The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

Tobias Brengel

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André Pinho

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ABSTRACT

Title: The Impact of Machine Learning on the Efficiency of the B2B Sales Service in Pharmaceutical Companies
Author: Tobias Brengel
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The explanatory study examines the possible value of Machine Learning in the B2B sales process in pharmaceutical companies. Sales representatives accounting for a wide range of activities, suffering from time consuming and repetitive tasks. This study investigates the potential of Machine Learning applications for B2B sales in order to facilitate sales representative's daily tasks and enhance the entire sales process. The results have been obtained through qualitative research based on 8 interviews with AI-experts, pharma consultants and sales representatives as well as secondary data in form of academic articles and reports. The findings reveal that, compared to other departments, ML-applications in B2B sales are less applied at the current stage, but mostly in the customer service process. The interviews have shown that the usage of ML-applications is possible within all steps of the sales process and enhances its overall efficiency and effectivity in terms of time, costs and quality. Furthermore, tasks which increase the efficiency of the sales department through ML applications are outlined. By applying ML within the B2B sales process, the daily work of sales representatives can be facilitated, which ultimately could not only have a positive impact on customer satisfaction, but also on employee commitment leading to competitive advantage in the price intense environment of the pharmaceutical industry.

SUMÁRIO

Título: O Impacto da Aprendizagem Automática na eficiencia do serviço de vendas B2B em Empresas Farmacêuticas
Autor: Tobias Brengel
Palavras-chave: Inteligência Artificial, Aprendizagem Automática, otimização de Processo, *B2B* Pharma

O presente estudo foca-se na possível importância da Aprendizagem Automática no serviço de vendas *B2B* em Empresas Farmacêuticas. Representantes de vendas responsáveis por uma grande variedade de actividades, afectados pelas demoradas e longas tarefas.
Esta dissertação examina o potêncial da Aprendizagem Automática nas vendas *B2B* a fim de facilitar as tarefas diárias dos representantes de vendas, e de melhorar ainda todo o processo de vendas. Os resultados são obtidos através de uma pesquisa qualitativa baseada em 10 entrevistas com *AI-experts*, consultantes farmacêuticos e representantes de vendas, assim como fichas de dados provenientes de artigos e relatórios.
Os resultados revelam que, em comparação com outros departamentos, a aplicação da Aprendizagem Automática em vendas *B2B* são actualmente menos aplicadas, sobretudo no que diz respeito ao atendimento ao cliente. As entrevistas mostraram que o uso da Aprendizagem Automática é possível em todas as fases do processo de vendas sendo que melhora toda a sua eficiência e efetividade em termos de tempo, custos e qualidade. Posteriormente, as tarefas de vendas mais eficientes dentro das farmácias estão estabelecidas; pelo que, a introdução da Aprendizagem Automática dentro do processo de vendas *B2B* poderá facilitar e, inclusive, melhorar o trabalho dos representantes de vendas, sendo que esta otimazação poderá, por conseguinte, não só ter um impacto positivo na satisfação do cliente como também no compromisso dos empregados originando, desta forma, uma vantagem competitiva face ao intenso ambiente de preços na industria farmacêutica.

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GLOSSARY

AI	Artificial Intelligence
AR	Augmented Reality
B2B	Business-to-Business
B2C	Business-to-Consumer
CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
IoT	Internet of Things
KPI	Key Performance Indicator
Lhf	Low Hanging Fruits
ML	Machine Learning

1 CHAPTER 1: INTRODUCTION

1.1 Relevance and problem statement

In the recent advent of emerging technologies and a highly competitive environment, digital transformation and disruptive technologies are often significant game-changer (Saar-Tsechansky, 2015). Concurrently, Internet of Things- (IoT), Artificial Intelligence- (AI), Augmented Reality- (AR), cloud-computing- or robotics – applications gather incredible amounts of data within a company.

Thus, an effective information system, including the storing and processing of the data as well as the derivation of new value-added business models, are the real game-changer for enterprises. Nowadays, new technologies might outperform humans in the sense that they analyse data much faster. Given that fact, they gather more information and derive a way more results and models from it than a human can do (Bhardwaj et al., 2017). One of these techniques is Machine Learning (ML) utilizing structured and unstructured data to elucidate how to generate hidden insights and prediction models (George et al., 2016).

By that, it focuses on the study of organizations, properties, and data analytics and their role in inference (Dhar, 2013). ML is no longer subject to the creativity and imagination of the media industry. Nowadays, it is one of the "hottest topics" in the technology sector evolving from an out-of-favour sub-discipline to a leading-edge frontier of research (Lewis and Denning, 2018). When Google's Alpha Go algorithm beat the Go world champion in 2016, it became apparent that ML will shape the future. Looking at today`s voice or image recognition software like Alexa and Siri, it is evident which significant impact ML self-learning capabilities will have on people's future daily lives. From a business perspective, ML applications can be implemented throughout the entire value chain within a company. Especially in highly competitive industries as pharma's, ML application might facilitate the procedures of particular business units significantly on the one-hand side but might also create competitive advantage through process optimization (Burgess, 2017).

Given the fact that a various researches deal with the improvement of ML algorithms from a technical point of view, less academic literature investigates ML from a business point of view. By evaluating the impact of ML enabled technologies on sales activities within pharmaceutical companies (pharma's), the underlying study intendeds to evaluate ML-enabled technologies within respective business units in pharma's.

1.2 Objective and research question

The underlying dissertation deals with the late-breaking technology ML. The purpose of the study is to contribute to the stream of research on ML, especially on the impact on the B2B sales process in pharma's. Hence, implications of how and where to implement ML within the sales operations may be derived. By evaluating the developed solutions, results will be generated so that statements about the degree of efficiency enhancements through ML can be obtained. Hence, the following research question was derived:

Research Question:

How can Machine Learning-enabled functions and applications maximize the efficiency and effectiveness of the B2B sales process for Pharmaceutical Companies in the future?

Furthermore, the research question intends to provide an insight into which fields of the B2B sales service may be affected by ML and thus influencing the business operation process. By matching Ml enabled technologies with respective sales tasks an indication will be derived which estimates the sales activities with the highest impact on the efficiency ratio increase within the sales department, supported by ML technologies. Moreover, the study enables a future outlook on how to use ML applications in order to maximize the outcome of the sales process. However, the scope of the thesis is restricted to ML in pharma's, from a sales point of view. Accordingly, the generated insights will be applicable for managers analysing which processes have the highest potential to be enhanced by ML. That is why, in this dissertation, strategic implications from ML will be more significant than the technical deployment of ML.

1.3 Outline

Fundamental education on ML, its concepts, challenges, and risks are covered in the first part of the dissertation. This section provides the reader with a deeper understanding of ML and its enabled applications/ functions. Besides, investigations on the pharmaceutical industry and its challenges are made aiming to understand the market conditions and the pharmaceutical environment. Afterward, a definition of sales, the sales process, and KPI's are associated with identifying first interfaces between ML and sales. Subsequently, the reader will be able to answer the following questions after the first chapter:

- What are the capabilities of ML?
- Which functions and technologies may be enabled by ML through these capabilities?
- What are the characteristics of the pharmaceutical industry?

- What are the main tasks of sales representatives, and how is the sales process structured?
- What are the KPI's which determine an efficient sales process?
- Where are ML technologies implemented within pharma's?

The second part of the dissertation is mainly based on in-depth interviews with ML experts and sales experts. The purpose of the interviews with sales representatives is to identify the decisive challenges in the current B2B sales process as well as getting an overview of primary responsibilities and performance indicators. The interviews with ML experts intend to identify the potential of ML-enabled functions and technologies. Thus, at the end of the dissertation, significant possibilities for efficient sales process optimizations through ML-enabled applications and features may be derived.

2 CHAPTER II: LITERATURE REVIEW

This chapter provides a review of existing literature on the primary research field: Machine learning and gathers information about the pharmaceutical industry and sales operations.

2.1 Machine Learning

The subsequent chapter aims to define and classify ML in the field of data science. Moreover, ML-capabilities and enabled functions/ applications will be summarized.

2.1.1 The basic concept of ML ordinated from AI

ML is a subcategory of AI, allocated in the field of data science (Puranam et al., 2018). The first coined definition of ML was established in 1959 by Arthur Samuel (1959) defining ML as the ability of computers to learn independently without being explicitly programmed. In that sense, ML is a mathematical computer-based method enabling machines to learn for themselves while executing tasks (Cui. et al., 2006) and gain valuable insides on essential data (Akerkar, 2014). To do so, ML requires an algorithm to extract useful insights from data focusing on adjust, retain, and update the algorithm based on gathered experiences (Cooper, 2018). The outcome of the learning process may be measured as the comparison between past and current behaviours rather than on real knowledge generated (Willens et al., 2016). ML applications are commonly used when structured, and unstructured data are too complicated for humans to describe analytically, but enough sample data - such as sensor data, pictures, or texts - is available. In that sense, ML may support computer models to identify patterns, shapes or designs in these existing data and thus, utilize these pattern to determine predictions and interferences to support the decision-making process in companies, even without human guidance and explicit reprogramming of the algorithm in future (Teodorescu, 2017). ML can be divided into three types of learning, namely, supervised (Cooper, 2018), unsupervised- (Luckert and Kehnert, 2016), and reinforced learning (Dey, 2013).

Supervised learning is a learning process that consists of a training dataset containing input variables and a given number of correct output variables. Input variables are external information in the form of attribute variables or metadata, while output values might be specific labels of class attributes (Luckert and Kehnert, 2016). An algorithm analyses the training data and produces an inferred function identifying errors and predict which label to give to unlabelled data (Kotsiantis et al., 2007). An example of supervised learning are regressions, where the algorithm receives input and predicts the value of the output.

In comparison to supervised learning, *unsupervised learning* tries to discover hidden structures in unlabelled data (Das et al., 2015). Access to output variables and therefore, the machine needs to discover the data individually trying to find structures and patterns on their own. (Bhardwaj et al., 2017). Thus, the experience is not necessary (Luckert and Kehnert, 2016). *Reinforced learning* follows a trial and error approach ought to take actions in an environment to maximize a notion of long-term reward (Das et al., 2015). The algorithm behind learns from negative feedback and is only provided with positive or negative reward values for training (Portugal et al., 2018).

Supervised Learning	*Unsupervised Learning*	*Reinforced Learning*
• Artificial neural network	• Artificial neural network	• Q-Learning
• Bayesian statistics	• Association rule learning	• Learning automata
• Decision trees	• Hierarchical clustering	
• Learning automata	• Partitional clustering	
• Instance-based learning		
• Regression analysis		
• Linear classifiers		

Table 1: *Overview of ML algorithms with particular techniques (adapted from Luckert and Kehnert, 2016).*

Even the three types of learning are beneficial for structuring ML in this paper; they overlap e.g., semi-supervised learning which uses unlabelled data to complement labelled data (Jordan and Mitchell, 2015). Deep learning (figure 1) encompasses all three described learning-types of ML (Skansi, 2018). By exposing multi-layered artificial neural networks algorithms to vast amounts of data, DL provides more precise and complex pattern discovery and feature learning and thereby represents a scalable version of ML (Long et al., 2018).

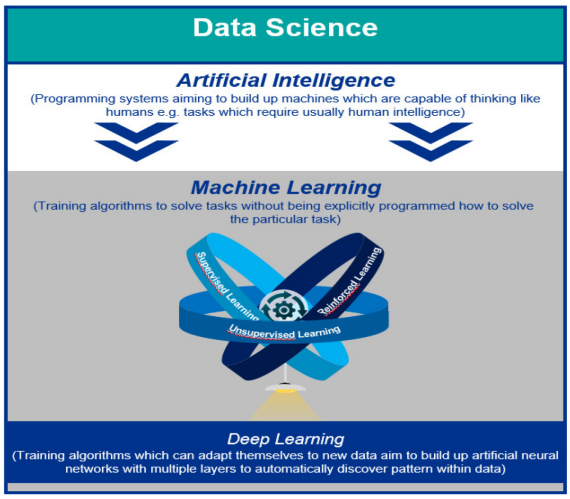

Figure 1: *Classification of ML within the field of data science (own representation based on Puranam, 2018).*

2.1.2 Machine Learning adds value to the company's overall performance

Despite the high interest in ML applications in magazines and online forums, primarily investigations in ML applications/ features evaluations from a business point of view are not established topics in the academic literature. A high amount of researches deal with the development and testing of new ML-algorithms (Long et at., 2019). The purpose of these studies is to enhance the algorithm's preciseness and accuracy. Fewer papers focus on the connection between ML technologies and their efficiency process outcomes for particular business units. However, studies reveal that ML-enabled technologies have to potential to support the overall outcome of companies (Provost and Fawcett, 2013). Interestingly, companies using ML strategies in their operations are on average 5% more productive and 6% more profitable than their competitors (McAfee and Brynjolfsson, 2012; Brynjolfsson et al., 2011), mainly through cutting costs in data collection and analyses accuracy (Teodorescu, 2017). Thus, ML capabilities magnify the company's operational processes in terms of efficiency and effectiveness (Rudin and Ustun, 2018). Subsequently, from a business perspective, the main benefits of ML applications can be divided into three different value areas (Cui et al., 2006; Burgess, 2017).

1) **Customer satisfaction/ centricity** elevates customer service and thus enhances profit streams
2) The **enhancement and development of processes** and operations within a company lead to **cost- reductions, -avoidance, and -compliance**
3) **Valuable insights into data lead to risk & loss mitigation** as well as revenue leakage mitigation

In order to achieve the superior company objects, aptitudes of ML have to be identified.

2.1.3 Machine learning capabilities

In the academic literature can be found eight different capabilities (Akerkar, 2014; Burgess, 2017) of ML (see table two). The first four capabilities are related to capturing information. The focus is on the transformation of unstructured data (picture of a drug) into structured data (drugs name). Thus, patterns and relations in massive data sets consisting of hundreds of variables can be recognized. NLU, prediction, and optimization endeavour to understand consequences analysing what the client wants to say (Burgess, 2017).

ML Capabilities	Description	Learning Approach	Use Case
Image recognition	Process of matching pixel as well as unstructured and structured data to discover text, pictures etc.	Supervised/ Unsupervised Learning	Automatically answering emails; face recognition, spam filtering, Handwriting recognition
Voice recognition:	Process of matching encoded words with the particular training set. Challenges might be the quality of the recordings, different languages and accents and the size of vocabulary.	Supervised/ Unsupervised Learning	Speech activity detection, acoustic factor analyses
Search:	Search is about the capability of ML algorithms to extract structured data from an unstructured text, for example from documents or emails.	Supervised/ Unsupervised Learning	Analyses of web-searches, social media analyses; document scanning, document comparison
Clustering:	Clustering is to infer insights from a new data set (based on alignments with the original pattern) or discover anomalous new data which deviate from the expected once, concludes with a prediction.	Unsupervised Learning	Market segmentation, DNA classification,
Natural Learning Understanding (NLU):	The main goal is to designate the syntactic (structure) and semantic (meaning of words and sentences) intend of the data.	Supervised Learning	Understand the meaning behind words, emotions etc., real time machine translation, sentiment analyses
Optimization:	Optimization includes the big field of problem solving and planning. Through the model and adaption to the environment the situation will be evaluated and an assumption can be derived whether the situation is closer to the goal or not.	Reinforced Learning	Optimizations in terms of route planning, time management or recommendations maximizing the outcome
Predictions	The predictions function mainly follow search (match job description and CV) or clustering capabilities ("you bought this drug that is why you need this one too") and aims to increase the probability of the likelihood of an event.	Supervised/ Unsupervised/ Reinforced Learning	Traffic Forecasts, stock and market analyses
Understanding	Understanding is based on the ability of machines to have a conscious awareness of what it is doing and thus, understand the motivation and intent of people rather than just making decisions and recommendations based on numerical analysis (Burgess. 2017). However, the development of this capability is in the recent stage not foreseeable.	Supervised/ Unsupervised/ Reinforced Learning	Mainly understanding of analyses and pattern connections

Table 2: *Overview of ML capabilities (own representation adapted from Burgess, 2017).*

As illustrated in table 2, no clear affiliation of the particular ML capability with the appropriate ML approach exists. Mostly it depends on the individual objective, and the way data are selected. Based on the capabilities of ML, the following four applications are mainly discussed within the academic literature, namely Robotic Process Automation, Prediction and Forecasting, Natural Language Processing, as well as Robotics and bots (Burgess, 2017).

2.1.4 Machine Learning enabled functions and applications

Based on the described capabilities, this study centres on the four designated applications for ML-algorithms because they have seen as the applications with the highest potential for implementation within the sales unit. In general, ML-capabilities cannot be assigned to one particular ML-function. However, within an organization, ML-functions and applications can enhance the entire data management process by intelligently preparing cleaning and joining data from different sources (Zhou, 2017). Furthermore, it enables real-time decision making. By that, possessing information anytime available on all devices is guaranteed (Forbes, 2017).

2.1.4.1 Robotic Process Automatization (RPA)

Robotic process automatization mainly follows the ML-capability of optimization and utilizes software to automate rule-based tasks at a scale that was performed by humans before (Accenture, 2016). It evolved from undertaking a repetitive duty like checking invoices and travel expenses of single users to automate business rules and orchestra robots to address large volumes of work (Hallikainen et al., 2018). Thus, it simplifies an operational scaling within a company by enhancing speed (process cycle time), quality while simultaneously decreasing

complexity and error susceptibility (less transactional errors) (Hallokainen et al., 2018; Accenture, 2016). Due to low implementation costs and a high expected return on investment (ROI), it can be seen as an effective and inexpensive way of process automatization enhancing profit streams and customer service (Willcocks et al., 2017). RPA can be assessed as the underlying technology for predictions, NLP, and robotics/ bot functions.

2.1.4.2 Prediction and Forecasting

Prediction and Forecasting functions mainly follow search or clustering capabilities (see table two). From a company's point of view predictions can be used to give an overview over sales demands, individual actions of customers or employees, customer choices but also to forecasts the likelihood of events (George and Haas, 2014). Even rare event modelling is uncommon in management researches ML enables, for instance, organizational responses to disasters, mapping probability of failure, or assuming risk behaviour. These results can be displayed in apps or computer software (Van der Vegt et al., 2015). Through the self-training of the algorithm, ML methods can produce superior predictive accuracy compared to traditional methods like linear regression or logit models (Baiari et al., 2016). The recent challenge of prediction and forecasting functions is to maximize the accuracy, determine missing variables (features) and consistencies of the model (Puranam et al., 2018). Thus, it will be an essential function for businesses in order to position themselves in the market and ensures safety and precise long term planning.

2.1.4.3 Natural language processing (NLP)

NLP utilizes many different techniques for interpreting and understanding human language, ranging from ML to DL (Akerkar, 2014). It is mainly divided into image-/ and voice-recognition capabilities (Burgess, 2017). Ideally, the algorithm behind analyses large amount of texts and words, understand them intending to reply to questions automatically. By speech-to-text as well as text-to-speech extractions discussions with human beings might be enabled (Nugues, 2006). Hence, NLP can identify emotions behind words and expressions. Thus, in future responses related to the contemporary behaviour of customers can be made and triggers for positive buying decisions might be identified (sentiment analysis).

2.1.4.4 Robotics and Bots

Robots becoming more and more discussed topics in modern times. Robots use input data from different sensors and combining their voice, image, NLP and optimization capabilities in order to come up with the most appropriate response to the action by continuously improving its

algorithm (Burgess, 2017). For that sake, the robot requires unstructured data, and thus, ML capabilities like search or text identification are transforming the data well-structured to the robot. Despite the fact, that the technology can overhaul transactional work at a 50% lower cost (compared to humans), it also can enable businesses to operate 24 hours per day for 356 days per year (Accenture, 2016).
Furthermore, the robot can execute the tasks independent from vacations or unforeseeable diseases (Burgess, 2017). Applications of these robots/ bots already exist in various fields like autonomous driving, manufacturing robots, game bots, or service bots (Torralba et al., 2008). Especially the latter one in from of catboats aiming to greet and review customer requests can be a significant trend in the field of sales and customer service.

A more in-depth insight into the value and usage of ML-applications within the pharmaceutical industry will be given in 2.4.

2.2 Pharmaceutical Industry

The subsequent section will provide an overview of the pharmaceutical industry, its challenges as well as the typical sales process within pharma's.

2.2.1 Market Structure and Market Size

Pharma's represent a firm that is involved in R&D, manufacturing, marketing/sales of drugs, and biologicals (International Trading Administration, 2010). Traditionally, pharma's core business was the development of new drugs (e.g., generics, orphans, prescription drugs) to treat diseases and make a substernal revenue out of (Denoon and Vollebregt, 2010). Nowadays, pharma's shift the focus toward the development of affordable medicine (applied budget limits that deny patients access to innovative therapies) and technological changes in, e.g., drug discovery and the integration of new digital tools in the business model (Capo et al., 2014). According to the estimates of the Pharma Market research report (2018), the global pharmaceutical market will be set up to grow at 6,5% per year (CAGR), reaching $1,06trn by 2022. Not only the orphan drug-market is to almost double until 2022 up to $209bn, but also generics and other prescription drugs contribute $112bn and $739bn in 2022 to the overall growth (Deloitte, 2018). Drivers for the high pharmaceutical consumption are legal, technological, environmental as well as economic changes in the environment e.g. faster routes to markets, compelling market access value proposition, rapid global population aging, anticipated growth in chronic disease, urbanization, income raise, higher governmental expenditures in pharmaceutical industry and utilization of disruptive technology as AI, or IoT (ITA, 2016; Pharma research Report, 2018; McKinsey, 2018). Nevertheless, the industry remains a low concentrated market, although highly competitive. Considering the fact that a market entry requires huge investments, e.g., for drug discovery, entry barriers are high. Consequently, the market is dominated by large multinational enterprises as Roche, Novartis, Pfizer (Boldrin and Levin, 2005). Moreover, these companies understand how to commercialize so-called "high-value blockbuster drugs" by a strong workforce that established powerful customer relationships (Raja and Sambandan, 2015). In that sense, the sales and marketing department is crucial within pharma's in order to stay competitive and guarantee a solid base for future revenues.

