots. | | | | |
| 3. (C) | Nennen Sie mir bitte die Potentiale in Punkten (von 0 - 100), die Chatbots hinsichtlich der folgenden vier wirtschaftlich relevanten Faktoren liefern: | | | | |
| | | 1. Kosteneinsparung | 2. Ertragsteigerung | 3. Zeiteinsparung | 4. Qualitätsverbesserung |
| 4. (O) | Nennen Sie bitte die größten Herausforderungen, die Chatbots bislang mit sich bringen. | | | | |
| 5. (O) | Nennen Sie bitte die Herausforderungen, die sich im Rahmen einer Implementierung von Chatbots in bestehende IT-Systeme ergeben. | | | | |
| 6. (O) | Nennen Sie bitte zu dem Thema Chatbots in Verbindung mit Machine- und/oder Deep Learning die jeweiligen: | | | | |
| | Potentiale | | | Herausforderungen | |
| 7. (O) | Nennen Sie bitte die wirtschaftlichen Erfolgsfaktoren von Chatbots | | | | |

## Zweiter Teil

| | 2. Marketing | | | | |
|---|---|---|---|---|---|
| 8. (O) | Nennen Sie bitte alltäglichen Aufgaben des Hochschulmarketings. | | | | |
| 9. (O) | In welchen Bereichen des Hochschulmarketings sehen Sie aktuell großes Automatisierungspotential? | | | | |
| 10. (O) | Nennen Sie bitte häufig gestellte Fragen. Was ist Interessenten wichtig? | | | | |
| 11. (O) | Nennen Sie bitte die Aufgaben und Prozesse des Hochschulmarketings, die mit einem hohen Zeit- und/oder Kostenaufwand verbunden sind. | | | | |
| 12. (O) | Was sind die kritischen Erfolgsfaktoren des Hochschulmarketings? | | | | |
| 13. (C) | Schätzen sie bitte anhand der vorgegebenen Optionen ein, wie in Zukunft automatisierte Kommunikationsprogramme durch Unterstützung Künstlicher Intelligenz (Machine- sowie Deep Learning) die Aufgaben des Hochschulmarketings beeinflussen könnten: | | | | |
| | 1. Kein nennenswerter Einfluss | 2. Unterstützung bei simplen Aufgaben | 3. Unterstützung bei komplexen Aufgaben | 4. Erfolgreiche Bearbeitung vollständiger Marketingprozesse | 5. Vollständige Marketingkommunikation autonom |
| | **3. Applicant Management** | | | | |
| 14. (O) | Nennen Sie bitte alltäglichen Aufgaben des Application Managements. | | | | |
| 15. (O) | In welchem Bereich des Application Managements sehen Sie aktuell das größte Automatisierungspotential? | | | | |
| 16. (O) | Nennen Sie bitte häufig gestellte Fragen. Was ist Bewerbern wichtig? | | | | |
| 17. (O) | Nennen Sie bitte Aufgaben und Prozesse des Application Managements, die mit einem hohen Zeit- und/oder Kostenaufwand verbunden sind. | | | | |
| 18. (O) | Was sind die kritischen Erfolgsfaktoren des Application Managements. | | | | |
| 19. (C) | Schätzen sie bitte anhand der vorgegebenen Optionen ein, wie in Zukunft automatisierte Kommunikationsprogramme durch Unterstützung Künstlicher Intelligenz (Machine- sowie Deep Learning) die Aufgaben des Hochschulmarketings beeinflussen könnten: | | | | |
| | 1. Kein nennenswerter Einfluss | 2. Unterstützung bei simplen Aufgaben | 3. Unterstützung bei komplexen Aufgaben | 4. Erfolgreiche Bearbeitung vollständiger Bewerbundprozesse | 5. Vollständige Interessentenkommunikation autonom |
| | **4. Service** | | | | |
| 20. (O) | Nennen Sie bitte alltägliche Aufgaben der Service Lounge Mitarbeiter. | | | | |
| 21. (O) | In welchem Bereich der Service Lounge Tätigkeiten sehen Sie aktuell das größte Automatisierungspotential? | | | | |
| 22. (O) | Nennen Sie bitte häufig gestellte Fragen. Was ist Studenten wichtig? | | | | |
| 23. (O) | Nennen Sie bitte Aufgaben und Prozesse der Service Lounge Tätigkeiten, die mit einem hohen Zeit- und/oder Kostenaufwand verbunden sind. | | | | |
| 24. (O) | Was sind die kritischen Erfolgsfaktoren der Service Lounge Tätigkeiten. | | | | |
| 25. (C) | Schätzen sie bitte anhand der vorgegebenen Optionen ein, wie in Zukunft automatisierte Kommunikationsprogramme durch Unterstützung Künstlicher Intelligenz (Machine- sowie Deep Learning) die Aufgaben des Hochschulmarketings beeinflussen könnten: | | | | |
| | 1. Kein nennenswerter Einfluss | 2. Unterstützung bei simplen Aufgaben | 3. Unterstützung bei komplexen Aufgaben | 4. Erfolgreiche Bearbeitung vollständiger Serviceaufgaben | 5. Vollständiger Service autonom |

## C Interview Partners

In the following, the selected interview partners are briefly introduced. In doing so, it is listed which factors speak for the selection of the partners and how the experience and expertise of the experts can contribute to the clarification of the established hypotheses and thus the research question of this thesis.