2.2.2 Challenges of the Pharmaceutical Industry

The most important challenges pharma's are facing are the competitive environment, reduced drug pipelines, the expiration of multiple patents as well as changes in customer preferences

(Wenzel, 2014). Particularly, the expiration of many patens started in 2010 is remembered as "patent cliff" phenomena punishing pharma's heavily (DeRuiter, 2012). For instance, famous blockbuster drugs, e.g., Rituxan, Humira, and Avastin lost their rights and patent status between 2014-2019, diminishing profits, and setting price pressures on pharma's (Fernandez et al., 2012). The development of new drugs requires a good understanding of the environment, the customer, as well as the facilitation of patient access (McKinsey, 2018). The second challenge is the decline in R&D productivity so-called "productivity paradox" (Litinski, 2010) based on the adherence to old discovering and developing processes (Syrovatka, 2011). Expositions in the availability of healthcare data and software & hardware enhancements presuppose the implementation of an ML strategy fostering productivity concerns (BCG, 2019). Thus, within the pharma's obsolete management culture, mental methods, and strategies have to be overcome, implementing new ways of doing business (PWC, 2019). A new mind-set is unavoidable in order to foster the synthesis of new technologies and digital business models. Given the fact that the industry has remained oddly unaffected by digital transformation, also the B2B market lacks behind in terms of automatization (Asare et al., 2016). Price competition triggered through the development of new drugs is another challenge the industry is facing (Deloitte, 2018). In that sense, smart and automated marketing and sales strategies need to be realized in order to intensify customer service, satisfy and retain the clients. Along with this come regional/ governmental restrictions in terms of drug advertisement, pricing, and promotion, which require strong personal customer interaction.

2.3 Sales in pharmaceutical companies

The subsequent section deals with the B2B sales process within pharma’s and its activities.

2.3.1 The sales process and its activities

Although several authors investigated researches in the field of sales, there is no clear conceptualization of the sales process and its related tasks in general (Williams and Plouffe, 2007). However, the most widely accepted paradigm in the sales disciplines until today evolved by Dubinsky (1980/1981) consisting of seven different sales steps that apply to pharma's (Moore et al., 2015). These stages are illustrated in figure 2.

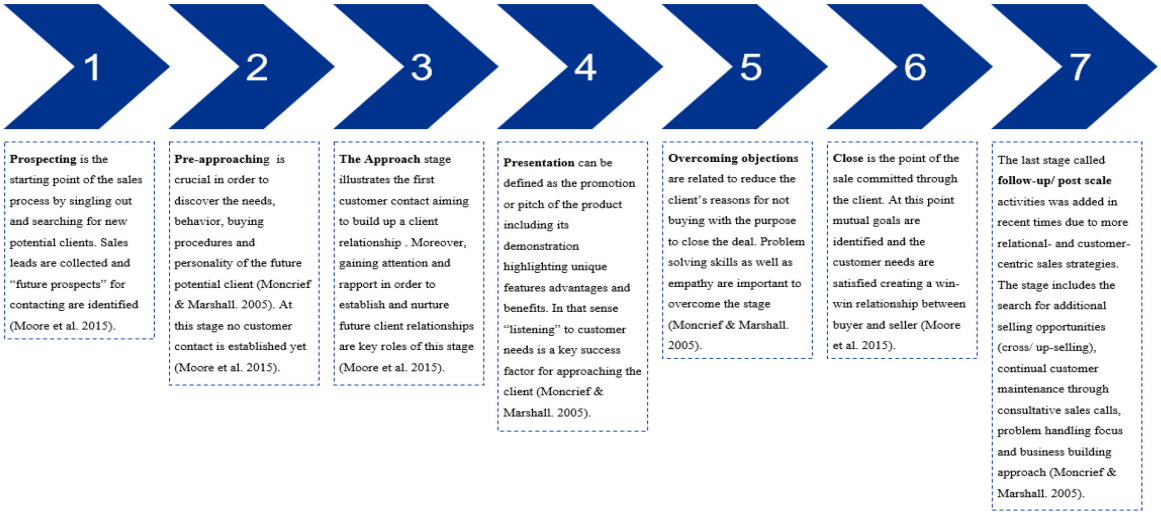

Figure 2: *The sales process in seven steps (adapted from Moncrief and Marshall, 2005; Moore et al, 2015).*

Pharma's operate in both markets, B2B and B2C. The target customer group (B2B) are hospitals, pharmacies, private cliques, wholesales, and doctor offices. The purpose of the salesforce is to build up long lasting relationships with these customers. In that way, more complex and costlier deals can be closed. Furthermore, B2B sales are stronger, embracing customer education, product demonstrations, and customer service, while a couple of stakeholders are part of the sales process. That necessitates a data-driven salesforce that is updated in real-time and understands each decision of the customer's purchase. For that sake, new technologies and digital real-time tools and channels can support the work of the salesforce (McKinsey, 2018). The strong relationship focus underlines the thesis that sales B2B representatives are the key players in pharma's and determine its success (Shi et al., 2017). Dixon & Tanner (2012) determine sales as "the phenomenon of human-driven interaction between and within individuals/organizations in order to bring about economic exchange within a value-creation context." In pharma's the salesforce contributes profoundly to the financial balance of the companies by nourishing revenue and profits (Zolter et al., 2009). For that cause, they need to review and analyse market trends, recognize customer needs, and become the contact person in the product development process and its launch (Judson et al., 2009). Secondly, the sales representative may be viewed as a business agent actively "push" the product or service (Zoltner et al., 2008) toward each potential customer (George and Haas, 2016). That italicizes the fact that the sales team is the prime source for customer information (Pelham and Lieb, 2004). By connecting both sides of the market (Stan et al, 2012), the role of the salesforce enveloped from a spokesperson of the selling firm to a consultant for the buying firm (Sheth and Sharma, 2007). Nonetheless, communication and collaboration with the other

departments are essential for the salesforce (Lynn and Akgun, 2003), requiring strong personal interaction skills (Ingram et al., 2012). Within pharma's, the salesforce is obliged to achieve ambitious goals (Judson et al., 2009). Thus, high customer involvement and engagement in multiple key accounts are essential success factors. These tasks are time-consuming and require strong organizational skills (Mantrala and Albers, 2010). Therefore, a sales rep churn can harm pharma's through information- and client/ contact losses (Shi et al., 2017).

2.3.2 Sales key performance indicators

Key performance indicators (KPI's) can be defined as physical values (Gosselin, 2005) which measure the performance of processes and operations within an organization (Matsuo et al., 2013).

Anderson and Oliver (1987) provide the first concept of sales performance as the evaluation of sales forces based on sales outcomes (e.g., sales units, revenue, market share, new accounts, profitability) as well as sales behaviour (teamwork, effective communication). Within pharma's salesforce performance can be measured in terms of monthly sales, up- and cross-selling activities and subsequently, monthly sales growth/ closing ratio (Ramarajan et al., 2017). Since the sales are often closed during phone calls, monthly email- and phone call-rates are an additional performance indicator. The number of prospecting activities like product meetings/ demos as well as the final closing rate are additional pointers for the sales reps completion (Zallocco et al., 2009). For pharma's clients, information is the primary source for further drug development.

Consequently, the salesforces can be assessed via their customer engagement level, which implies an evaluation based on their client know-how and information related to market and competitor environments. In case this information can automatically be tracked, through ML algorithms, churns and other exits can be successfully caught up (Jaramillo et al., 2007).

2.4 Machine Learning in Pharmaceutical Companies

The subsequent sections will connect ML technology and pharma's. At the recent stage, several authors investigated ML applications within the value chain. R&D (Christensen et al., 2017), production (Liu et al., 2018) and logistics (Jordan and Mitchell, 2015) were the focal points of their analyses. The underlying study attempts to complete the topic by examining ML in sales and its impact on the efficiency within.

2.4.1 An efficient sales process

Efficiency is referred to an input-output ratio or comparison to reach a particular goal with minimal outlay and thus, directly effecting the companies margins and profits (Ostroff and Schmitt, 1993). In terms of sales performance, this ratio can be explained as sales outcomes in comparison to sales inputs described as calls, demos, emails, or letters (Ingram et al., 2002). In order to improve the input ratio, technologies can help to save time and enhance key-account management performance. Moreover, costs efficient tools can optimize e.g., customer-calls quality by RPA solutions (Zallocco et al., 2009). Compared to efficiency, effectivity is more related to the sum of total sales outcomes of all sales units, rather than the performance of a person within the firm (Anderson and Oliver, 1987). It goes along with the organizational mission and develops strategies in terms of gathering insights and understanding. Examples for that can be, the identification of target markets, customer call patterns, sales product portfolio strategies, competitive positioning (Zallocco et al., 2009). Thus, it meets ML primary capability of understanding and discovering hidden patterns.

2.4.2 An efficient ML process

To foster efficiency and effectivity within sales ML has to be integrated successfully inside the company's culture as well as within the company's strategy. That is why relevant stakeholders refer to understand the four ingredients of an efficient ML-strategy, namely algorithm/ model, data, computation/ training, and judgment/ optimization (Peukert, 2019):

Algorithm/Model

Approaches to choose to the right algorithm are broad because no transparent classification scheme for algorithms exists (Long et al., 2019). Following the main target of the algorithm labelling, clustering, and categorizing data and identify hidden patterns or similarities within the dataset. Thereby, over-fittings can be reduced modifying a much more complex dataset, find undiscovered interactions, reduce prediction errors, and cross-validate the results (Puranam, 2018). Thus, the further enhancement of the algorithm is the real competitive game-changer for pharma's in the future (Obermeyer and Emanuel, 2016).

Data/ Computation/ Training

The major challenge within business units is not the implementation of machine learning applications into the IT-infrastructure of the company. A successful data management strategy as a baseline of an effective machine learning system is illustrated in figure 3. Only an efficient usage of the data can ensure that ML application running smooth and achieve the desired results.

Judgement/Hypermeter optimization

Further development and adaption of the algorithm to achieve more precise results are one of the main challenges. That requires a constant incoming data flow as well as the knowledge about interpretations and adapting algorithms input variables. Besides, ML applications are no substitutes for the researcher's human judgments. While ML algorithm can discover robust patterns in data, conceptualize and measure (select) them, the explanation (theorizing/ reasoning) (Sheperd and Sutcliff, 2011), remain mostly human prerogatives (Puranam et al., 2018).

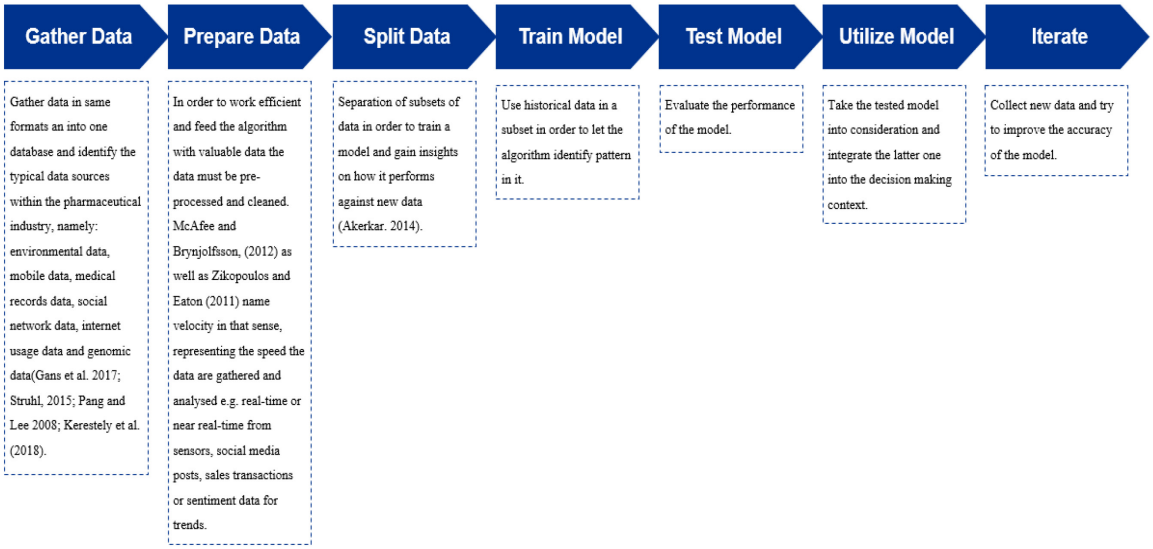

Figure 3: *Overview for an efficient data management process for ML applications (adapted from Akerkar, 2014).*

2.4.3 The use cases of Machine Learning within pharma's

Within an organization, ML-functions and applications can enhance the entire data management process by intelligently preparing cleaning and joining data from different sources (Zhou, 2017). By integration ML algorithms into the business processes, the decision-making process will be facilitated by real-time information support. By that, having information anytime available on all devices is guaranteed (Forbes, 2017).

2.4.3.1 R&D and Manufacturing

Drug Discovery/

ML applications for drug discovery and manufacturing may be predictions of success rates based on biological factors. Moreover, precision medicine to identify alternative therapy path often involves an unsupervised learning approach. (Ajani et al., 2018).

Disease Identification and Diagnosis

Moreover, investigations in the field of disease identification (e.g., cancer) prevention and curing have dramatically emerged during the last decade (Kerestely et al., 2018). Thus, ML can

help to reduce the rising drug discovery costs and support the doctor-patient relationship by enabling personalized treatments and behavioural modification for patients (Bhardwaj et al., 2017).

Clinical trial research

Identifying through prediction candidates for clinical trials would result in smaller, quicker, and fewer trials overall. Besides, prognostic analytics can be drawn on a much more extensive range of increasing data precision (McKinsey, 2018). Hence, finding the best sample size increases the efficiency or reducing data errors are the main applications in the field.

Smart Electronical Health records

Document classification (emails) and character recognition are essential ML-applications in pharmaceutical companies and facilitate the employee's organizational outlay.

2.4.3.2 Logistics/Supply Chain

Through forecasting, the demand better, ML service level and inventory costs can be reduced. Collaboration synergies between supplier networks might be identified and enhance the supply chain environment by e.g., predict the transportation and material costs or estimate missing capacity information.

2.4.3.3 Sales and Marketing

Machine Learning in form of web or mobile analytics tools to predict individual actions, customer choices (George and Haas, 2014), customer purchases (Cui et al., 2006) or the likelihood of an event (Van der Vegt et al., 2015), are becoming significant for companies (Cui et al., 2006). Hence, the customer journey could be improved, triggers for buying decisions may be identified, and therefore sales qualified leads enhanced. Moreover, predictions in fields of individual risk propensity, avoidance behaviours, or risk mitigation are standard (George and Haas, 2016). Moreover, Chabot's, for instance, ensures a 24h/7 service offering the best answer to customers while analysing their response. Thus, ML and data analytics fostering sales productivity and drive double-digit sales without future investments and sales team changes (McKinsey, 2018).

2.4.4 Challenges and Risk of ML applications in sales

The first challenge inherent with the implementation of Machine learning in companies is access to a vast amount of sensitive data which subject to privacy concerns (Goh et al., 2019). Thus, ethical and regulatory restrictions have to be complied with at each stage of the data collecting process (European General Data Protection Regulation) (Vayena et al., 2018).

Another risk of ML algorithms is that it is a so-called "black box" system because thousands of complex rules are associated with the ML model (Long et al., 2018). Thus, the "rules engine" should be visible in order to let users understand the reasoning behind the results (Zhou, 2017). In that sense, the management of a company has to ensure the technology's understanding within the business unit. Otherwise, the technology will be employed mistakenly, and employees do not comprehend the reason behind the technology leading to a negative impact on its efficiency ratio (Goh et al., 2019). Moreover, a convenient education regarding technological changes is essential to achieve acceptance of the ML solutions throughout the salesforce overcoming the main fear of replacement (Zhou, 2017).

However, literature about the benefits of ML applications exists on a full scale, but a guideline on how to maximize efficiency in the sales process in pharma's through ML does not exist at this time. That is why the underlying dissertation endeavours to form a model that connects sales processes within pharma's with the right ML-enabled function/ technology and measures its efficiency rate.

3 CHAPTER III: METHODOLOGY

The subsequent chapter carefully examines the methodological steps taken during the given research process and explains the collected data, including qualitative results.

3.1 Research Method and Strategy

Researches in the field of ML from a managerial perspective is limited, as the technology is continuously progressing and the environment involved continually changing. That is the reason why there is a great room to add significant insights to the ML concept. The objective of the study is to recognize which technologies are enabled by ML. Afterward, the paper should give an assumption of how to utilize them in order to increase the efficiency of the sales department. In order to come up with reasonable approaches, the dissertation follows an exploratory approach. Following such an approach, the gathered insights will enhance the perception of an obstacle profoundly, seeking an in-depth description of a defined problem (Gephart, 2004). Moreover, qualitative methods are mainly applied for the exploration of a little known subject of research (pharma's) as well as for supplementing and validating existing literature (Lang, 2010).

The conducted research is based on two methods. (1) The collection and inquiry of secondary data as well as (2) primary data (figure 4).

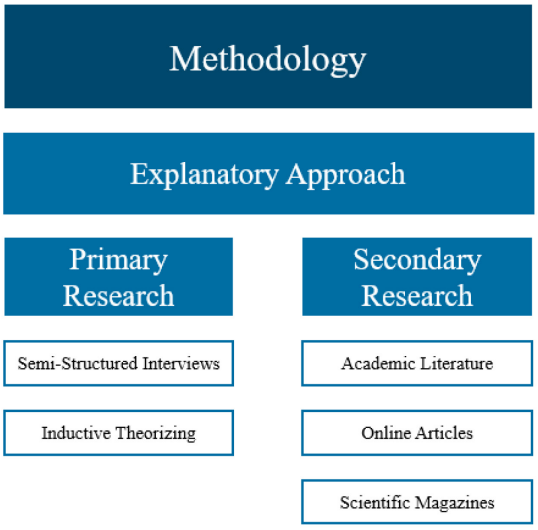

Figure 4: *Overview research strategy (own representation, 2019).*

Secondary data

Secondary data in terms of online-articles and publications were convened to provide a fundamental overview of topics like ML, the pharmaceutical industry, B2B vs. B2C, and the tasks throughout the sales process. More specially, investigations on the technologies ML

enables have to be made in order to discover tasks and operations of the sales process can be affected by ML. Besides, a profound insight into the sales process is reasonable because "sales efficiency KPI's" have to be identified to compile recommendations on how to maximize efficiency throughout the sales process.

Primary data

The primary source of qualitative research is qualitative data and inductive theorizing (Bansal et al., 2018). Subsequently, qualitative data can be conducted through the collection of empirical materials e.g., case studies, personal experiences, interviews, or artefacts (Denzin and Lincoln, 2000). Inductive theorizing relies on logical reasoning based on former insights with the aim to abstract and generalizes new knowledge from the data (Bansal et al., 2018). One type of qualitative research is qualitative in-depth interviews which are beneficial in terms of ease and cost-efficiency (Given, 2008). The goal of qualitative interviews conducted during the research with ML and pharma sales experts in the production of new content benefiting from the fact that the interviewee's experiences, ideas, and impressions are documented and considered (Alvesson, 2003).

Moreover, the interviews are often loosely structured and open to content the interviewee considers as essential. Rowley (2012) describes qualitative interviews as the collection of "facts" and gain insights as well as an understanding of the interviewee's experiences, attitudes, processes, predictions, and opinions. Hence, the purpose is to go below the surface and explore new undiscovered ideas and insights (Britten, 1995). However, regularly, the type of in-depth interview can be classified based on their structure lever (Rowley, 2012). The three common types are structured, unstructured, and semi-structured interviews, all following an explanatory approach (Van Puyvelde, 2018).

Semi-structured interviews

This paper follows a semi-structured approach that empowers the researcher through a mix of rigid structure and uncertainty to go deeper into relevant topics (Ackermann and Rockmann, 2002). A couple of neutral open-end questions are predetermined with an open result. Thus, the responded has leeway in terms of flexibility and freedom of the answers (Given, 2008). The right amount of interviews is controversially discussed in the literature. While the anthropologist Spradley (1979) recommends conducting between 25 and 30 interviews, business researcher McCracken (1988) proposes to collect eight, while Glaser and Strauss (1967) do not mention a specific number but suggest to gather interviews until a state of theoretical saturation is reached. For that sake, the author decided to collect around 8 interviews. Concerning the structure of the interview Gubrium et al. (2012) recommend to start the

interview with two to three introductory icebreakers, followed by transition questions five to eight main questions. The main questions are related to the research question and should be the focal point of the interview. To conclude, valuable interview insights will be summarized (Patton, 1987).

Data Collection

The participants of the interview were contacted via E-Mail, LinkedIn, and personal contacts. Before the interview, all of the participants were given an explanation of the research objective, the research question, methods of data analysis, and reassurance about confidential issues. In total, 8 participants were interviewed for 45 minutes.

Participants

The participants of the survey composed of two different target groups. Firstly, ML experts were interviewed, mostly professors or consultants with a computer science background or experience in the field of AI. The second group consists of sales representatives and experts from large and small pharma's as well as consultants working in pharma's environment.

Interviewee	*Company Operations Field*	*Position within the Company*	*Company Indication*
Interviewee 1	AI/ Implementation Consulting	ML/AI Consultant/ Senior Hands-on Advisor	Freelancer
Interviewee 2	University/ Business School	Prof for digitalization and economics of technology's	Leading university
Interviewee 3	University	Postdoc in the field of AI	Leading University
Interviewee 4	Automotive Industry	Director Digital Lab	Multinational Company
Interviewee 5	CIO Advisory Consulting	Managing Data Scientist	Big Four Consulting
Interviewee 6	Pharma/ Consulting	Manager	Consulting Boutique specialised in pharma-/ healthcare strategies
Interviewee 7	Pharma Industry	Pharma Science	Multinational Company
Interviewee 8	Pharma Industry	CEO	B2B Customer of Pharmaceutical Corporations

Table 3: *Overview of interviewees.*

4 CHAPTER IV: ANALYSIS OF THE IMPACT OF ML ENABLED TECHNOLOGIES/ FUNCTIONS ON THE B2B SALES PROCESS OF PHARMACEUTICAL COMPANIES

The subsequent chapter summarizes the semi structured interviews with Machine Learning experts and sales expert. Throughout the chapter a model will be derived connecting the sales process and its tasks with particular machine learning functions and applications.

4.1 The sales within pharmaceutical companies

This section will sum up the most prominent trends within pharma's aiming to come up with a verified sales process form the theory rose at the end of chapter 4.1.3.

4.1.1 The main challenges within pharma's are diversified

The insight gathered through the interviews corresponded with the insights from the literature review.

The most influential challenges within the pharmaceutical industry address digital transformation lack (interview 6), missing technological know-how (interview 8), high R&D costs (interview 8) as well as long time to market cycles (interview 7). Pursuing a digital approach in order to implement new technologies and enhance operations is a novel challenge pharma's have to deal with (interviewee 6). Hence, most of the pharma's are driven by costs-pressures rather than by their digital DNA. Pharma's turning their paradigm to concentrating on the access of new treatments to an affordable price for the end-consumer. For instance, Novartis – traditionally focused on vet medicine & generic drugs – specialized in the development of new affordable cutting edge therapies based on faster time-to-market cycles and fewer R&D expenses (interviewee 7). Another concern of pharma's is the high dependence on political, country-specific regulations, e.g., restrictions concerning the advertisement of drugs in Germany (interviewee 6). ISO norms and GDPR restriction and other fast-changing laws require a lot of flexibility and adaptions from pharma's. Another example is the price pressure which permits only a small derivation from the original price set up (interview 8). The pharmaceutical industry is extremely competitive, as well as price-sensitive. That is why pharma's ought to uncover distinct methods to distinguish from their opponents. ML-applications hold the potential to strengthen the company's competitive advantage through process optimization (interview 7).

4.1.2 The main challenge of sales representatives is to reach individual performance goals

The subsequent section implicates to identify the most significant pains and concerns sales reps might have during their daily routines. It will be essential to obtain a statement later, where to implement ML solutions.

In general, the sales department in pharma's is represented by the respondents as a very competitive and time-intensive department, frequently with claiming daily, monthly, and yearly goals (Interviewee 7, 8). One interviewee remarks as follows:

"Sales reps traveling from one client to the other one from Monday to Friday. Once you don't fulfil the goals, colleagues overtake the job for you with the result that you are going to be outperformed (interviewee 7)."

Sales representatives are steadily operating under pressure and against the clock. Fast-changing product details and market situations hamper the salesforce work. Hence, it is challenging to keep up with news and real-time information for the end-customer (Interviewee 7). The competitive pressure also requires a new level of product complexity as well as a broadly diversified product portfolio. The sales staff can only overlook this complexity with the aid of digital tools accessing database, specifications, price lists, and discount rules in real-time (Interviewee 6). To build up long-lasting relations in the B2B market, credible information about the product portfolio for efficient customer support is a critical success factor (Interviewee 8). Another key challenge is to understand the customer by asking the right questions in a conversation and consult them whenever and wherever they require information. That is why detailed product specifications, a simple purchasing process, quick answers to questions, and prompt delivery are additional factors of success in the B2B sales market. Moreover, customers in the B2B market are also regularly driven by time pressure (Interviewee 7). Therefore, short tailored pitch decks, short product demonstrations, and extensive communication skills are imperative for the salesforce in pharma's. The flexibility and enormous speed demand stable connection between client databases (CRM) and ERP systems in order to provide rapid information, e.g., on product delivery or product data (Interviewee 5). The interviews confirmed that performances of sales reps are measured in terms of sales calls/emails, conversation rates, and successful deals closed as well as up-& cross-selling activities (Interview 6). In order to examine and measure the performance, the salesforce is obliged to report and monitor their activities.

"After an information exchange with clients (calls, emails, product presentations, etc.) the results need to be manually transferred to an excel/ CRM system which takes time and effort." (Interviewee 8).

Another concern mentioned in the interviews is the lack of transparency. New digital tools and applications exist within the company, but nobody knows about it. That indicates that pharma's ought to enhance their communication channels as well as their employee training (Interview 6).

4.1.3 Sales steps and operations in pharmaceutical companies are inconsistent

This chapter aims to illustrate the sales process and its particular tasks within pharma's as a foundation for chapter 4.2. The results inferred in this section are mainly based on inductive theorizing because most of the interviewees did not want to mention specific sales activities and tasks.

Nevertheless, the insights deduced unveiled that the B2B sales process in pharma's cannot be lump surmised (Interviewee 8). Each company has its independent structure and organization follow different goals depending on its size, profits, and the number of employees (Interviewee 9). In large enterprises, key accounts manage the sales, interactions, and relationships with each client. In smaller companies sales representatives are responsible for a couple of different hospitals, doctors and drug stores.

In chapter 2.3.1, the sales process consists of seven steps. A different model was derived, which clusters the sales process into four principal sales categories and two ongoing sales phases (figure 5).

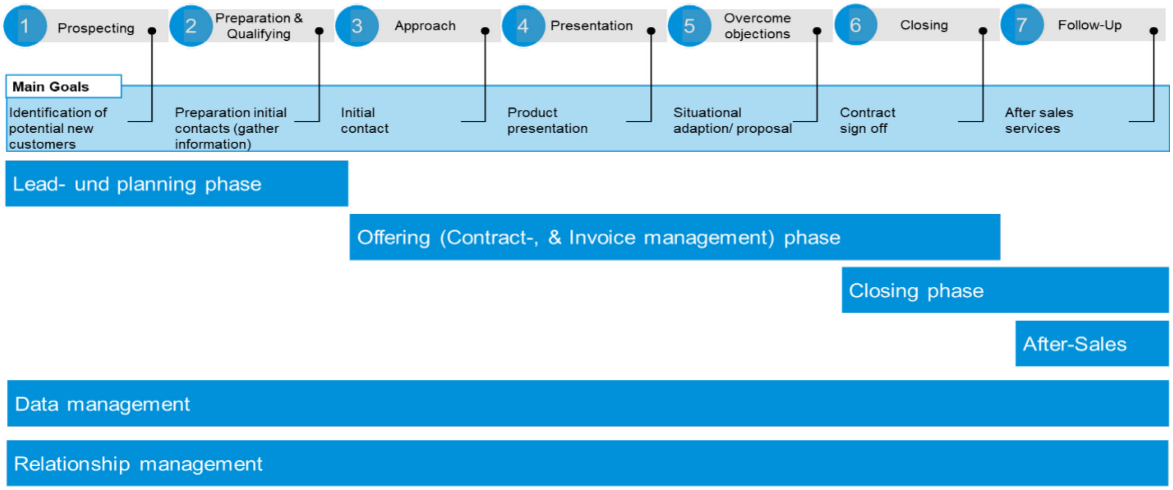

Figure 5: *The sales process in pharma's (own representation, 2019).*

The obstacle to Dubinsky's model was that individual activities could not be separated from each other because of no precise categorization. That is why packages where develop which can depart the phases more precisely. The distinction between the main tasks and support tasks is the time component. While supportive tasks are executed on a daily base, activities belonging to the main phases are often performed less recurrent.

1) Lead and Planning Phase

The lead and planning phase is the starting point for further strategic decisions for the head of sales based on market, trend, and event analyses as well as forecasts. Based on those assumptions, future lead channels, and new customers may be recognized. Moreover, the forecasts and predictions provide new information on the future outlook and success rate of the particular drug. Thus, it is crucial for the setting of strategic goals. The more precise the tasks are performed, the easier it is for the sales department to determine reachable yearly, monthly, and daily sales goals. The phase terminates with the visualization of all required data to reach new customers (Interviewee 8).

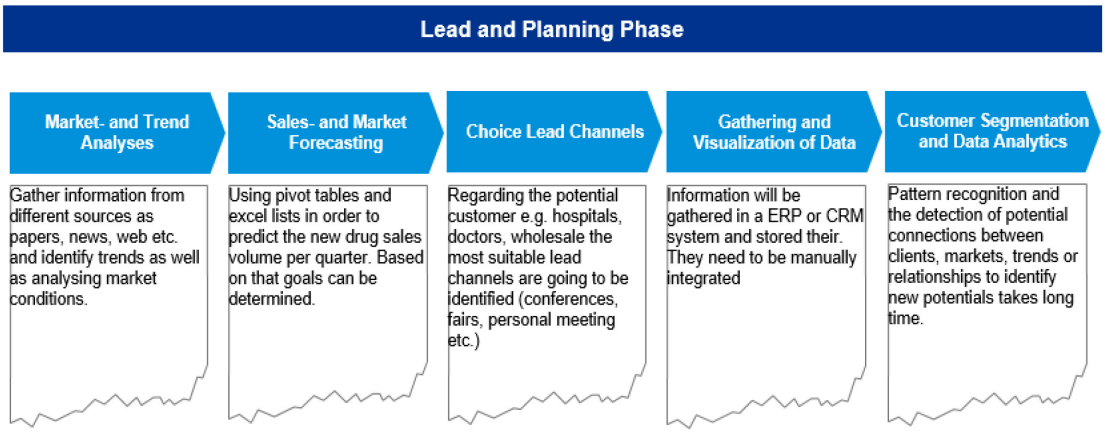

Figure 6: *Lead and planning phase with related activities (own representation, 2019).*

2) Offering Phase

After the lead and planning phase is finalized, the offering phase sets in. During that phase, the first customer contact is made. Real-time data (prices, products, and customer data) available at every point of customer interaction is a significant success factor (Interviewee 5). During

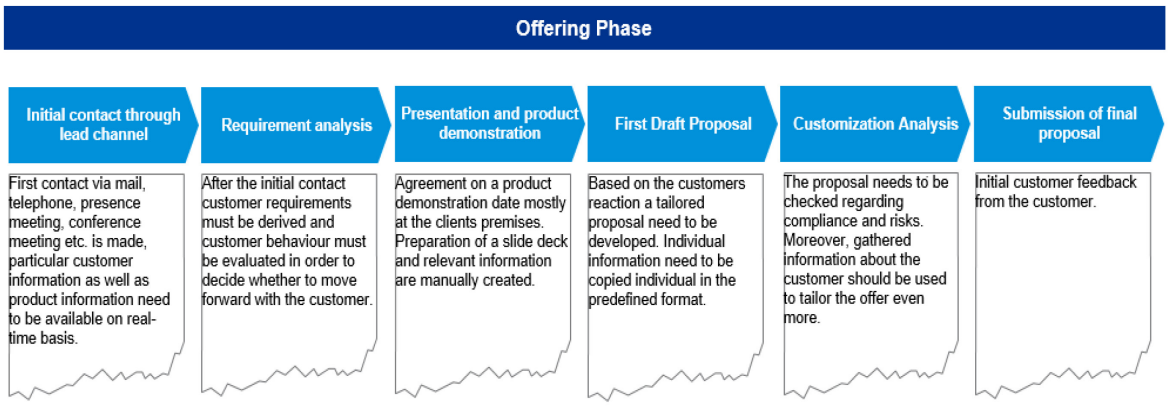

Figure 7: *Offering phase with related activities (own representation, 2019).*

customer interaction, it is necessary to understand the customer without losing information about their concerns and their preferences. During this phase, the salesforce offers a lot of customer-specific activities and tasks, e.g., protocolling, product presentations, pitches, and individual proposals based on the customer's input. The phase ends with the first feedback of a proposal draft (Interviewee 7).

3) Closing Phase

The closing phase starts with the first customer feedback. The preparation of contract- and accounting documents, as well as the closing of the deal, are focal points. Information about prices, delivery time, discounts, and the number of products or product modifications have to be gathered, summarized, and added into a CRM/ ERP system (Interviewee 5). Notably, price anticipations and discount rates determine the success or failure of a deal. Most likely, the phase closes with the shipping and tracking of the drugs.

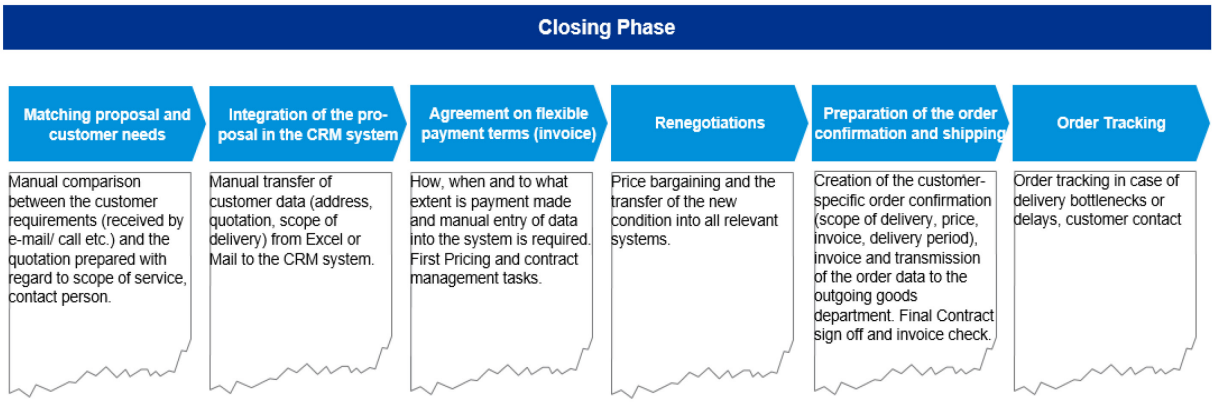

Figure 8: *Closing phase with related activities (own representation, 2019).*

4) After-Sales

The after-sales services within pharma's are mainly based on permanent presence whenever the client requests information. This information can be specific company details, product-related issues as well as any other wishes the customer might have. Due to the high competition within the industry, fast and precise responses are significant because customer satisfaction and retention is the most critical factor for long-lasting relationships (Interviewee 8). Hence, the

collection of feedback is a success factor in order to retain the customer and increase the chance of closing further sales.

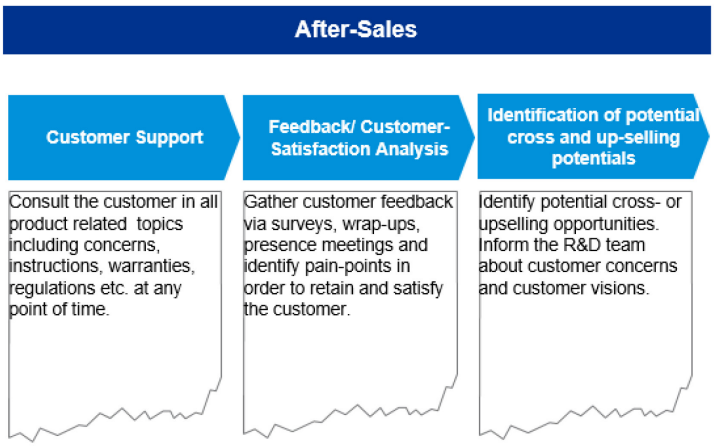

Figure 9: *After sales with related activities (own representation, 2019).*

5) Data Management

Data management activities developed from underappreciated tasks to potential game-changers throughout the sales rep activities. Nowadays, data are gathered at any touchpoints within the sales process regardless of client interactions, conducted analyses, or the input from data into company-related systems. In pharma's, all actions need to be recorded, and thus, many data can be gathered (Interviewee 8). Despite ensuring IT-architecture and security, an automated dataflow provides the sales reps with relevant information and saves them time and manual effort. The enhancement of handling and working with these data on a daily base will boost sales reps in accomplishing their wide range of tasks and goals (Interviewee 6).

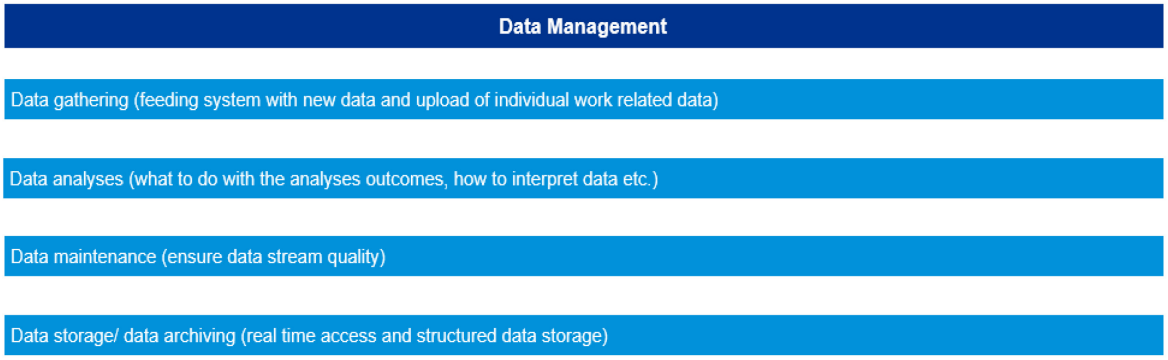

Figure 10: *Data management with related ongoing activities (own representation, 2019).*

6) Relationship Management

The tasks included in the relationship management phase accompany the sales rep during their entire function on a daily base (Interviewee 8). Hence, high repetition potential, a high manual effort for data input and inefficient time management (e.g., screening and answering of e-mails, customer trip planning) deemed to be barriers in the daily routine of sales reps.

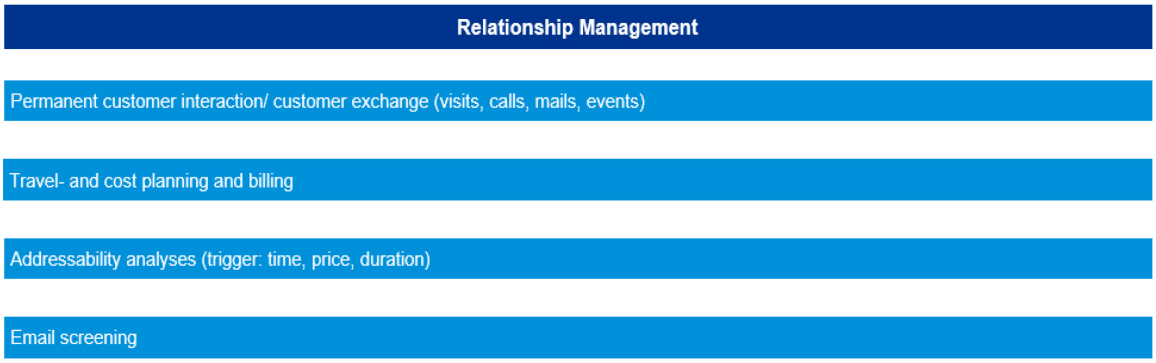

Figure 11: *Relationship management with related ongoing activities (own representation, 2019).*

4.2 Machine Learning potentials and challenges

The subsequent chapter aims to identify the potentials of ML-applications and challenges. At the end of the chapter success factors of ML applications may be derived, and suggestions of ML-applicable tasks and processes will be given.

4.2.1 The state-of-the-art technology ML has not reached its full potential in pharma's yet

There is an agreement among the interviewees regarding the status quo of ML-applications and functions. Machine Learning applications and functions are software that is trained through algorithms (statistical models, regressions). The intention is to support operations and processes throughout the entire value chain of the businesses, reflected by 80% of the interviewees (Interviewee 3). For instance, 4/5 ML experts discern the highest potential in the production line, while 3/5 mentioned logistics as the primary implementation field. The reason for that is higher upside potential in this field triggered by uncertain cost factors for companies (Interviewee 2). Nevertheless, all of the ML experts appraise ML and its functions/ capabilities in sales as a recent hot topic for companies fostering its competitive advantage through process optimization and automation. Interviewee 1 alludes this hypothesis in as follows:

"As long as you can transform your data into numbers/ series of numbers, ML can be implemented everywhere. That is the case for all the data currently existing."