**Carina Kern** has been responsible for university support of the entire IBM product and service portfolio at IBM Deutschland GmbH for 5 years. Over the last few years, she has focused in particular on potential areas of application for the IBM Watson Assistant and its chatbot solutions (C. Kern, pers. comm., 18. November 2020 Appendix C 00:03:11-00:03:40). The audio file can be found in the digital attachment under Carina Kern.mp3.

**Peter Droste** is a Digital Incubator at Vodafone GmbH and has a total of 23 years of professional experience at Vodafone. He is also the product owner for TOBi (name of the Vodafone chatbot) development and responsible for the virtual assistant for asynchronous messaging with customers as well as internal human resources communication. The Vodafone chatbot is also based on the IBM Watson Assistant (P. Droste, pers. comm., 5. November 2020, Appendix C 00:10:51-00:12:30), as is the StudyBuddy prototype described in this thesis. The audio file can be found in the digital attachment under Peter Droste.mp3.

**Felix A.** is an IT expert in an international IT corporation. He supports strategic business partners who are looking for cloud solutions. As such, he is part of a team of experts that enables chatbot and cloud solutions for major customers (F. A. pers. comm., 27. November 2020, Appendix C 00:03:45-00:04:30). The expert wishes to remain anonymous during the interview, which is why his last name is only presented in the abbreviated form. The audio file can be found in the digital attachment under Felix A..mp3.

**Dominik Hirschberg** is a data analyst at the consulting firm Elaboratum GmbH, where he works on projects with chatbots and conversational user interfaces. His

activities range from the supervision of the projects to the implementation (D. Hirschberg pers. comm., 19. November 2020, Appendix C 00:01:02-00:01:40). The audio file can be found in the digital attachment under Dominik Hirschberg.mp3.

**Danja Müsch-Hupach** took over as head of the Marketing department at Fresenius University of Applied Sciences effective December 1st, 2019. She is responsible for all advertising and Marketing activities at the university. Previously, she worked for nine years at the sporting goods manufacturer ASICS - most recently as head of Marketing for Central Europe - and as a presenter and editor at various sports television stations (Hochschule Fresenius 2019, n.p.). The audio file can be found in the digital attachment under Danja Müsch-Hupach.mp3.

**Marie Kadèra** has been responsible for the team management of the student advisory service at the Fresenius University of Applied Sciences in Cologne for 2 years to date. She is responsible for the support of applicants as well as the acquisition of students of the Faculty of Business and Media within the framework of the Prospect and Applicant Management of the Fresenius University of Applied Sciences (M. Kadèra, pers. comm., 13. November 2020, Appendix C 00:02:22-00:02:46). The audio file can be found in the digital attachment under Marie Kadèra.mp3.

**Ulrike Koch** has been working for the Student Services department at Fresenius University of Applied Sciences in Cologne for over 10 years. In her day-to-day work, she assists students with a variety of concerns and also communicates across departments. In addition to services, her activities also include organizational and administrative tasks in the interest of the university and the students (U. Koch, pers. comm., 8. December 2020, Appendix C 00:01:14-00:01:40). The audio file can be found in the digital attachment under Ulrike Koch.mp3.

## VI Affidavit

I hereby affirm that this submitted master thesis was authored unaided and solely by me. Additionally, no other sources than those in the reference list were used.

Parts of this paper, including figures, that have been taken either verbatim or analogously from other works have in each case been properly cited with regard to their origin and authorship.

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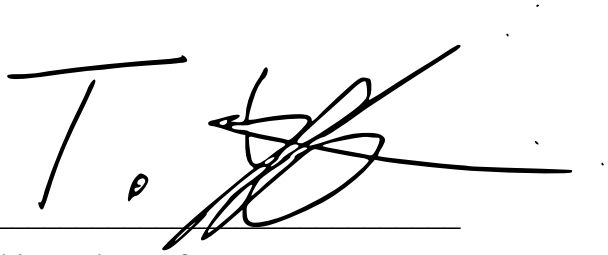
Cologne, January 25, 2021



Tobias Oskar Laßmann