To become fundamental to more numerous companies, enhancements in the production of better and more broadly applicable algorithms for the foreseeable future are necessary (Interviewee 3). On the contrary, Interviewee 4 (2019) points out that the true potential of ML-applications does not lie in the construction of new algorithms, but in the implementation and adaption of the algorithms already existing within the particular company-specific system. Although there is consensus about the growing relevance of ML, future developments remain tough to predict because the outcome is a black box. More and more ML solutions/ ML services will undoubtedly be offered to companies during the next years due to the media hype around the topic (Interviewee 2). Large pharma's have recognized the imperative to invest in new digital solutions. Novartis established a tech-hub in Barcelona which deals with AI applications and new apps. The challenge is to close the gap between employees who produce the algorithm and those who utilize the results (Interviewee 7). Recently ML-applications are commonly used to predict the outcome of special sales events, balance sheet figures, yearly sales rates, and the potential sales volume within big pharma's. Smaller pharma's companies, on the contrary, do not have the expertise and resources in order to realize an ML strategy quickly.

4.2.2 Data Management as the key challenge of ML applications

The majority of the interviewees' consent on data preparation and processing as the major challenge for companies (5/5 experts), followed by a lack of understanding (magic number code problem 4/5 experts) appearing in challenges associated with the correct usage and adaption of algorithms (4/5 experts) (figure 12). Solutions to overcome the divergence between mathematicians/ physicians, who develop the algorithm and business people who do not understand the logic behind the algorithms, need to be figured out by companies in order to develop a result/ customer-oriented ML strategy (Interviewee 5). After all, 3/5 experts highlighted legal restrictions concerning data digitization and compliance with regulations as a significant hurdle for companies. E.g., the Russian data protection policy is less strict, allowing e-health companies to gather and use data from central IT. Thus, pharma 'sin Russia can work on new drugs even before the international competitors recognized the future problem (Interviewee 1). However, when dealing with country specific data protection laws as well as data conformity must be proofed from the companies' side in order to guarantee a smooth utilization of ML applications (Interviewee 4). Misconceptions and inefficient utilization of ML applications are often spread out from top-management who want to foster innovation without fundamental knowledge on how to nail the challenge. Thus, many pharma's desire to implement solutions into their systems but do not even have the IT- architecture to set up efficient ML-

strategies (2/5 experts). Cloud solutions and data warehouse strategies are striving to accumulate data within one system in order to ensure full transparency the data availability and storage. From these hurdles, success factors may be derived in 4.2.3.

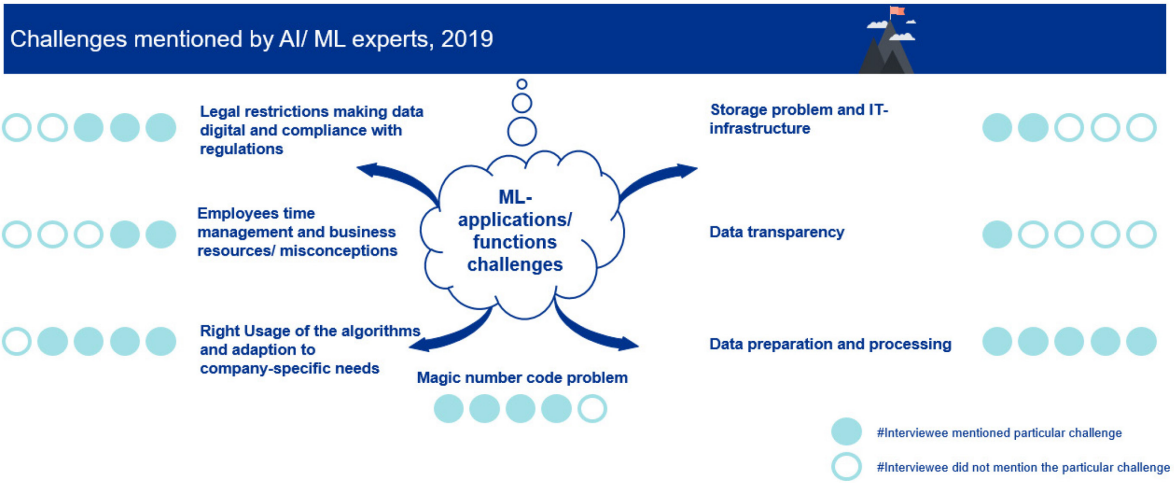

Figure 12: *ML challenges within pharma's (own representation, 2019).*

4.2.3 Success factors for an efficient usage of ML enabled applications

Among the interviewees is a collective agreement toward the most decisive success factors. All of the interviewed persons (100%) highlighted the understanding of ML applications as the most significant future challenge, illustrated in figure 13. First of all, the management level of a company must be aware of this fact that the set-up of clear goals and its communication throughout the business units is essential. The way how the management educates and cultures their employees will significantly impact the ML-adaption throughout the company. Failure will result in black box phenomena (Interviewee 2). Thus, the applications cannot reach its full potential because e.g., mistakes will not be identified, and people cannot interpret the results (Interviewee 3). Thus, the model cannot be improved, which leads to the second factor of success, classical data science work (83, 3%) including gathering, training, balancing, and ironing out data. Analyses came up with the result that these tasks take 80% of the implementation time. The remaining 20% comprise the actual coding and building up the problem (Interviewee 1). A thriving ML-introduction also needs to be compliant with the implemented IT-systems and architecture considered as the sine qua non. The adaption of the developed algorithm is another key for an efficient ML-implementation, according to 66, 6% of the interviewed persons. Based on the company-specific needs variables within the algorithm need to be continuously updated, converted, and modified based on the anticipated outcome. Moreover, persistent training and optimization of the dataset denoting convey different layers (number input) into a number output of the algorithm between different domains. In order to reach the full potential of the algorithm, data collection over a specific period needs to be collected and transformed into numbers/ series of numbers. 66, 6% of the respondents jilted data access as a successor. Today on the on hand-side several databanks exist where the company's purchase data and collect various information about the customer. From a business perspective point of view, the cost and time components also matter in order to come up with an efficient and effective implementation strategy. Unlike the common sense of ML setups solely require a few data which do not require high purchasing investments.

"A prototype can be built within a few hours and only requires between (200 MB and 2GB) of data" (Interviewee 1).

The amount of data depends on the particular company-specific intension and statistical model. While time-series scrutinizes, require only a few data, text and picture analyses call for more eloquent data in order to achieve a beneficial outcome. In that sense, pharma's need to raise the question of whether they have the resources to deal with these issues or alternatively outsource the required tasks (Interviewee 2).

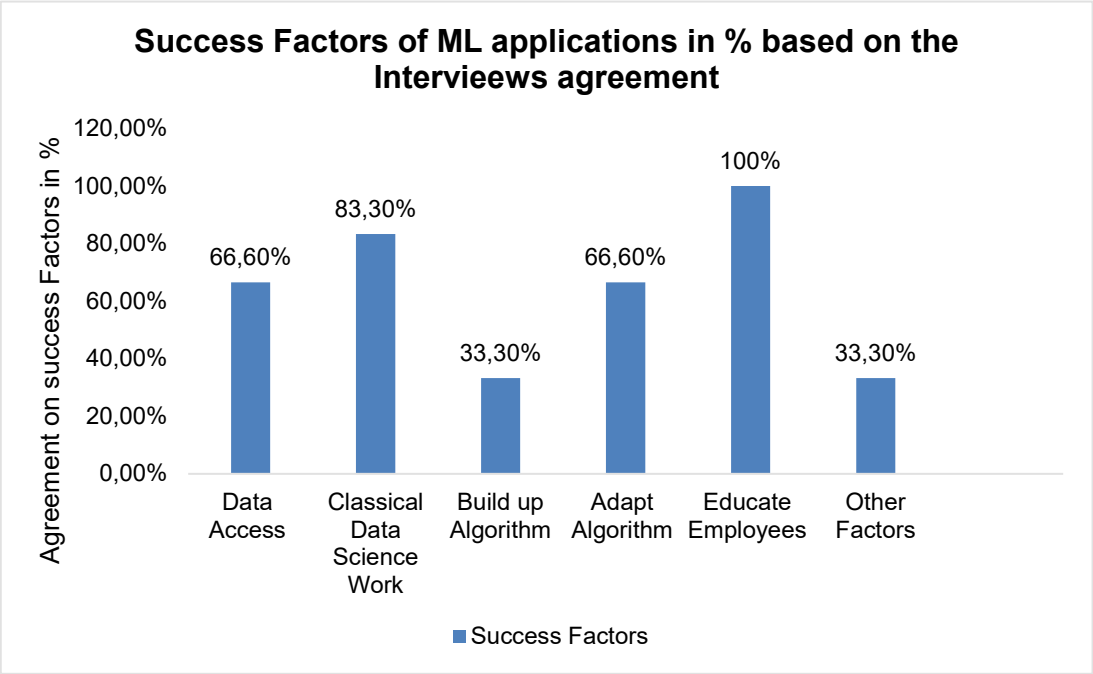

Figure 13: *Success factors of ML applications (own representation, 2019).*

4.2.4 Predictions and forecasts as the leading functions of ML

ML learning-enabled applications will significantly change the pharma's performance and workflow. Forecasts report that in the next 15-20 years, 50% of the jobs will shift towards automatization (Interviewee 1). Form a business point of view ML- applications leading to shrinking labour costs (10 robots can replace 100 employees), flawless compliance and risk management (contract, invoice checks), higher productivity (24/7) and efficiency (4-5 time faster) and thus, generating new revenue streams for the company (McKinsey, 2018).

Recalling the most common ML applications from chapter 2.1.4 the interviewees evaluated predictions and forecasts (table 4) with 83, 3% as the function with enormous potential,

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5	Interviewee 6
Robotic Process Automation (RPA)	X		X	X		X
Robots/ Bots	X		X			
Predictions & Forecasts	X	X		X	X	X
NLP	X	X		X		X

Table 4: *Overview of the most useful ML applications/ functions by ML-experts (own representation, 2019).*

accompanied by RPA & text and image recognition with 66, 6% each and robots & bots with 33, 3%.

Despite the four applications, interviewees did not mention further applications. Insofar it can be assumed that this is the central application backed by ML algorithms. The sales process consists of different phases and complex activities. Hence the upcoming question is where to implement the applications within the sales process of pharma's to reach an efficiency increase. The interviewees highlighted the following intersection where ML applications and functions can remit an unusually high degree of value (interviewee 1, 2, 3, 4, 5):

1) … everywhere where data points exist,
2) … everywhere where time-consuming and monotonous tasks exist,
3) … everywhere where repetitive, less complex tasks exist,
4) … sensors or other tools collecting data and transform these data into numbers,
5) … data are stored and analysed,
6) … standardized models and software systems implemented.

Given the fact that sales activities be allocated to repetitiveness and complexity mentioned above, the following section will derive a model classifying the sales tasks with the highest potential to increase the efficiency of the unit.

4.2.5 Low hanging fruits can be identified in different sales phases

The sales process, as a data-driven operation, gathers many data creating massive databases and thus accomplishes solid ML-prerequisites (Interviewee 1). Statistical data can be compared in any step of the sales process enabling ML-functions e.g., predictions to support the operations. Acknowledged by the literature and proofed by ML experts, less complex, repetitive and time-consuming tasks are the low hanging fruits for companies striving for sales efficiency improvements (see chapter 4.2.4). The following metric (figure 14) provides an overview of the accumulated sales tasks stated in the interviews and the academic literature. The metric consists of two axes that organizing the sales actions regarding their level of complexity and their repetitiveness. These attributes intend to recognize the sales tasks with the highest ML-potential to maximize the effectivity and efficiency within the sales department. Thereby, the horizontal axis displays the repetitiveness of tasks. The more often an activity is executed, the higher is its monotony-degree as well as time-exposure among employees. Thus, their replacement potential through ML applications is the highest. The vertical axis illustrates the level of complexity. More complicated duties require more data, specific know-how, more in-depth analyses, as well as interconnections. That is why the development of particular ML

algorithms and analytics is more difficult for more complex tasks. By integrating the two dimensions, the activities can be assigned to four distinct groups.

Low Hanging Fruits (Lhf) can be defined as activities that are highly repetitive (mostly on a daily basis) and less complex (few data necessary, easily structured). Thus, they might be realized quickly within the business unit. Often these tasks are monotonous and time-consuming (interviewee 9). Therefore they have a high potential in increasing sales efficiency rates. Examples are the entire data management category (see chapter 4.1.3) as well as e.g., document checks regarding compliance and risk as well as different kinds of trends or market analyses. The second category is "2nd priority tasks," which are tasks that are more likely executed weekly than daily. They ask for more data inputs, and their correlations with other units/topics are moderately complex. Thus, the effort to support these activities by ML-applications is higher than Lhf tasks. Examples are product demos and the development of presentations for the latter ones.

3rd priority activities characterized by their high level of complexity and carried out on a monthly base rather than on a weekly base. They have more intersections within the decision-making process, frequently need human abilities and more data. Examples might be renegotiations or the first draw of proposals/ contracts. Tasks that are only performed once per quarter/ year are not captured in the metric because implementation costs would exceed the efficiency ratio undoubtedly.

On the contrary, companies fostering efficiency within their sales unit through ML applications should focus on the beginning of Lhf because they are more straightforward to realize and faster to accomplish. More complex tasks expect better data knowledge, analytical understanding, time integration effort, and more extended training of the algorithm. Because the implementation will be more complicated, time and effort are higher and less effective.

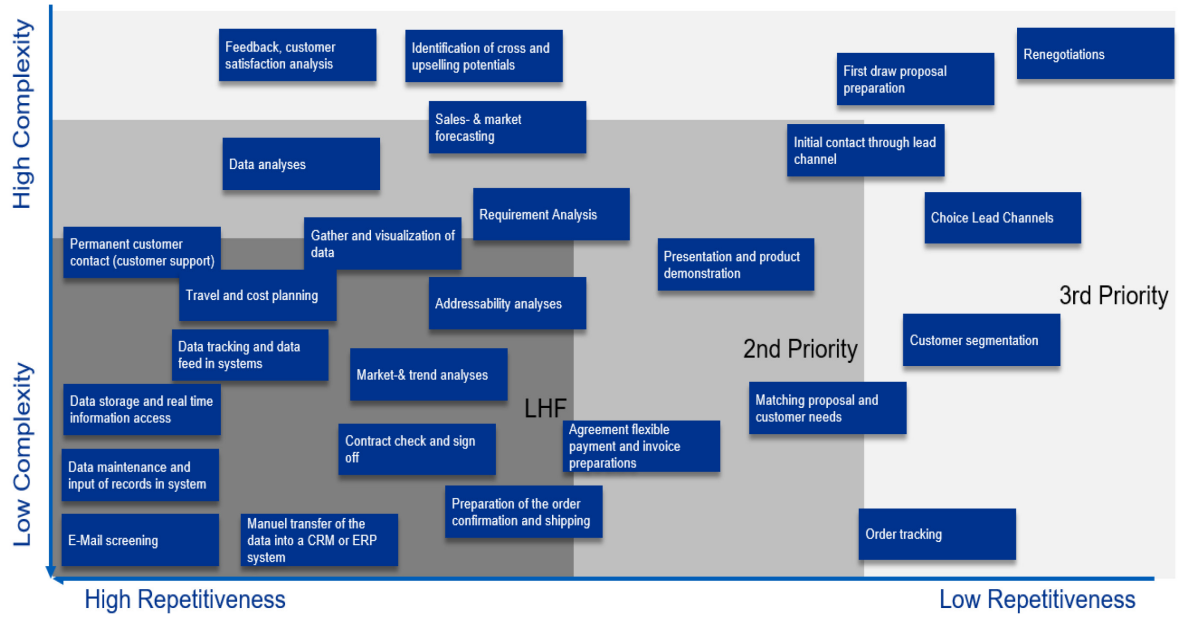

Figure 14: *Classification of sales activities according to repetitiveness and complexity (own representation, 2019).*

Given the result that some activities are extraordinarily time-consuming, these tasks are designated by high ML potential. That is why, in the following step, a "time" dimension will be appended to the model (figure 15). These tasks are impeding sales inputs (calls, demos etc.) and thus the overall efficiency and effectiveness. Besides, these tasks are immense cost factors within pharma's and concurrently impeding salesforces from focusing on their core activities of forming new customer relationships. Hence, the new model (determines) determines highly time-sensitive activities.

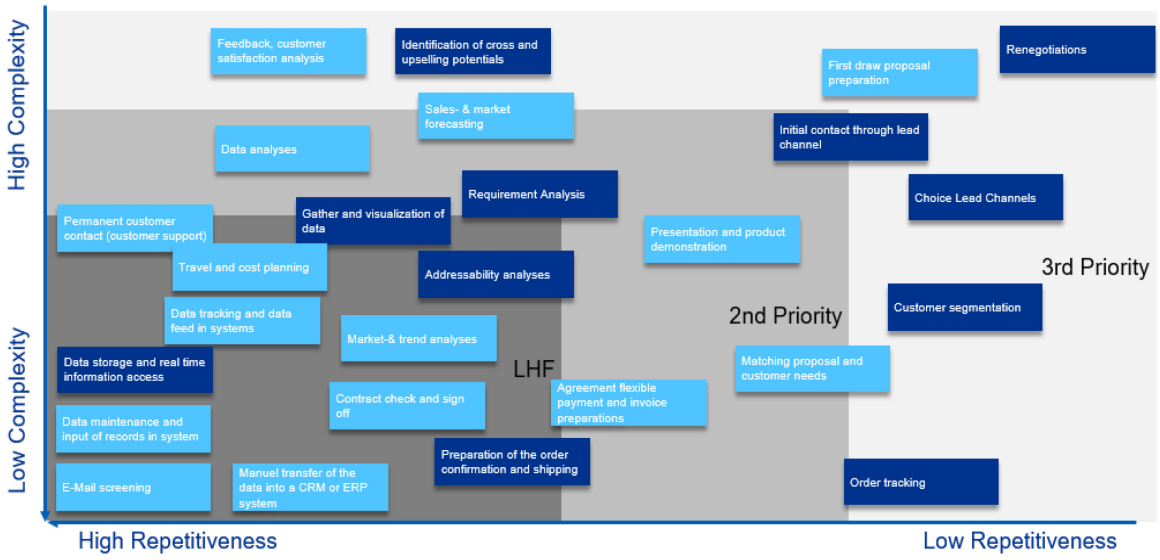

Figure 15: *Classification of sales activities according to an additional time dimensions (own representation, 2019).*

Time savings in sales departments allow the salesforce to centre on more on value-generating tasks e.g., customer service, identifying cross- and upselling potentials. The categorization

reveals that especially data management activities are time-consuming because they are not automated. In case these tasks are not automated, it is challenging to commence integrating ML-applications.

4.2.6 RPA has a high potential to enhance various sales activities

The analyses from chapter 4.1 and 4.2 pinpointed LHF as the most significant enabler of ML-applications. In the second step, duties which are time-consuming and therefore unbeneficial from the business perspective were highlighted. The subsequent table 5 will display the elaborated activities and match them with the four specific ML applications and functions, recalled from the interviews and the literature review.

The table reveals that within the sales department, RPA has the potential to overtake the majority of the tasks. New software systems like Blue Prism, Automation anywhere or UiPath record core-process and automate the latter one based on ML-algorithms. Thus, processes can run on a higher quality saving time e.g., for the entire data management and integration process (Interviewee 5). Real-time data allow pharma's to set the right priorities i.e., spend the most time on the most relevant customers. During sales calls, apps and mobile devices enable the staff to access the entire product portfolio directly. They can interactively configure offers and include relevant customer data. Availabilities and delivery terms can already be clarified during the conversation. Moreover, the office staff is also kept up to date.

Category	Task	RPA	Predictions and Forecasting	NLP	Robots/ Bots
Lead and Planning Phase	Sales and market forecasts	x	x		
	Gather and visualization of data	x			
	Customer segmentation and data analyses	x	x	x	
Offering Phase	Requirement analyses	x	x	x	
	Presentation and product demonstration	x			
	First draft proposal	x			
	Customization analyses	x	x	x	x
Closing Phase	Matching Proposal and customer needs			x	
	Invoice and contracct management	x			x
	Preparation of the order confirmation and shipping	x			
	Final contract check and sign off	x		x	
After-Sales	Customer Support	x		x	x
	Cross and Upselling Potentiale (Trigger)		x		
	Feedback/ Customer Satsfaction Analysis	x	x	x	x
Data Management	Data tracking and data "feed" in systems	x			x
	Data analyses	x	x	x	x
	Data Maintenance	x			x
	Data storage and real time information	x			x
Relationship Management	Permanent customer interaction	x		x	x
	E-Mail screening			x	
	Addressability analyses	x	x		
	Travel- & cost planning & billing	x	x		

Table 5: *Overview of sales tasks matching particular ML applications/ functions (own representation, 2019).*

Through NLP, psychological behaviour might be analysed (lexis and word melody) and thus, the application could advise the salesforce in real-time by figuring out the semantically related texts and its purpose behind. Thus, customer interaction and buying triggers can be identified. Hence, the entire customer interaction can be tracked and recorded automatically, avoiding manual input in the system, which saves time. Furthermore, the risk of suffering significant information about the client will be mitigated. NLP also enhances the error susceptibility when creating or proofing invoices and contracts (Interviewee 3). Especially in fast-changing environments as the pharma's, new regulations and compliance restrictions might be automatically checked and drawn up. Besides, the proposal and client needs are natural matchable and adaptable.

Predictions and Forecasting

Precise predictions and forecasts save hidden costs as well as resources and thus could facilitate to determine pharma's sales goal correctly. Especially, deep learning approaches are outstanding in classifying patterns which humans would not discover. Thus, clear and accurate outputs of a prediction either as future forecast numbers or the probability of a status quo might be derived supporting the sales rep on a daily base (Interviewee 1). Since ML-applications can "learn" organizations can train the algorithms on consumer behaviour, thus predicting its customer behaviour/ habits resulting in the right demand forecast. Moreover, services and products can be served with the right advertisement and buying triggers, e.g., the best timing, prices, or discounts are predictable. Through optimal changes in variables, the accuracy of the forecast can be maximized.

Robots/ Bots

The most current technology based on ML might be chat- and other software bots. These bots can ensure a 24/7 customer service 365 days a year, without the risk of being sick or the demand for holidays. Nevertheless, a full replacement of sales reps in pharma's is impossible due to the weight of personal contact. Still, bots can ensure simplified and fast feedback from the client. Mostly this technology is enabled by an RPA software (Interviewee 5)

As illustrated in table 5 ML-application can be integrated throughout the entire sales department. The question is how efficient and effective are these implementations from a business point of view. Thus the next section will analyse the most efficient and practical applications for the sales department.

4.2.7 ML technologies foster an efficient sales process

The following model (see appendix) illustrates the final model. In the previous step, the activities of the salesforce were matched with the compliant ML-function/ application. This model adds a more fabulous description to the respective intersection between sales activity and ML-technology. Afterward, the described action is evaluated in terms of efficiency criteria which are based on the chapter.2.4.1 determined as:

1) Time reduction potential
2) Cost-saving potential
3) Quality enhancement
4) Risk and loss mitigation

In chapter 2.4.1, efficiency was defined as an input-output ratio. This ration can be enhanced by decreasing time and costs for activities, leading enable the salesforce to focus on their core activities. Effectivity was related to the overall sales volume. To boost sales, the company ought

to sell the best quality product. Through ML-enabled technology, high-quality information standards are ensured. Through fast and secured control mechanisms, the transactions can be handled much more quickly, leading to long-lasting relationships with B2B customers from pharma's.

According to the number of anticipated evaluation criteria (1-4), each activity-tech-pair ascertains an estimate between 0 and 1. These values are between 0 and 1. 1, determines the most efficient/ effective value (table 5). That implies that the assigned ML technology has a very significant impact on sales activity efficiency/ effectiveness. Proceeding, 0 goes along with the assumption that ML technologies cannot support the particular task. These activities are excluded from the following calculations of the ratios. The overall objective of the index is to distinguish tasks that can maximize the efficiency of the sales process through ML-applications/ functions.

Efficiency/ Effectivity Value	Fulfilled Criteria	Harvey Ball
0,25	**One** criteria fulfilled	◔
0,50	**Two** criteria fulfilled	◐
0,75	**Three** criteria fulfilled	◕
1,00	**All** criteria fulfilled	●

Table 6: *Evaluation scale for ML applicable tasks (own representation, 2019).*

In general, all of the four identified ML technologies have the potential to increase the sales input ratio in pharma's (figure 16). Even though RPA has the most intersections with several sales activities, it is less efficient/ effective in its usage (0, 72). Surprisingly, NLP (0, 78) as well as predictions (0, 78) are the most efficient/ effective ML-applications followed by robots and bots (0, 75).

It is explainable by the impact of the phases on the external as well as internal operations. Within both phases NLP and predictions have the potential to foster accuracy, speed while simultaneously decreasing costs for processes in terms of employee cots. Chat-/ or service bots, for example, significantly intensify the whole customer journey and internal operations on a large scale by increasing reaction times. RPA (figure 17) has a lower efficiency because it can be applicable to more sales task than the other technologies (18). Thus, RPA also optimizes

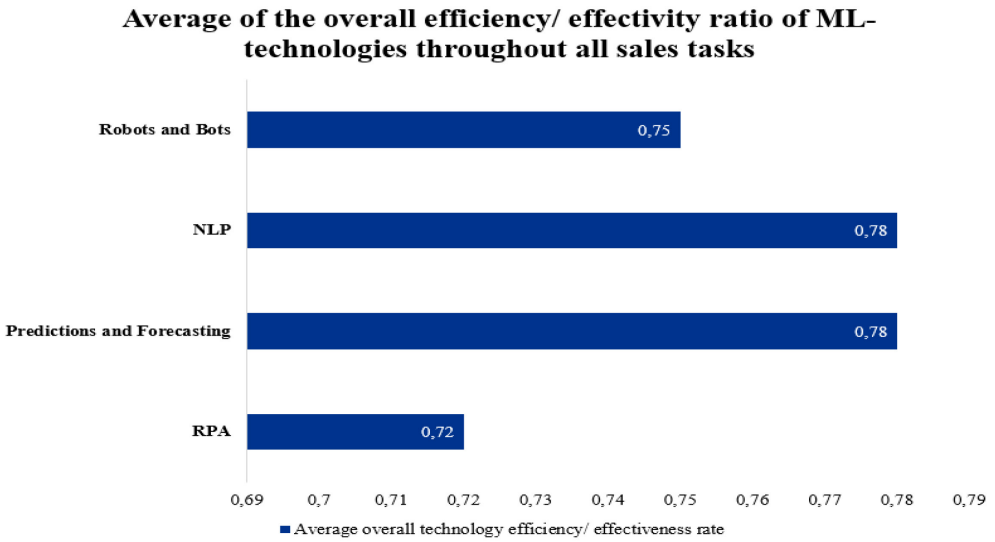

Figure 16: *Average of the overall efficiency/ effectivity ratio of ML technologies throughout all sales tasks (own representation, 2019).*

supportive tasks which add less value to the process optimization and thus the efficiency average ratio is smaller.

Figure 18 reveals that the implementation of ML-technology within the closing phase (0, 96) resembles to have the most powerful potential to enhance the effectivity and efficiency of the sales process. Related to the fact that this phase includes much administrative work as contract checks, invoice generation, and adaptions, the high potential appears reasonable. Most likely, NLP software can save much time throughout the whole stage. In total compliance with previous insights, after-sales applications (0, 94) can facilitate the entire customer service and information, attainability, and information quality of the customer

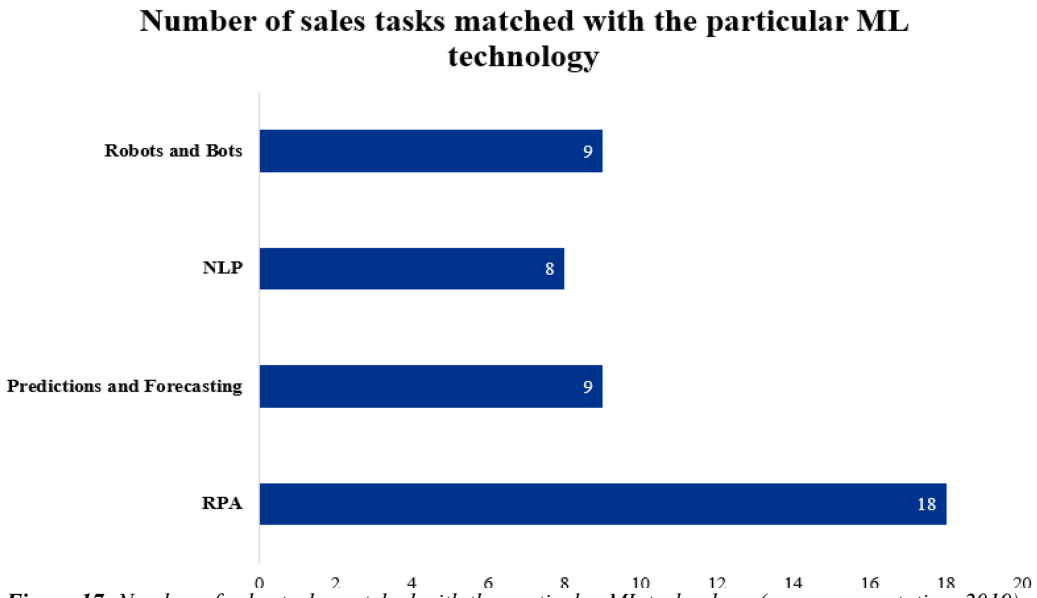

Figure 17: *Number of sales tasks matched with the particular ML technology (own representation, 2019).*

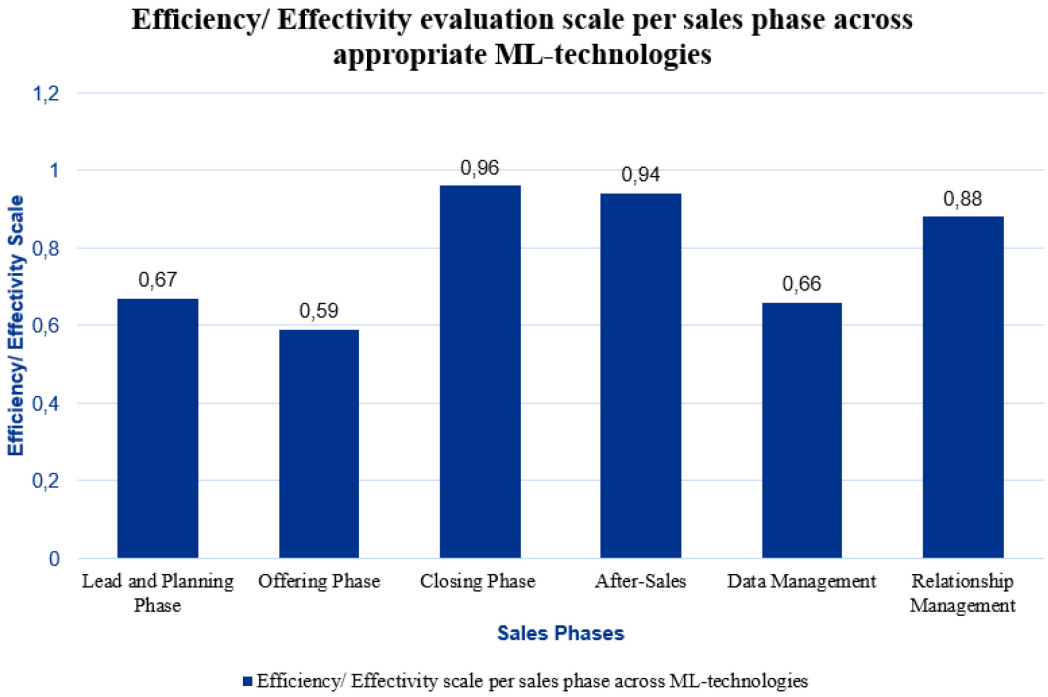

Figure 18: *Overall efficiency/ effectivity evaluation scale per sales phase across appropriate ML technologies (own representation, 2019).*

service. Relationship management (0, 88) characterized by much time consuming repetitive work, takes the 3rd position in the ranking. Surprisingly, data management tasks (0, 66) take together with the offering phase (0, 59) the worst ranking. Although data management tasks are Lhf, the results gained show less influence on efficiency and effectivity value. The reason for this somewhat contradictory result can be the fact that these tasks do not have directly apparent customer value. They more likely impacting the sales operations and passively fostering sales itself. The lead and planning phase consists of various analyses, accounting for 0, 67. The calculation of the efficiency/ effectivity ratio on a task basis (horizontal) corresponds with the previous analysis because the closing phase contributes 50% to the most efficient sales activities, namely proposal matching (1,00), invoice and contract management (1,00) as well as final contract check and sign off (1,00) (figure 19).

While 1, 00 determines tasks where ML-applications can enhance the process effectivity and efficiency significantly, activity value 0, 5 is also positively influenced by the implementation of ML applications. Moreover, the activities which directly target the customer seem to have a higher efficiency/ effectivity increase than internal tasks e.g., sales forecasts and data tracking.

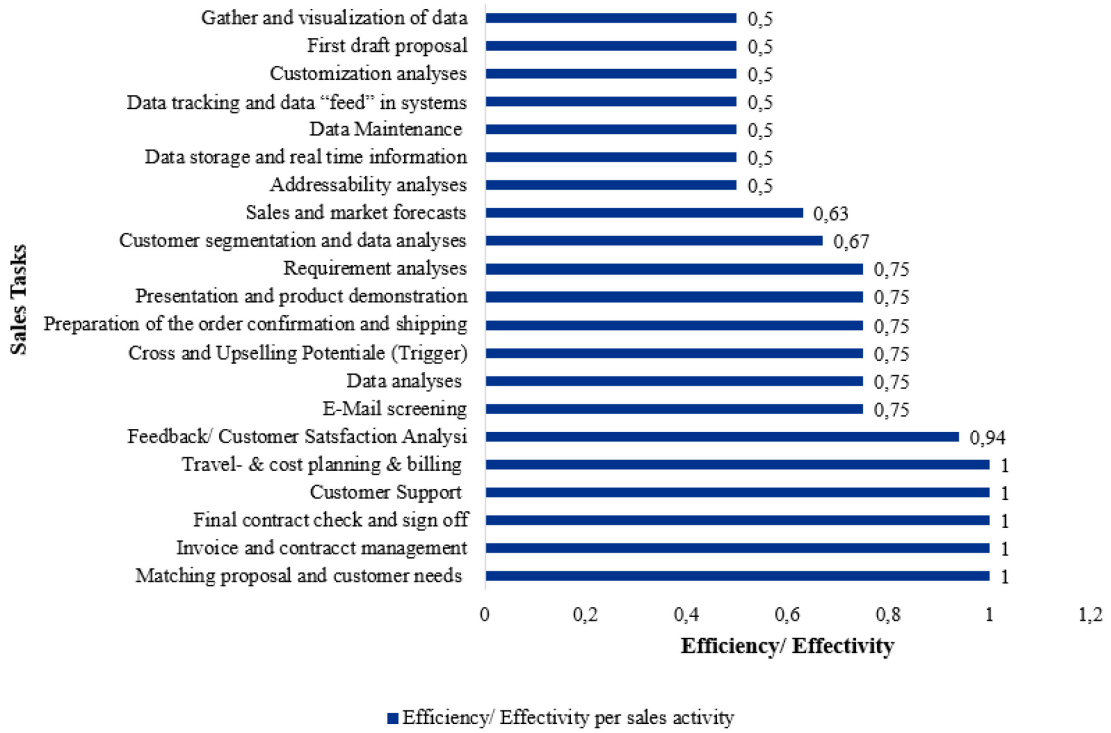

Figure 19: *The impact of ML applications on the efficiency/effectivity of sales tasks (own representation, 2019).*

4.2.8 Managerial Implications to maximize the value within pharma's sales department

The conducted research validates the hypothesis that ML applications can significantly enhance sales operations within pharma's. In times of fast-changing environments, data-based business insights and predictions, as well as real-time data, are essential success factors for pharma's. ML-applications within the sales department can relieve the salesforce, even to overachieve determined goals. In order to implement ML application within the sales department in pharma's efficiently for the future, three steps are essential.

Set up a solid base for the development of ML applications

The starting to maximize ML applications is a profound base. That implies the commitment of the board of the pharma's. The management must understand the value of new technology and integrates the strategy into the corporate culture. This will facilitate communication within the company and ensures the acceptance rate of the employees. Besides, a solid IT-infrastructure and security base must be established in order to guarantee smooth data flows within the company. In the next step, critical operations and activities need to be pointed out. Excellent guidance for that is BPM software like *Kissflow* or *ProcessMaker*. When processes, as well as activities, are transparent, "red flags" are effortlessly recognizable.

Implement a successful ML-strategy in the sales department

As soon as the company decides to implement ML technology within their business unit employees need to be involved and trained during the entire implementation process. Solely

reliable communication will prevent the pharma's from misconceptions across the salesforce. A good understanding of technology leads to more efficient utilization prepares the salesforce for the change. That is why it is likewise crucial to accelerate small steps of change. Thus, employees can test the new applications from the beginning and integrate them slightly to their daily routines.

Evidently, the emphasis is on the identification of the most efficient tasks acknowledging the implementation of ML applications. First, starting with the classification of repetitive, time-consuming, and less complex activities is essential to discover Lhf, which bother the majority of the employees in sales. Secondly, a match of the particular task with the appropriate application requires a good understanding of the issue. Within sales departments in pharma's, the study examines the closing and after-sales phase as the first touchpoint of efficient ML integrations. More precisely, invoice- and billing documents through RPA and software bots, contract checks/adjustments through NLP and customer service through Chabot's/ RPA are the most solutions maximizing sales department efficiency.

Constant enhancements and improvements

After a flourishing implementation of an ML solution, it is crucial to encourage the exchange between the sales department and the developers. The exchange fosters the accuracy of the algorithm for particular pains. Thus efficiency ratios within sales can be ensured, and pharma's reach their sharp objects.

If the three steps are integrated into the corporate culture, ML can assist every department to achieve its goals for future.

5 CHAPTER V: RESULTS

The purpose of this research study is to assess the possibility of ML applications and functions within the B2B sales process for pharma's. The underlying research constitutes results with ML experts, sales representatives, as well as consultants interested in the topic. In line with the results of Wenzel, 2014, pharma's are strongly depended on continually changing regulations, new restrictions, and price pressure. Pharma's are aware of these challenges and try to find new ways to gain competitive advantages. Most likely process optimization is the cheapest and most effective way to reduce operational costs, simultaneously improving customer satisfaction. Enrichments in terms of speed and accuracy, advanced risk management, and the mitigation of compliance risks are only a few approaches to foster the overall companies' performance. On the other hand-side, pharma's predetermine ambitious sales goals for their salesforce, who are often under enormous time and pressure. The results of the conducted interviews assess the four main applications/ functions, namely RPA, predictions, NLP, and robots which go along with the assumptions from Burgess 2017. By evaluating these technologies, the underlying study emphasizes that the benefit of these applications is to maintain and replenish time-consuming, complex, and repetitive tasks. The characteristics seem a great fit to support the salesforce within pharma's by facilitating their work. Thus, sales reps can focus on their primary objective of building up client relationships.

Further investigations revealed that ML potentials within the B2B sales process in pharma's are given but unexploited to a large extent yet. To overcome the obstacles and foster ML applications within the sales department, pharma's ought to create a joint base. Education of the sales representatives, integration of ML-applications into the corporate culture, but also set up the right prerequisites as an efficient IT-architecture/ IT security system in order to prepare the salesforce for changes and innovations, are essential to increase the sales department's processes.

The present study also gained insights into the possible connection between ML applications and respective sales tasks. Thus, Lhf as data management tasks, billing, and invoice and contact management, customer service is a beneficial opening point for pharma's ML journey. By matching the tasks with the particular ML application function, an overall overview indicates which appropriate technology can optimize the particular task. By evaluating the efficiency and effectivity potential of the ML-technologies, the NLP and predictions can maximize the sales process efficiency in pharma's best. By evaluating particular activities, direct customer-related tasks like enriched customer service, contract- and invoice checks, feedbacks, as well as

billings, have the highest value to maximize the sales department's outcome in terms of efficiency increase for the future.

6 CHAPTER VI: LIMITATIONS AND IMPLICATIONS FOR FUTURE RESEARCH

As with all empirical studies, the underlying analyses come with several limitations. First, due to the limited time frame, the sample size of interviewees from pharma's salesforces is too small in order to generalize the entire sales process, including all activities. Sales representatives are reserved for proclaiming information about technologies and internal processes. Moreover, the entire industry seems restricted to external research. Thus, for further investigations, more industry experts should be interviewed. Second, due to the research design, described as semi-structured-interviews, the results are likely to suffer from a large scope for interpretation. However, the method was proficient at levying results about state-of-the-art ML applications and an overview of the general B2B sales process in pharma's. The conducted research identified Lhf fruits and matched particular activities with one or more fitting ML applications. Although these technologies and tasks measured in terms of their effectivity and efficiency, it is undefined how long and at which costs the businesses can integrate the presented solution. Even though this reassessment can change the efficiency/ effectivity rate of the respective solution, the ratio indicators are determined based on assumptions from the interviewees and the literature review. An alternative valuation can change results significantly. The same applies to the evaluation of the sales activity categorization in chapter 4.2.5. The underlying thesis assesses that ML-applications can maximize sales process operations.

On the contrary, it is impossible to predict the future potential of ML, based on Moore's law, "If something cannot go forever, it will not" (Zhou. 2017). Therefore, further investigations of ML algorithm limits would be an exciting objective for further researches.

The research contains solely western literature. Including Chinese literature (leading country in AI based technologies) would presumably gather more in-depth insights into ML technologies. Thus, more than four ML functions/ applications could be recognized. Nevertheless, the scope of the study does not permit to evaluate more than the four Ml technologies.

A critical success factor in maximizing the sales service through ML applications is to educate the employees about new technological innovations and changes. That is why new units (intermedia's) or roles need to be established. These roles can foster the exchange between the

IT department and sales in order to exchange information and thus foster the whole business outcome. The job-description of such an intermedia can be an exciting future research topic.

In summary, the underlying research contributes to the academic ML literature by examining unexplored ML potentials within sales processes in pharma's. In the next years, ML applications will be integrated into various new units and processes within pharma's. Thus, further researches will proof whether ML can be a long-term game-changer for efficiency and effectivity increases within the sales process of pharma's.

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8 APPENDIX

8.1 Appendix 1: Interview Guide

Target Group I: ML Experts

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: XY
Interviewee:

1. Please introduce yourself briefly and describe your position within your company/ university/ field of research.

Nowadays, the competitive advantage of companies is often based on technological progress. Especially, the impact of new technologies like AI/ML and their implementation within company's value chain increased significantly and might influence the future business operations even more [Capo et al. 2014].

2. Do you think the rise and importance of AI/ ML will continue to grow or do you think the technological limitation has risen? Why do you think so?

3. What do you think are the key challenges for the future development of ML?

ML's has various capabilities like speech & image recognition or prediction. Hence, these capabilities enable different technologies, i.e. Chabot's, or functions, i.e. robotic process automatization [Burgess. 2017].

4. In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future?

Within pharmaceutical companies ML is often used for pattern discovery which can be used for drug discovery and precision medicine applications and process optimization, i.e. customer analysis, leading to cost reductions and enhancing profitability in a high competitive industry [Cui et al. 2006; Burgess. 2017].

5. In which business units (R&D/ marketing/sales/supply chain etc.) of a (pharmaceutical) company would you see highest potentials for ML applications in the future?

6. What do you think are the main challenges for implementing ML algorithms in acompany not using ML so far? What are the success factors of implementing efficient ML routines?

Sales forces are main drivers of company profitability aiming for customer attention, retention and satisfaction. That is why sales mangers strive for permanent process optimization and efficiency within their departments [Zolter et al. 2009; Shi et al. 2017].

7. Where do you identify the biggest potentials for ML in the sales process and what do you think which tasks could be supported in the future sales process through ML?

8. Do you think that a full automatized sales process is realistic and could fully replace humans?

9. Where do you see machine learning in 5 years/ 10 years?

Target Group II: Sales Experts (Pharma)

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date:
Interviewee:

1. Please introduce yourself briefly and describe your position within your company

2. What's your company's position in the pharmaceutical industry and how would you describe your company in terms of type; dimension (employees) and market (markets your company is targeting)?

Mainly, the pharmaceutical industry may be characterized by risky and long R&D processes, a high competitive market for intellectual property, threats of substitutes, restrictive legal regulations and strong sales- & purchase pressures [Bátiz-Lazo and Holland, 2001].

3. What are the biggest challenges for your company at the moment?

Sales force performance can be measured in terms of monthly sales, up- and cross-selling activities and subsequently, monthly sales growth/ closing ratio [Ramarajan et al. 2017].

4. What are the most important key performance indicators (KPI's) within your sales department?

5. Which different sales types (inside/outside sale, client services, lead generation etc.) exist within your company and who are they targeting?

Traditionally, the sales process within companies consists of seven different steps. (1) Prospecting, (2) pre-approach, (3) approach, (4) presentation, (5) overcoming objections, (6) close, (7) follow up/post scale activities [Moore et al. 2015].

6. What are the typical steps of the B2B sales process within your company?

7. Given your opinion what are the typical tasks in your B2B sales department? Are they classified (e.g. repetitive vs non-repetitive tasks/standardized vs. non-standardized tasks/daily vs. weekly vs monthly tasks)? Are there any tasks outsourced?

8. What are the biggest challenges of the internal B2B sales process?

Nowadays, the competitive advantage of companies is often based on technological progress. Especially, the impact of new technologies like AI/ML and their implementation within company's value chain increased significantly and might influence the future business operations even more [Capo et al. 2014].

9. In what level, technology is already integrated within the sales process in order to support the mentioned tasks and challenges? Are there technological incentives within your company to foster technology?

10. What are the lessons learned from the implementation of a new technology?

ML's has various capabilities like speech & image recognition or prediction. Hence, these capabilities enable different technologies, e.g. Chabot's, or functions, i.e. robotic process automatization [Burgess. 2017].

11. Are there any AI/ ML applications already implemented in the current sales process?

12. What do you think at which touchpoints ML could support your daily work?

8.2 Appendix 2: Interview Guideline

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 15.04.2019
Interviewee: Interviewee 1

1. Please introduce yourself briefly and describe your position within your company/ university/ field of research.
Interviewee 1 has a technological background and is a data scientist and AI expert who consults firms in order to implement AI/ ML functions and application within their business processes. He is specialized in deep learning a neural networks.
2. Do you think the rise and importance of AI/ ML will continue to grow or do you think the technological limitation has risen? Why do you think so?
As long as you can transform your data into numbers/series of numbers ML can be implemented everywhere. That is the case for all the data currently existing.
3. What do you think are the key challenges for the future development of ML?
Legal restriction to make data digital. E.g. in Russia there are e-health companies collecting the data and the data are gathered and used from an IT-instance centrally (data protection policy not too strict). The Russians can forecasts in that sense how a virus processes in course of the times and also predict epidemics. So the system could recommend you to not enroll your child in school because the probability is by 95% given that the particular virus will occur in school. Neural networks are an algorithm from ML and a lot of data are required. Other algorithms don't need that many data. But algorithms which are no neural networks are less scalable in terms of samples, while a neural network can also work with big data but it is not necessary. E.g. for time series analysis you don't need a lot of data (200MB-2GB) while you need for text and picture analysis which are more complex a way more data are required. When it comes to set up a neural network/ ML algorithm you use 20% of the time to analyze and code/ build up the problem, the other 80% are classical data science work like gather data, iron out data, balance data, code data (human based) and train. If data not clean, you don't have the right amount of data (doesn't have to be that much) you're not coming that far and struggle. A prototype can be built within a few hours.
Often, solutions are available but from process perspectives view in big cooperation's you need people who are free and can deal with that subject in concerns. Often, these people don't have time and decisions take long that is why as a startup it's a way faster. The information and clarification within a department is essential for the success of the implementation of new technology, but most of the people think Big Data/ ML is a huge sorcery and thus missing the chance of implement.
4. In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future?
Prediction and Forecasting. Automatization.
DEEP LEARNING AND neural networks overcode the classical machine learning algorithms especially in text processing, image recognition and time series analysis. Deep learning approaches are very good in discover pattern in datasets and then you can do two things: 1) classify pattern (categorize) or 2) carry the pattern forward (regression, time series analysis) prediction. Always when you insert number and you get an output it is kind of a prediction either it can be a future forecast number or the probability of a status quo. Focal point is that humans cannot see the particular pattern which is the machine able to discover. For the human it is chaos for the neural network it is a nice pattern.
5. In which business units (R&D/ marketing/sales/supply chain etc.) of a (pharmaceutical) company would you see highest potentials for ML applications in the future?
Definitely we have to be aware of the fact that within a company there are a way more use cases available in every department.
6. What do you think are the main challenges for implementing ML algorithms in a company not using ML so far? What are the success factors of implementing efficient ML routines?

Requirements for a successful implementation of ML is that you need to anticipate that there is a pattern in data e.g. weather data (daily/yearly fluctuations).
The success factor is to train and optimize the dataset and try very different variable combinations. E.g. in winter time there is a higher probability of influenza than in summer, because the temperature goes down and thus, you can increase the production. So in case you have enough data it is possible to make a precise forecast.
Another success factor is that it is quiet easy is to convey the different layers (with number inputs transformed into number output) of the algorithm from one domain to all other domains like time series, natural language, text, pictures, 3D-models, behaviors and videos. The only question is which data are available and which problems are in the dataset.
When it comes to analysis e.g. time series analysis it is better to have data gathered over von cycle (year) in order to come up with reasonable results, because of the velocity.
Neural networks solve the same problems as ML but with a higher degree of accuracy. That is why it is also good to implement.

7. Where do you identify the biggest potentials for ML in the sales process and what do you think which tasks could be supported in the future sales process through ML?

Sales is an area with a lot of data and huge databases. That is why it is possible to use ML in almost all steps of the sales process. One use case is to predict the likelihood of events and through the change in variables you can maximize the likelihood of buying a product, sales forecast (train set). Bots which support the sales representative which advices in different cases the salesforce. Neural networks which can analysis the written text in terms of embedding the written text semantically, figure out how semantic related texts are, what the feeling behind words is. On the other hand-side ML can support psychological behaviors e.g. analyzing the voice (word melody etc.). Whenever you have sales interviews with the clients in some cases an AI algorithm listen to what you say and give the salesforce real time advices.
In sales we have two different data sources. On the one hand-side we have mere data from the sales database e.g. CRM (flu vaccination winter).
Recommendations and advertisement which is personalized on your own interest and needs. What is means is that you can train the neural network on the consumer behavior of the customer resulting that you can predict the behavior of the clients and in accordance with that serve the right ads or buying triggers. The consumer behavior can be analyzed with a high accurate probability because our habits are pattern which can be displayed mathematically. So in case you have a lot of data over a specific time period, neural networks can be created easily.

8. Do you think that a full automatized sales process is realistic and could fully replace humans?

Definitely. There is an international competition for drug discovery (protein-complexes). There was a community of 20.000 people and there were some people from Deep Mind and they made a used case out of it and won the protein competition. They were better than the community.

9. Where do you see machine learning in 5 years/ 10 years?

There are forecasts that in the next 15-20 years 50% of the jobs will shift based on automatization. That does not mean that 50% got unemployed but the jobs will shift. E.g. no taxi-drivers when we have autonomous driving. In company's there will be a shift as well meaning that repetitive and followed pattern tasks could be fully replaced. In the next time it will start that sales people are support by new tools in order to make better sales predictions to optimize sales. Sales robots will be a future step though in order to cancel out the salesforce.
AI on the current step cannot be creative by itself. It can interpolate but extrapolate! It can react on known pattern (maybe also empathic) but that's more human-machine interaction! Facing can be seen as a solution at current stage.

Interview Summary 1:

Interview partner A is a data scientist and AI expert who consults firms in order to implement AI/ ML functions and application within their business processes. He is specialized in deep learning and neural networks and a leading consultant when it comes to the implementation of ML solutions. He proclaims that the ML potential is immense and solutions can be implemented everywhere where you can transform your data into numbers/series of numbers. That is the case for all the data currently existing. Moreover, ML applications can be integrated within every part of the entire value chain within pharma's He highlights neural networks and deep learning algorithms as the real game-changer for future machine learning applications because they can classify and moving the pattern forward leading to a more precise results. That is one of the reason why he mentioned predictions, forecasts as well as automation as the core technologies supported by ML algorithms. He lays out that the implementation of such a ML algorithm within the business unit is simple and not really costly which is another competitive advantage of the technology. Moreover, he criticizes the process perspective in big firms and highlights the importance of people who can deal with the technology as well as the understanding of the particular business unit. That is why he relates to startups which can develop such solutions a way quicker. He evaluates the sales department in pharma's as a good field of implementation based on the huge amount of data which are generated on each step of the customer journey. The scope of implementation goes from advertisements, over Chabot's to the usage of neural networks to identify hidden pattern in the data. In that sense he mentioned data quality and constant inputs as the main success factors for a successful data management flow within the business unit.
He also assumes that the entire sales department can be automated and replaced at one point and mentioned protein competitions were the deep mind algorithms outperformed human beings.
He evaluates ML as future game changer for business optimization but also agrees on the fact that the outcome and the real value of machine learning applications cannot be measured at this point of time.
He ensures that job descriptions and job tasks will significantly change within the next 20 years. Thus, new tasks which are related to the control of the machines will appear.

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 24.04.2019
Interviewee: Interviewee 2

1. Please introduce yourself briefly and describe your position within your company/ university/ field of research.
Interviewee 2, is an assistant professor in the information systems department at Catholica Lisbon. He is trying to understand the economics of AI. One of the project is to understand the race between humans and machine. The setting within is a large new organization that replace human editor who is doing the ranking on the front page of newspapers articles with a recommendation engine. It's a field experiment so some users randomly get assigned to getting the recommendation and others see what the human has selected for them and we then try to understand under which situations the machine can outperform the human in terms of clicks. The most interesting finding is in order to outperform human the machine needs data, but more

data is does not necessarily always better but there are some decreasing returns to data. So at one point the curve simply flats out.

2. Do you think the rise and importance of AI/ ML will continue to grow or do you think the technological limitation has risen? Why do you think so?

Now the technology is good at specific domains, recognizing objects, animals and stuff and pictures better than humans, in other things it's not so clear too little data the human is better to pick news articles that you like and once it knows more about your preferences the machine outperform the human. There are two things: 1 is the context specific sort of limitation and the other is the data limitation on both ends (not only too much but also too little data) doesn't help.

3. What do you think are the key challenges for the future development of ML?

If you define AI as a machine that has some general intelligence doing more than e.g. excel and one specific area, then trying to see how you can combine all the individual domain specific excellences into one system that would be the big challenge for the next years. But do we want that because basic economic theory also states that specialization is good and everyone benefits from specialization, so it's not sure you want to invest in something that is general. Probably you won't be able to come up with something that is an expert with everything, so again you have the trade-off between generalist and specialist.

4. In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future?

Prediction is the key skill that the machines have because in the end it's a fancy statistical model using data to make sense of historical data and then try to predict into the future. Every task which involves a kind of prediction will be one where you can use a machine. It's just a matter of how you get access to data. Maybe for some things new sensors have to be developed or creative grace has to be developed on how to use existing sensors, because the types of data that are in the real world exist so many different kind of data. Now we are used to think about data in terms of spreadsheet s and numbers, but also picture/pixel recognition (also transformed in numbers and spreadsheets). When you think about other prediction tasks we might come up with some new sensors which transform and capture data into numbers and spreadsheets.

Almost everything is basically enabled by prediction so e.g. self-driving cars predict all the objects on the picture, and applications like demand forecasting. There is a lot of work in trying to come up with applications and predictions, so if I would have a brilliant idea I would probably not sit here. Automation based on robots and when it comes to B2B market it would probably more interesting in logistics like self-driving trucks, self-loading trucks. If it's more in B2C market there is some scope for replacing humans e.g. people who work on the vending machines.

5. In which business units (R&D/ marketing/sales/supply chain etc.) of a (pharmaceutical) company would you see highest potentials for ML applications in the future?

In the pharmaceutical sector you can have pharmacy's which are open 24/7. And there could be a software part that understands what kind of medication you need and your doctor's note is eligible. State of the art is that the usage of ML applications is more likely to be implemented in R&D as well as logistics department. The focus of ML is probably not on sales but somewhere else because the upside potential is larger because the R&D processes in pharma companies are highly uncertain and whatever you can do decreasing the cost of R&D is useful and probably sales is less a costs factor and therefore is less focus on trying to improve that. And there is also probably less scope to improve, because if you think about ML is good at prediction and trying to understand pattern, in the R&D processes/ research itself is looking basically on data and if you can structure it more it's a place where you can employ standardized models and software systems which tries to look for connections. In sales he doesn't really see where the prediction part really comes, but of course you can make better prediction of who is going to buy what which comes back to the idea of demand forecasting and that's where people

and market research firms are already working on. In that way we would see ML only as another tool in the toolbox as a statistical tool.

6. What do you think are the main challenges for implementing ML algorithms in accompany not using ML so far? What are the success factors of implementing efficient ML routines?

It is important to understand how the models work and it's not easy so I assume there is a huge change that you buy a black box software tool which is somewhere used in the firm but nobody understands what it is doing and where it makes mistakes and how large these mistakes are and so one the one hand-side do it internally is of course costly, and people understand the technology in the market are scares, but then buying it as package software solution makes sure you won't be able to build up these capabilities within your firm. Ml is not only a software which defines the operations of the firm but its software which tries to change the operation of the firm and if you don't know exactly how it works at some point it can become a downside.

7. Where do you identify the biggest potentials for ML in the sales process and what do you think which tasks could be supported in the future sales process through ML?

The easiest short-run gains are looking at data which goes beyond the individual sales representatives to try to understand demand patterns or the willingness to pay of specific customers and then engage in optimizing on these domains, charging higher prices or discount rates. And sort of leverage on the experience or information an individual sales representative only uses for his/her own management of their work and sort of try to leverage on data of all your sales representative and try to find patterns and try to accumulate the expertise in some sense. Where machines are really good at is looking at larger amount of data and humans are limited in the intention, since we cannot look all the information which are out there, basically just looking at individual information some subsets or aggregates information. Answering emails and trigger customer's decision can be trained on real time world data which is context specific and for examples which emails engaging in sales conversations it is easy to build a tool which answers to questions and emails.

He currently read about data lake and I think the idea is that all data independent of its structure and format is somewhat connected and at the moment you pull it is being transformed into the structure you need for the specific model. So going from millions of emails coming in text files to transforming them into a spreadsheet which has front tools, subject, body, fields.

8. Do you think that a full automatized sales process is realistic and could fully replace humans?

That depends on the context, where you already find this is in stock trading. It is completely automated and this probably works because it is very standardized. Speed also matters because machines are good in doing things fast and doing things according to rules and 24/7. In other contexts there are much more benefit to social encounters, so the human part cannot be replaced, so something is not standardized, so you need somebody to explain or there are some other intangible things that cannot be really done by a machine. In the current state of art fully replace a sales process is not realistic but in case if the machine is very good in mimicking probably yes.

9. Where do you see machine learning in 5 years/ 10 years?

He has no idea! It is a black box. Within companies he really does not know because it is a lot of marketing and everybody is talking about that it is so important, but he guesses the people are talking about it are in the business of selling this technologies or selling services to implement this technology's so for me it is not necessarily clear what the potentials are. In terms on research on technologies, we should head to predictions where we add causality. Now it's just looking at pattern disregarding any causal mechanism, so that works fine if you want to detect cats on pictures because the way a cat looks won't change. So you don't really need to understand why a certain formation of pixels in a certain area of a picture is correlated to being

a cat, but in other scenarios there is much more potential for the world to change and then this systems will fail if they don't have new data coming in all the time. Google search doesn't have to worry about causality because every time the word changes new data are coming in, and people have different search term and learn really quickly. But other things when you think you're government and think about raise of lower taxes then you need to compare it to some counterfactual: what would happen if I raise taxes because you can't simply raise taxes; even if you did then an evaluation of it afterwards could be confounded by so many other things that have changed in meantime. So trying to add this logic that people have thought about for a long time statistic to machine learning models will be the big step that will come and then it also opens up all kind of possibilities for all kinds of better prediction mechanism and make the prediction part better.

Summary Interview 2

Interviewee B, is an assistant professor in the information systems department at Catholica Lisbon and the ETH Zurich. He is interested in research and understanding how digitization affects firms, consumers and markets. And one aspect of this is trying to understand the economics of AI. However, he assumes that the success of ML applications is based on the access to data and the feed of the system. He thinks that AI as a machine that has some general intelligence doing more than e.g. excel and one specific area, then trying to see how you can combine all the individual domain specific excellences into one system which he determines as the big challenge for the next years. Moreover, he determines predictions in all different forms as the key skill of Machine Learning. He also mentions automation based on robots and when it comes to B2B market and identifies intersections in logistics like self-driving trucks, self-loading trucks. Moreover, he sees more in B2C market the potential to replacing humans e.g. people who work on the vending machines. Within pharma's he says that ML is probably not on sales but somewhere else because the upside potential is larger because the R&D processes in pharma companies is highly uncertain and whatever you can do decreasing the cost of R&D is useful and probably sales is less a costs factor and therefore is less focus on trying to improve that. However, customer services can be significantly improved through the new technology.
He describes the main challenge of the implementation ML enabled technology as a black box phenomenon which occurs in case the workforce which deals with the technology is not aware of its functions, features and outcomes. Moreover, he highlights the leverage on the experience or information of individual sales representative who can not only use the information for their own tasks but also try to leverage the data to find pattern and try to accumulate the expertise in some sense. Since specific knowledge is required, but also a solid IT-infrastructure businesses must deal with the question whether they would like to outsource the development of ML algorithm. His outlook is that ML applications will become more and more significant for the companies in future. This is one the one hand side due to the fact that there is a recent hype and a lot of advertisement around the topic, and one the other hand-side it can really increase performances on some scale. Moreover people will try to develop more and more precise insights into the algorithm and how to improve them. Thus, the result of ML applications in future will also be a black box.

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 02.05.2019
Interviewee: Interviewee 3

1. Please introduce yourself briefly and describe your position within your company/ university/ field of research.

Interviewee C, is a post-doc researcher in the bio-engineering department at ETH Zurich. His PhD was in the Informatics department at Edinburgh University, and after that he did a post-doc in the Engineering department also at Edinburgh.

His research interests include image analysis (medical image analysis in particular), deep learning, representation learning, generative models and meta-heuristic optimization.

2. Do you think the rise and importance of AI/ ML will continue to grow or do you think the technological limitation has risen? Why do you think so?

He doesn't think that machine learning methods have reached their limits, in the sense that people will continue to produce better and more broadly applicable algorithms for the foreseeable future. He also thinks that this question could be taken in several ways though:

- Will AI/ML technology continue to improve? Yes.
- Will technology that already exists see increasing application? Also yes, and this is also true even if research stagnates, there will still be a long period of uptake of the technology.
- Will AI/ML become more *important*? Well, I'm not totally sure what important means I think there be more of it and it will it become fundamental to a larger number of companies.

3. What do you think are the key challenges for the future development of ML?

ML is a very broad field, and different sub areas will face somewhat different challenges. Herewith it could be data maintenance, and the adjustment of the right variables to the right algorithm.

4. In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future?

Currently the main strength of ML is its ability to automate tasks that would be otherwise time consuming and monotonous. Repetitive Task as well as task which require presence and time can be automated quickly. Deep learning potentials are another source for value generation because they identify pattern much faster. Moreover, they can identify pattern which are complex and not obvious for the human eye.

5. In which business units (R&D/ marketing/sales/supply chain etc.) of a (pharmaceutical) company would you see highest potentials for ML applications in the future?

Not really familiar with pharmaceutical companies but so it is hard to estimate where the highest potentials are right now. Within a firms ML algorithm can undertake almost every task within the value chain. He sees the highest potential in the productions line. Predictions and automation can foster the efficiency of the entire process e.g. through predictive maintenance and RPA solution software enables product quality checks.

6. What do you think are the main challenges for implementing ML algorithms in a company not using ML so far? What are the success factors of implementing efficient ML routines?

One of the main problems is knowing what parts of your company's operations machine learning might be able to automate. If you aren't familiar with machine learning, and only have the abstract idea that machine learning is something that your company should be using, it isn't really straight forward to know how to

7. Where do you identify the biggest potentials for ML in the sales process and what do you think which tasks could be supported in the future sales process through ML?

Uncertainties about the sales process. Customer Service might a good intersection for ML applications because they directly have a direct contacts to the customer, offering them an entire new customer journey.

8. Do you think that a full automatized sales process is realistic and could fully replace humans?

He thinks the actual *sales* process is already essentially fully automated. It seems to me that what is currently less automated is for example the dispatch and delivery of the product after it has been bought. But certainly these things are already being worked on, with drone delivery and autonomous vehicles.

9. Where do you see machine learning in 5 years/ 10 years?

This is very difficult. He would think that where we are in 5 years might be also be quite different from where we are in 10.

Summary Interviewee 3

Interviewee 3, has a technical background and is a post-doc researcher in the bio-engineering department at ETH Zurich. His PhD was in the Informatics department at Edinburgh University, and after that he also accomplished a post-doc in the Engineering department also at Edinburgh. His research interests include image analysis (medical image analysis in particular), deep learning, representation learning. He assumes that the outcome of ML enabled technology and application is very hard to foresee because it depends on the human ability how they can adapt and change the algorithms based on their desired outcome. The challenge is right now to applicate ML algorithms to new business units and more broadly. Nevertheless, he assumes that the potential of ML is not reached yet and more and more applications can be enabled through the algorithms because. He highlights this period as the "period of uptake of the technology". From his point of view the two main applications of ML algorithms are RPA solution software as well as NLP solutions. Especially text and image recognition can enhance a lot of compliance tasks and automate checks and validations with an extremely low mistake rate. RPA solutions can guarantee time and costs savings when implemented on the right intersection. The biggest problem company's struggle right now that they want to implement fancy ML solutions but either they do not have the compliant IT-infrastructure or the top-management of the company misses out to integrate the ML-strategy within the corporate culture. If people aren't familiar with machine learning, and only have the abstract idea that machine learning is something that your company should be using, it isn't really straight forward. Thus, failures are preprogrammed. From his point of view ML integrations and the education of the employees is essential in order to feed the algorithm with the right data forecasting the anticipated outcome.

He is not really familiar with the sales process and pharmaceutical company's in general and can only think about customer services as the starting field of implementation. Moreover, he thinks the actual *sales* process is already essentially fully automated. It seems to him that what is currently less automated is for example the dispatch and delivery of the product after it has been bought. But certainly these things are already being worked on, with drone delivery and autonomous vehicles. In the future the confirms that the development and applications based on ML are quite different in 5 years from the ones which are going to be developed in 10 years, showing the huge potential of ML applications again.

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 21.05.2019
Interviewee: Interview 4

1. Please introduce yourself briefly and describe your position within your company/ university/ field of research.

Interviewee 4 has a background in computer science. He worked in several startups as a software developer and also consulted business in terms of software strategies. He is now the head of Porsche digital, the new mobility and service hub of Porsche.

2. Do you think the rise and importance of AI/ ML will continue to grow or do you think the technological limitation has risen? Why do you think so?

The grow hasn't' ended yet because ML's implementation phase has only begun now. Publications in China and Germany are pretty strong in the field. In order to set up ML/AI to a new level completely new ways of thinking as well as ideas are necessary.

3. What do you think are the key challenges for the future development of ML?

- Nowadays, basic ML algorithms exists and there is no need to develop new algorithms because the real challenge is now to use these algorithms and adapt the use variables. In that sense the biggest challenge is to implement the modified algorithms within the company (ML-Implementation era), meaning within the existing systems, which also have to be aligned and adapted.
- Most of the algorithms are written by Mathematics or Physicians which are based on their calculations. People in business units often don't understand the logic behind while Mathematics and Physicians are not aware of the proper variable and level of the investigated problem. Thus, there is a magic number code problem. To bring the humans and the ML-algorithm on the same stage and foster its understanding in order to understand the ML/AI- decision making will be a huge challenge and requires new employees capabilities and skills.
- Data transparency and storage problems are new challenges the companies have to face. ISO norms have to be complied with. Regulations regarding data protections laws and conformity with existing regulations need to be proofed.

4. In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future?

Basically, ML- automatization functions and capabilities can be everywhere implemented within the company where the human is not better than the system. Thus, it can enhance typical "human-jobs". Moreover, it can be implemented where huge data points exist and everywhere where the company can find repetitive tasks.

The biggest potentials are:

- Automatization where changes are made often (laws)
- Pattern recognition and classification of data into groups → (image/ voice recognition)

5. In which business units (R&D/ marketing/sales/supply chain etc.) of a (pharmaceutical) company would you see highest potentials for ML applications in the future?

First of all most of the processes within every business unit can be improved by ML- algorithms in order to save time, costs, working more efficient and productive. Especially, within the R&D department are big potentials e.g. material machining, material processing.

Within the production a lot of processes like component tracking, incoming and outgoing goods etc. have a high RPA potential. Employees also could be trained and supported by visual mimicking.

Dynamic planning e.g. sales forecasting, spare part forecasting, machine maintenance and error analysis.

All of this affects the revenue and profits of the companies.

6. What do you think are the main challenges for implementing ML algorithms in a company not using ML so far? What are the success factors of implementing efficient ML routines?

The real challenge is to use the existing algorithms and convert and edit them to your individual needs to accomplishing the required output. Another big challenge will be the risk management and regulation compliance because the companies often deal with sensitive data and information which have to be protected.

7. Where do you identify the biggest potentials for ML in the sales process and what do you think which tasks could be supported in the future sales process through ML?

He does not know exactly the sales process but you can implement ML-applications and functions where data exist. Forecasting, dynamic planning and customer interaction can be fields where ML applications might play a significant role.

8. Do you think that a full automatized sales process is realistic and could fully replace humans?

Yes, could be. The important thing to understand is why the customer buys a product or a service. In that sense it is important to build a profile around the customer which recognized the customer's preferences, habits and purchasing triggers. However currently we need the human in order to teach the system/ the algorithm because the algorithm by itself doesn't know the solution for a customer requirement yet.

9. Where do you see machine learning in 5 years/ 10 years?

This is hard to say and I really don't know but I think it is an exponential technology which hasn't reached its full potential yet. Their will be more and more use cases and new business models around this technology in combination with data management systems. There will be a lot more ML/AI solutions as services in future, meaning to sell AI/ML solutions as new products.

Summary Interviewee 4

Interviewee 4 has a background in computer science. He worked in several startups as a software developer and also consulted business in terms of software strategies. He is now the head of Porsche digital, the new mobility and service hub of Porsche in Ludwigsburg, Stuttgart. He assumes that ML and its applications haven't reached its full potential yet and describes the current phase as the ML implementation phase. He highlights that it is possible to scale up ML applications but that this requests a very new way of thinking about ML algorithms. He also mentioned China as a very credible source of ML literature. Moreover he identifies three main challenges for the ML integration within companies, namely ML algorithm adaption, ML algorithm understanding and data transparency and storage. Regarding the adaption of algorithms the biggest challenge is to implement the modified algorithms within the company meaning within the existing systems, which also have to be aligned and adapted. Most of the algorithms are written by Mathematics or Physicians which are based on their calculations. People in business units often don't understand the logic behind while Mathematics and Physicians are not aware of the proper variable and level of the investigated problem. Thus, there is a magic number code problem which can be overcome through educational work. Data transparency and storage problems are new challenges the companies have to face. ISO norms have to be complied with. Regulations regarding data protections laws and conformity with existing regulations need to be proofed. In his opinion ML algorithms can be implemented everywhere where the human is not better than the machine. Thus, it can enhance typical "human-jobs". Moreover, it can be implemented where huge data points exist and everywhere where the company can find repetitive tasks. However, the biggest potentials has automatization where changes are made often (laws) and pattern recognition and classification of data into groups through NLP. He seems ML as an additional source of revenue. Especially, within the R&D department are big potentials e.g. material machining, material processing. Within the production a lot of processes like component tracking, incoming and outgoing goods etc. have a high RPA potential. Employees also could be trained and supported by visual mimicking. Dynamic planning e.g. sales forecasting, spare part forecasting, machine

maintenance and error analysis. Regarding the sales process, which he is not aware of sees ML-applications and functions everywhere where data exist. Forecasting, dynamic planning and customer interaction can be fields where ML applications might play a significant role. Especially the ability of ML algorithms to understand why the customer buys a product or a service can be essential. In that sense it is important to build a profile around the customer which recognized the customer's preferences, habits and purchasing triggers. In the future he underlines the fact that there will be more and more use cases and new business models around this technology in combination with data management systems.

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 01.06.2019
Interviewee: Interview 5

1. Please introduce yourself briefly and describe your position within your company/ university/ field of research.
Interviewee 5 is an employee of KPMG working in the field of CIO advisory. He is experienced in the field of data science and mainly has a technological background. During his studies he focused on Physics while currently he is undertaking data scientist work.
2. Do you think the rise and importance of AI/ ML will continue to grow or do you think the technological limitation has risen? Why do you think so?
First of all he highlights "The morning papers" as additional sources for gathering insights in the topic of AI/ML. Moreover, he confirms that not limits are exist for ML enabled technologies and functions. AI consists of a variety of different algorithms and ML should have the ability to self-adapt to the required data and to the demanded outcome. In the development of the technology there were first clusters then cloud solutions and functional services. Also the ML algorithms but also the hardware were they perform in developing constantly. Some algorithm underline only specific tasks and have to developed based on the required outcomes which requires a reasonable knowledge about it.
3. What do you think are the key challenges for the future development of ML?
- First of all the establishment of new IT-Infrastructure is required to generate new value. Sometimes this goes along with system changes. Moreover, this changes the entire business model because the IT department is becoming the core of the digital business models especially in pharma's. This is due to the fact that the IT department is the highly profitable and not only a department which requires high investments.
- The IT-department requires freedom in their way to undertake tasks and thus needs enabler of efficient ML strategy's and a positive integration within the business model. The majority of the enterprises does not have created that basis yet. The flawless access to data, less homogeneity in the data and a bigger ERP systems go along with a successful implementation.
- The next challenges lays in the IT-department because they do not communicate their results and request well. However, also the top-management has the duty to interact with the IT-department to overcome misunderstandings. Therefore the management has to ensure that employees getting educated according to ML/ algorithms developments and its usage. Trust can be generated to small things which facilitate the workers workflow, e.g. the integration of buttons which overtake a simple task.

4. In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future?

There are three major applications/ technologies based on ML:

- RPA is a common hot topic within the consulting sector fostering efficiency within operations, saving costs as well decrease errors within the process.
- Text and picture recognition is highlighted as well for example for contract management. The identification of pictures can be valuable within the production unit where process can be tracked easily and serial numbers are identified without problems
- Forecasting and Predictions are also important technologies within the process and operations management. While determine potential error sources.

5. In which business units (R&D/ marketing/sales/supply chain etc.) of a (pharmaceutical) company would you see highest potentials for ML applications in the future?

Within pharma's you can implement ML algorithms everywhere, throughout the entire value chain. The overall goal is to increase the performance. Doing so within the production costs (e.g. for planning) can be significantly reduced, within the sales departments margins can be increased by the establishment of longer credible customer relationships, in the purchasing department can be through a good planning costs savings. Also the facility management can be supported by robots who overtake supportive tasks e.g. cleaning or maintenance tasks.

6. What do you think are the main challenges for implementing ML algorithms in a company not using ML so far? What are the success factors of implementing efficient ML routines?

A challenge for companies is to implement ML solutions in a small costs reaching fast reactions and outcomes. The general integration is expensive and takes a data scientist 20 to 400 days in order to deal with missing data, errors establishing a proficient deep learning system. In company which already fostered innovation and technologies that can be reduced due to the different set up and prerequisites. However, nowadays a valuable price model requires at least 10-50 evidences which is not too much. When the IT-structure is not established yet, companies can buy data easily.

7. Where do you identify the biggest potentials for ML in the sales process and what do you think which tasks could be supported in the future sales process through ML?

The biggest potentials are within the offering phase. A well supported pricing is in a heavily related pharma environment a good trigger to foster sales and profits. Moreover, ML algorithm can support the offering for the customer by identifying its needs, but also taking into the account environmental factors as well as examples and outliers.

8. Do you think that a full automatized sales process is realistic and could fully replace humans?

Yes it can happen, but for the moment machines need humans to instruct them

9. Where do you see machine learning in 5 years/ 10 years?

More and more touchpoint will be established in the future years but a real evaluation is impossible at the current stage. The trend is based on general AI and automatizations which foster productivity and efficiency within the society.

Summary Interviewee 5

Interviewee 5 is an employee of KPMG working as a data scientist in the field of CIO advisory. He deals with the implementation of RPA solutions within HR, logistics, procurement and production. He is experienced in the field of data science and mainly has a technological background. During his studies he focused on Physics while he was interesting about new technologies. He agrees that the rise of ML technologies and applications only has started yet. In order to put ML to the next level it is necessary to enable the algorithm to adapt itself to new

environments, new outcomes etc. He mentioned the 3 biggest challenges, namely: IT-infrastructure, Freedom for IT-departments and Communication:
The implementation of ML algorithms often goes along with system changes. Moreover, this changes the entire business model because the IT department is becoming the core of the digital business models especially in pharma's. Thus, the right set up is essential. He also highlights that the IT-department requires freedom and support meaning the flawless access to data, less homogeneity in the data and a bigger ERP systems. Thirdly, communication through the entire business/ company has to be ensured because otherwise the technology is used in a wrong way or misunderstandings come up. Trust can be generated slowly to small things which facilitate the workers workflow, e.g. the integration of buttons which overtake a simple task. Concerning the main capabilities of ML he mentioned RPA, NLP as well as Predictions. He names RPA as a common hot topic within the consulting sector fostering efficiency within operations, saving costs as well decrease errors within the process. According to NLP he states example for contract management examples supported by text recognitions. In the production he identifies picture recognition potential which meaning processes can be tracked easily and serial numbers are identified without problems
Forecasting and Predictions are also important technologies within the process and operations management. The have the potential to determine error sources. Within pharma's ML can help to improve the performance in every unit. Doing so the production costs (e.g. for planning) can be significantly reduced, within the sales departments margins can be increased by the establishment of longer credible customer relationships, in the purchasing department also appear costs savings through credible planning. He concludes that in the future years more and more ML-touchpoint will be established in the entire business value chain but a real evaluation is impossible at the current stage.

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 23.06.2019
Interviewee: Interview 5

1. **Please introduce yourself briefly and describe your position within your company**

Justus is working at Syte, a consultancy boutique specialized in digital health strategy mainly supporting their clients towards tailored client digital health solutions and building up new digital healthcare services and core products. Moreover, academic contributions on new technological trends in the area of e.g. AI/ Ml in the Digital Health landscape are published by Syte.

2. **What's your company's position in the pharmaceutical industry and how would you describe your company in terms of type; dimension and market?**

Type: Small consultancy boutique specialized in medtech, pharma and insurance with big clients like Allianz or MetLife
Dimension: 30 employees
Markets: healthcare-, pharma- and insurance-industry

3. **What are the biggest challenges for your company at the moment?**

Most of the pharmaceutical companies lacking in terms of digitization and technology. For them the digital world is quite new because PC's background is rather "drug" and R&D development rather than using a digital approach in order to implement e.g. new technological

solutions within their business units. To integrate technological solution, changing business models and become data-driven are big challenges for PC's at the moment.

4. **What are the most important key performance indicators (KPI's) within your sales department?**

Often, sales forces have revenue targets and specific sales goals. However, these targets often depend on the market: (OTC vs. GKV vs. PKV – in Germany)
Another component is the knowledge of the salesforces, because often sales representatives have to be experts in the field where they sell in order to serve the client best.

5. **Which different sales types exist within your company and who are they targeting?**

That also depends on the particular PC. Some pharma companies lay their salesforce off because they are not required anymore. However similar to the KPI's section it also depends on the market (OTC/GKV/PKV)

6. **Given your opinion what are the typical tasks in your B2B sales department? Are they classified (e.g. repetitive vs non-repetitive tasks/standardized vs. non-standardized tasks/daily vs. weekly vs monthly tasks)?**

The typical task of sales representatives is to work scientific using an educational approach to guarantee an expert status in order to answer every question the client might ask. Moreover, sales representatives creating a marketing push in order to arouse interest in the new product. Often the target group are doctors who have no time. That is why, pitches/ product presentations need to be on point, tailored, short and precise. In that sense, the representatives have to be available for their customers 24/7, because in case there are important questions arising it is important to respond quickly to client's request.

7. **What are the biggest challenges of the internal B2B sales process?**

Basically, the biggest challenge the sales representatives are facing is time. On the micro-level doctors don't have time to listen to the representative (only 5-10min max.). Therefore, the salesforce need to transfer the complex message quickly. Moreover, the salesforce needs to organize their schedule (time and location) effectively because to arrange meetings with doctors and other potential clients seems very difficult.
On the macro-level it is important to cover all potential clients geographically and to analyze the lessons learned from previous sales.

8. **In your point of view, what are the main capabilities of ML and which technologies and functions may be enabled by these capabilities in the future**?

AI/ML are self-trained systems which have a greater ability to discover pattern easier (with less effort) than the humans. Often, it solves problems which cannot be solved by humans. Since it can compare a huge combination of variables ML can derive results the human cannot discover.

9. **In which business units of a (pharmaceutical) company would you see highest potentials for ML applications in the future?**

The biggest potential is probably in the R&D area. With ML clinical trials might be enhanced and thus, customer interaction might be improved too.

10. **What do you think are the main challenges for implementing ML algorithms in a company not using ML so far? What are the success factors of implementing efficient ML routines?**

The challenge of PC's is nowadays to guarantee the data access. For organizations is essential to educate and train the employees in order to point out which potentials AI/ML may have and how to use it effectively. For that, PC have to reorganize their business units and position themselves new, including new service units.

11. **Do you think that a full automatized sales process is realistic and could fully replace humans?**

Also in future, not everything can be automatized, since the human component is essential. Fields of implementation might be:

In short term: process optimization/ support
In middle term: Taking individual/ own decisions
In long term: Self-control and optimization of processes and operations

Summary interviewee 6

Interviewee 6 is working in a consultancy boutique specialized in digital health strategy mainly supporting their clients towards tailored client digital health solutions and building up new digital healthcare services and core products. Moreover, academic contributions on new technological trends in the area of e.g. AI/ Ml in the Digital Health landscape are published by his company. As a pharma experts he confirms that pharma's lacking in terms of digitization and technology. For them the digital world is quite new because their background is rather "drug" and R&D development than using a digital approach in order to implement e.g. new technological solutions within their business units. To integrate technological solution, changing business models and become data-driven are big challenges for pharma's at the moment. He mentions that the salesforce often have specific and challenging goals which depend on the market: (OTC vs. GKV vs. PKV – in Germany). Moreover, he describes them as a valuable source of knowledge. The common tasks of sales reps is customer service meaning that the salesforce uses an educational approach to guarantee an expert status in order to answer every question the client might ask. Sales representatives must create a marketing push in order to arouse interest in the new product. Often the target group are doctors who have no time. That is why, pitches/ product presentations need to be on point, tailored, short and precise. In that sense, the representatives have to be available for their customers 24/7, because in case there are important questions arising it is important to respond quickly to client's request. . On the micro-level doctors don't have time to listen to the representative (only 5-10min max.). Therefore, the salesforce need to transfer the complex message quickly. On the macro-level it is important to cover all potential clients geographically and to analyze the lessons learned from previous sales. There he sees machine learnings greatest potential because these systems are self-trained and have a greater ability to discover pattern easier (with less effort) than the humans. Often, it solves problems which cannot be solved by humans. The main challenge he identifies for pharma's is nowadays to guarantee the data access. For organizations is essential to educate and train the employees in order to point out which potentials AI/ML may have and how to use it effectively. For pharma's it means to reorganize their business units and position themselves new, including new service units. The potential fields in sales are according to him process optimization/ support (short term), Taking individual/ own decisions (middle term), self-control/ optimization (long term).

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 17.05.2019
Interviewee: Interviewee 7

1. Please introduce yourself briefly and describe your position within your company

Interviewee is a current employee of Novartis. He is currently in the financial department within the commercial commission in "general pharma". He is currently dealing with AI/ML in a cash flow project. He undertook a dual study program in Roche and undertook his master in Finance at ESADE.

2. What's your company's position in the pharmaceutical industry and how would you describe your company in terms of type; dimension (employees) and market (markets your company is targeting)?
Company: Novartis
Employees: 125.000
Market: Biotech- & Pharmaceutical Company
3. What are the biggest challenges for your company at the moment?
The biggest challenge for Novartis is currently the restructuring due to the new CEO (2018). Since Novartis was specialized also in vet-medicine/ generic drug development etc. the new approach is to follow more cutting edge therapies. These therapies and particular drugs have high R&D costs and thus, are very expensive for the end-consumer. E.g. a one-time therapy to combat leukemia cost 500.000€ with refund policy in case the therapy doesn't affect the patient. The challenge is that most of the patients cannot afford this expensive therapies and drugs, thus there is a huge pressure on health insurance companies. That is why the question is how companies can access new treatments to an affordable price for the end-consumer. Moreover, there are country specific restrictions e.g. for Marketing where in the US open "drug marketing" is possible, whereas in Germany/ CH it's forbidden.
4. What are the most important key performance indicators (KPI's) within your sales department?
It also depends on the country. In Germany it is forbidden to track the rev/salesforce/doctor because that will lead to bias results. In the Switzerland it is possible. However, sales representatives have clear defined goals they have to achieve. That is why client calls, closing ration or client meetings (how often) are tracked. Moreover, the particular sales representative needs to document the meetings outcome/ content and has to track how the conversation went and which problems the client might have.
5. Which different sales types (inside/outside sale, client services, lead generation etc.) exist within your company and who are they targeting?
Mostly exist sales representative which are mainly focused on the doctors because the doctors and hospitals are the decision makers and based on them the purchases are made.
Typical B2B process is the following:

In case the Novartis sell huge amounts to particular wholesales companies key accountants mange the sales/interaction and relationship.
6. What are the typical steps of the B2B sales process within your company?
Same steps.
7. Given your opinion what are the typical tasks in your B2B sales department? Are they classified (e.g. repetitive vs non-repetitive tasks/standardized vs. non-standardized tasks/daily vs. weekly vs monthly tasks)? Are there any tasks outsourced?
The sales tasks are usually not outsourced because it is important to establish a strong client-representative relationship. Sales responsibilities can be first to interact with the doctors, later managing and control specific regions/areas. The responsibility will increase during time. Moreover, typical sales tasks are cold calling, client meetings, consulting, relationship management, identification new clients.
8. What are the biggest challenges of the internal B2B sales process?

The biggest challenges are to fulfill the challenging preset goals. Sales representatives are under time pressure and always on track. They need to save time e.g. for traveling, checking mails and documentation of client meetings.

9. In what level, technology is already integrated within the sales process in order to support the mentioned tasks and challenges? Are there technological incentives within your company to foster technology?

Novartis has a tech-hub in Barcelona which deals with new technologies AI/ML and new Apps. ML is mostly used to predict actual forecasts with a high percentage of accuracy. An example is balance sheet prediction as well as the forecasts of specials sales events and its potential sales volume and of course yearly sales rates. Moreover, an app was released to support the documentation and travel planning process of sales representatives. Besides, an app for real time data about the company was released to give employees an overview about e.g. yearly sales, revenue and other company related information.

10. What are the lessons learned from the implementation of a new technology?

Data Scientists, physicians or math experts are lacking in terms of business know-how meaning that their chosen variables for sales forecasts might be completely different from the ones business people are choosing. There must be an exchange between the "IT-guys" and the business unit in order to use new technology and smoothen the integration process.

11. Are there any AI/ ML applications already implemented in the current sales process?

The app which he described up.

12. What do you think at which touchpoints ML could support your daily work?

Forecasting and prediction -> Optimization and time saving.

Summary Interview 7

Interviewee is a current employee of Novartis. He is currently in the financial department within the commercial commission in "general pharma". He is currently dealing with AI/ML in a Cash flow project. He undertook a dual study program in Roche and undertook his master in Finance at ESADE.

From his point of view the biggest challenge of pharma's is the access to new treatments to an affordable price for the end-consumer.

Moreover, there are country specific restrictions e.g. for Marketing where in the US open "drug marketing" is possible, whereas in Germany it's forbidden. According to interviewee 7 sales representatives have clear defined goals they have to achieve, but they are constantly on track and under time pressure.

That is why client calls, closing ration or client meetings (how often) are tracked. Moreover, the particular sales representative needs to manually document the meetings outcome/ content and has to track how the conversation went and which problems the client might have. Most of the clients are doctors, hospitals, drug stores and wholesales who are often restricted in time. Sales responsibilities start with interacting with the doctors, later managing and control specific regions/areas. The responsibility will increase during time. Moreover, typical sales tasks are cold calling, client meetings, consulting, relationship management, identification new clients.

Besides, he agreed on the sevens steps of the sales tasks but mentioned that they don't have a clear separation between particular steps and responsibility. According to him pharma's started to shift their focus more on digital within the last years. In his department ML is mostly used to predict actual forecasts with a high percentage of accuracy. An example is balance sheet prediction as well as the forecasts of specials sales events and its potential sales volume and of course yearly sales rates. Moreover, an app was released to support the documentation and travel planning process of sales representatives. Besides, an app for real time data about the company was released to give employees an overview about e.g. yearly sales, revenue and other company related information.

The problem he sees is the communication between the department and the hub which develops Novartis specific algorithms in Spain in terms of that the choose variables of data scientists for sales forecasts might be completely different from the ones business people are choosing. He mentioned that there must be an exchange between the "IT-guys" and the business unit in order to use new technology and smoothen the integration process.

The Impact of Machine Learning on the efficiency of the B2B Sales Service in Pharmaceutical Companies

RQ: How can Machine Learning-enabled tech/functions maximize the efficiency of the B2B Sales Service for Pharmaceutical Companies in future?

Interviewer: Mr. Tobias Brengel Date: 31.06.2019
Interviewee: Interviewee 8

1. Please introduce yourself briefly and describe your position within your company

Interviewee is currently employed as a pharmacist at a pharmacy in a small city with about 11.000 inhabitants. He was able to gain 30 years of practical experience working as a pharmacist for various pharmacies. After studying at Johann-Wolfgang-Goethe University in Frankfurt he attained his state exam in pharmacy and his approbation to work as a pharmacist.

2. What's your company's position in the pharmaceutical industry and how would you describe your company in terms of type; dimension (employees) and market (markets your company is targeting)?

Company: Pharmacy
Employees: 3 Fulltime-employees, 5 Part-time-employees, averaging about 6 FTE per workday
Market: Direct distribution of pharmaceuticals and prescription drugs to the final customer

3. What are the biggest challenges for your company at the moment?

The growth of online pharmacy business in general is a huge challenge for conventional pharmacies. They are oftentimes able to offer pharmaceuticals at a significantly lower price due to advantages in cost of personnel and economies of scale. Conventional pharmacies have to build on advantages like better service and face-to-face medical advice.

The introduction of digital prescriptions in Germany, promoted by minister of health Jens Spahn might pose a significant threat to brick-and-mortar pharmacies in the whole country. While doctors are currently only allowed to issue prescriptions for drugs and pharmaceuticals in a printed form, they might have the ability to issue them as a digital document. Patients then would be able to directly transfer those prescriptions to their chosen online pharmacy. The conventional pharmacies would get completely left out in this transaction or at least lose a significant amount of business and revenue.

Rising complexity in legal restrictions and a rising number of "Pharmazentralnummern" in recent years have also lead to a steady increase in administrative effort. Therefore a lot of workforce is forced to do a lot of manual administrative tasks on a daily basis that cannot be automated due to regulations requiring them to be in filed in an analogue form.

4. What are the most important key performance indicators (KPI's) within your sales department?

It also depends on the country. In Germany it is forbidden to track the rev/salesforce/doctor because that will lead to bias results. In the Switzerland it is possible. However, sales representatives have clear defined goals they have to achieve. That is why client calls, closing ration or client meetings (how often) are tracked. Moreover, the particular sales representative needs to document the meetings outcome/ content and has to track how the conversation went and which problems the client might have.

5. Which different sales types (inside/outside sale, client services, lead generation etc.) exist within your company and who are they targeting?

The pharmacy mostly targets final customers of drugs and pharmaceuticals. Due to its character as a brick-and-mortar store the pharmacy is only limited to regional customers that mostly live in the city the pharmacy is located in or that live in smaller villages in the area without a pharmacy.

There is also some form of B2B-sales as the pharmacy delivers medicine to a few local retirement homes. For an additional surcharge this service also includes a blistering service of medicine in individual packaging for individual patients.

6. What are the typical steps of the B2B sales process within your company?

There is no typical B2B-process in pharmacy.

The steps from the perspective of a typical pharmaceutical wholesaler are:

1) A sales representative directly contacts the pharmacy via mail or phone
2) The sales representative visits the pharmacy for face-to-face negotiations
3) During negotiations the sales representative can only offer a smile

7. Given your opinion what are the typical tasks in your B2B sales department? Are they classified (e.g. repetitive vs non-repetitive tasks/standardized vs. non-standardized tasks/daily vs. weekly vs monthly tasks)? Are there any tasks outsourced?

This question is not applicable for the sales process of a typical pharmacy.

From the perspective of a pharmaceutical wholesaler:

Sales employees are usually employed directly by the wholesaler

8. What are the biggest challenges of the internal B2B sales process?

This question is not applicable for the sales process of a typical pharmacy.

9. In what level, technology is already integrated within the sales process in order to support the mentioned tasks and challenges? Are there technological incentives within your company to foster technology?

On every level of the sales process of pharmaceuticals a lot of documentation has to be filed. If these documentation processes could be more automated i.e. through technologies of Intelligent Automation the overall workload could be reduced significantly. This work effort could be invested in more important tasks like the advisory of patients and customers. A challenge in the implementation of such technologies is that the respective documentation usually has to be filed and stored in an analogue way on paper and in a written form.

10. What are the lessons learned from the implementation of a new technology?

Oftentimes the implementation of new technology can bring more complexity and more work effort for the employees in a pharmacy. Regulatory bodies usually believe that they are able to implement more laws and regulations due to overall technological progress. They imply that there is no rise in overall workload caused by more regulations because information technology can facilitate a decrease in necessary workload that evens out the additional workload of more regulations.

11. Are there any AI/ ML applications already implemented in the current sales process?

There are currently no AI/ML applications in the sales process of the pharmacy.

12. What do you think at which touchpoints ML could support your daily work?

These technologies have a lot of potential to automate manual, error-prone processes. An implementation as early in the sales process as at the doctor's office that issues the prescription could already reduce a lot of work effort along the complete process.

These technologies can also be used to provide more individualized customer service in the sales process. On the basis of customer or medical data up-selling and customer care potential could be identified for the benefit of both parties.

A lot of customers seek medical advice from their pharmacists. This advice could become more useful and personalized if a ML/AI application could help identify the customer needs based

on previously collected data and the described symptoms. The pharmacists could issue the best fitting drug and could also avoid the risk of issuing a substance that the customer is allergic to.

Summary Interview 8

Interviewee 8 gained 30 years of practical experience working as a pharmacist for various pharmacies. After studying at Johann-Wolfgang-Goethe University in Frankfurt he attained his state exam in pharmacy and his approbation to work as a pharmacist. The biggest challenges he identified in the growth of online pharmacy business. They are oftentimes able to offer pharmaceuticals at a significantly lower price due to advantages in cost of personnel and economies of scale. Conventional pharmacies have to build on advantages like better service and face-to-face medical advisory, same as sales reps from big pharma companies. The second challenge is rising complexity in legal restrictions and a rising number of "Pharmazentralnummern" in recent years have also lead to a steady increase in administrative effort. Therefore a lot of workforce is forced to do a lot of manual administrative tasks on a daily basis that cannot be automated due to regulations requiring them to be in filed in an analogue form which is time consuming and monotonous. Within pharmacies is no typical B2B-process implemented but interviewee 8 identified the steps from the perspective of a typical pharmaceutical wholesaler as:

1) A sales representative directly contacts the pharmacy via mail or phone
2) The sales representative visits the pharmacy for face-to-face negotiations
3) During negotiations the sales representative can only offer a smile

On every level of the sales process of pharmaceuticals a lot of documentation has to be filed. If these documentation processes could be more automated i.e. through technologies of Intelligent Automation the overall workload could be reduced significantly. This work effort could be invested in more important tasks like the advisory of patients and customers. These technologies have a lot of potential to automate manual, error-prone processes. An implementation as early in the sales process as at the doctor's office that issues the prescription could already reduce a lot of work effort along the complete process.

These technologies can also be used to provide more individualized customer service in the sales process. On the basis of customer or medical data up-selling and customer care potential could be identified for the benefit of both parties.

A lot of customers seek medical advice from their pharmacists. This advice could become more useful and personalized if a ML/AI application could help identify the customer needs based on previously collected data and the described symptoms.

8.3 Appendix 3: Final Model Calculation

Machine Learning Technology meets Sales Tasks – Analysis Lead and Planning Phase

Sales Phase	Task	RPA	Efficiency/ Effectivity	Predictions and Forecasting	Efficiency/ Effectivity	NLP	Efficiency/ Effectivity	Robots & Bots	Efficiency/ Effectivity		Efficiency/ Effectivity per task
Lead and Planning Phase	Gather and visualization of data	Automated visualization and link to e.g. ppt applications as well as implication for decisions on which basis it is easier for the management to make decisions	◐								0,50
	Customer segmentation and data analyses	Automatically collect customer data from different sources throughout customer interaction and derived analyses based on different explanatory variables, identifying more pattern than the normal sales rep because of more data access	◐	Gathering of historical data; clearing of outliers and missing data, exogenous factors which impacting sales; regression, time series analysis for precise forecasts	◕	Through natural processing and optimal character recognition can potential information transferred and saved while improving the forecast quality of the particular use-case	◕				0,67
	Overall phase efficiency/ effectivity per phase per technology		0,50		0,75		0,75			0,67	0,60

Machine Learning Technology meets Sales Tasks – Analysis Offering Phase

Sales Phase	Task	RPA	Efficiency/ Effectivity	Predictions and Forecasting	Efficiency/ Effectivity	NLP	Efficiency/ Effectivity	Robots & Bots	Efficiency/ Effectivity		Efficiency/ Effectivity per task
Offering Phase	Requirement analyses	Automatically collect customer data from different sources throughout customer interaction mails, web-search, trends etc.	◕	Gathering of historical data; clearing of outliers and missing data, exogenous factors which impacting sales; regression, time series analysis for precise forecasts	◕	Through natural processing and optimal character recognition can potential information transferred and saved while improving the forecast quality and identify the particular need and interest of the customer	◕				0,75
	Presentation and product demonstration	Automated preparation of visual graphs which are tailored to customer needs; e.g. templates for product specification can be made and transferred to ppt format and must not be created manually	◕								0,75
	First draft proposal	Automated contract templates might be prepared from the right customer account and also filled in instead of manual adaption to the particular contract	◑								0,50
	Customization analyses	Automated analyses based on the gathered data through emails, calls, contracts, request or CRM and ERP systems, thus, WTP, right timing for approaching the client or other triggers might be identified	◑	Predictions can be derived while matching the customer preferences out of the CRM system with new market trends, customer preference changes etc.	◕	Through natural processing and text/ voice recognition data from customers might be gathered in one system, identifying the customer in terms of temper, situation personal preferences from mails or calls	◔	Customer support bots could easily prepare the gathered data instead of manually writing reports about customer interaction	◑		0,50
	Overall phase efficiency/ effectivity per phase per technology		0,63		0,75		0,50		0,50	**0,59**	**0,63**

Machine Learning Technology meets Sales Tasks – Analysis Closing Phase

Sales Phase	Task	RPA	Efficiency/ Effectivity	Predictions and Forecasting	Efficiency/ Effectivity	NLP	Efficiency/ Effectivity	Robots & Bots	Efficiency/ Effectivity		Efficiency/ Effectivity per task
Closing Phase	Matching Proposal and customer needs					CRM and ERP customer data can be automatically matched with new customer insights/ e.g. mails or calls to mitigate risk of contract errors or mix ups					1,00
	Invoice and contract management	Prepare and deliver invoices from the right email accounts; With an RPA bot programmed to retrieve that data, your payment data can be invoked in seconds with a single click from the rep and also can calculate the right WTP						Prepare and deliver invoices from the right email accounts; With an RPA bot programmed to retrieve that data, your payment data can be invoked in seconds with a single click from the rep			1,00
	Preparation of the order confirmation and shipping	Prepare and deliver order confirmations and shipping from the right email accounts									0,75
	Final contract check and sign off					CRM and ERP customer data can be automatically matched with new customer insights/ e.g. mails or calls to mitigate risk of contract errors or mix ups					1,00
	Overall phase efficiency/ effectivity per phase per technology		0,88				1,00		1,00	0,96	0,94

Machine Learning Technology matches Sales Tasks – Analysis After-Sales

Sales Phase	Task	RPA	Efficiency/ Effectivity	Predictions and Forecasting	Efficiency/ Effectivity	NLP	Efficiency/ Effectivity	Robots & Bots	Efficiency/ Effectivity		Efficiency/ Effectivity per task
After-Sales	Customer Support	RPA bots software to ensure answers to customer requests and discussions. Moreover, update of new data into the CRM system.	●					Automation and automated answers to different client requests 24/7 through a Chabot. Triggers for cross- and upselling potentials can be identified	●		1,00
	Cross and Upselling Potentials (Trigger)			Gathering of historical data; clearing of outliers and missing data, exogenous factors which impacting sales; regression, time series analysis for precise forecasts	◕						0,75
	Feedback/ Customer Satisfaction Analysis	Instead of Manuel Feedback calls and analyses the system can generated based on the categories and clusters feedback identifying biggest issues and fostering customer satisfaction	●	Gathering of historical data; clearing of outliers and missing data, exogenous factors which impacting sales; regression, time series analysis for precise forecasts	◕	Categorization and Clustering of client request and answers derived from the Chabot system and interpretation of those data e.g. reasoning	●	Derive and gather direct feedback and prepare the data for further processing automatically	●		0,94
	Overall phase efficiency/ effectivity per phase per technology		1,00		0,75		1,00		1,00	0,94	0,90

Machine Learning Technology matches Sales Tasks – Analysis Data Management

Sales Phase	Task	RPA	Efficiency/ Effectivity	Predictions and Forecasting	Efficiency/ Effectivity	NLP	Efficiency/ Effectivity	Robots & Bots	Efficiency/ Effectivity		Efficiency/ Effectivity per task
Data Management	Data tracking and data "feed" in systems	Write a simple bot to update your CRM records with customer contact data	◑					Write a simple bot to update your CRM records with customer contact data	◑		0,50
	Data analyses	Derive and gather direct feedback and prepare the data for further processing automatically	◕	Gathering of historical data; clearing of outliers and missing data, exogenous factors which impacting sales; regression, time series analysis for precise forecasts	◕	Categorization and Clustering of all different kind of data and answers derived from the Chabot system and interpretation of those data e.g. reasoning	◕	Derive and gather direct feedback and prepare the data for further processing automatically	◕		0,75
	Data Maintenance	Instead of manual data replication, bots can update accounting records	◑					Instead of manual data replication, bots can update e.g. accounting records	◑		0,50
	Data storage and real time information	RPA bots software to ensure that changes in CRM are uploaded to scorecards so sales reps can see their progress real time; .	◑					RPA bots to ensure that changes in CRM are uploaded to scorecards so sales reps can see their progress real time	◑		0,50
	Overall phase efficiency/ effectivity per phase per technology		0,56		0,75		0,75		0,56	0,66	0,56

Machine Learning Technology matches Sales Tasks – Relationship Management/ Summary

Sales Phase	Task	RPA	Efficiency/ Effectivity	Predictions and Forecasting	Efficiency/ Effectivity	NLP	Efficiency/ Effectivity	Robots & Bots	Efficiency/ Effectivity		Efficiency/ Effectivity per task
Relationship Management	Permanent customer interaction	RPA bots software to ensure answers to customer requests and discussions. Moreover, update of new data into the CRM system.	●					Automation and automated answers to different client requests 24/7 through a Chabot. Triggers for cross- and upselling potentials can be identified	●		1,00
	E-Mail screening					Automated analyses and identification of spam mails as well as customer and company internal mails categorization as well as prioritization of those	◕				0,75
	Addressability analyses	Automated collection from potential clients from databases and visualization in ppt format for regarding future potential clients	◔	Gathering of historical data; clearing of outliers and missing data, exogenous factors which impacting sales; regression, time series analysis for precise forecasts	◕						0,50
	Travel- & cost planning & billing	Insert of customer, meeting time and automated answer on when to start, where to go (best route) while constantly providing you with real time data about e.g. traffic information	●	Time and travel forecast can figure out the most time saving way and route to your customers and provide you with real time information	●						1,00
	Overall phase efficiency/ effectivity per phase per technology		0, 75		0,88		0,75		1,00	**0,88**	**0,81**
Overall Rate Efficiency/ Effectivity Rate (Technology)			**0,72**		**0,78**		**0,78**		**0,75**		