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Executive Summary
Automatization of Decision Making

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List of Abbreviations

AI	Artificial Intelligence
BI	Business Intelligence
B2B	Business to Business
IT	Information Technology
OEM	Original Equipment Manufacturer
RQ	Research Question

1 Problem Definition

This paper is based on a project between a group of Management Center Innsbruck (MCI) students and PIKON Deutschland AG. The project consists of a qualitative research in the field of automated decision making, which was conducted in collaboration with five companies selected by PIKON.

This qualitative research is based on five research questions:

RQ1: *What is the perception towards the automatization of decision making?*

RQ2: *What are the main fields of application?*

RQ3: *Who are the key stakeholders in the decision making of automated processes?*

RQ4: *What are/were the expected/experienced outcomes?*

RQ5: *What are the challenges expected/experienced from idea to implementation?*

2 Research Method

A qualitative research approach is suitable for exploring a specific topic in depth by collecting data using methods such as case studies, observations, and interviews (Myers, 2013, p. 8). In this case, five in-depth interviews were conducted with pre-selected professionals of this field of research. More precisely, these interviews, structured according to the five research questions, were either conducted by telephone or online via Skype. Before each interview, the interviewees received a one-pager, introducing the topic of automated decision making in order to ensure mutual understanding (see *Appendix 1*). After having conducted all five interviews, the interviews were transcribed and coded with regards to the respective research questions.

3 Research Questions and Analysis

In the following, we will address the established research questions and present the data collected throughout the interviews.

3.1 RQ1: What is the perception towards the automatization of decision making?

Artificial Intelligence (AI) is a main theme in the interviews in regard to the area of automated decision making. The understanding and definition varied slightly among the interviewees. One suggests that AI is basically algorithms that, instead of being written by a human, are written by a computer. In this perception, the program is not dynamic or in other aspects more sophisticated than a normal algorithm. The difference is that AI might be faster and better. The same interviewee expressed that the company in general has a conservative view towards the adoption of AI. Another interview participant is more

optimistic, suggesting that AI is algorithms that can, based on big data, find patterns and structures. Based on this, AI can propose decisions, take decisions, or even predict scenarios based on probabilities. In this point of view, the largest differentiator of AI is that these outcomes are improving over time, as more data is provided (which is features of data mining/machine learning). The same interviewee suggests that AI already is a reality with proven business use cases, and that it will be an increasingly dominant topic in the next years. Moreover, it is claimed to be necessary for the survival of a firm on the mid-term, especially for European companies which want to compete on the global market. Another interviewee argued that if the data collection and preparation for automation of decisions is still not a major strategic focus, then these companies will soon disappear from the market. In this perception, it is not a trend, but rather a natural next step of the already established movement towards automation, continuous improvements, and efficiency through digitalization. Furthermore, it is argued that data science is the art of maximizing output while minimizing input, hence AI is only interesting as a mean to this end.

Despite the awareness among the interview partners about the relevance of AI and automated decision processes, the general opinion is that it is either non-existing or at a very early stage in the respective companies. One mentions specifically that, in comparison to competitors, the level of AI is low, arguing that a position upstream the supply chain (distant from end-consumers) generally results in a lower pressure to adapt to new innovative technologies. In this regard, it is expressed how it is difficult to detect the most profitable among the many applications of AI and methods of automation.

It is generally noted that data mining and preparation of data (moving from big data to smart data) are the major first steps necessary to enable further automatizations. Supporting this, one interviewee states that the next step is data mining and to find patterns in the unstructured data existing in the company. Another implies that finding patterns is the first step to enhance the decisions processes in the production (using the example of AI for enabling predictive intelligence in production). In addition, it is mentioned that the production facilities built and designed by themselves have higher potential for automatizations than facilities bought from external manufacturer.

AI and advanced decision processes are argued to be vital for improvements in business intelligence (BI) systems. However, already established processes and organization are carrying out the BI tasks manually or with less advanced support tools. Thus, it reduces the urgency and the opportunity cost of implementing new advanced processes. One interviewee argues that most intelligence in the BI department is human intelligence (as opposed to AI), and that the current processes are organized with employees who manually do the business warehousing, data warehousing,

dashboarding, and other BI related tasks. These established processes are increasingly more insufficient due to the more complex and fast nature of the data being processed, hence an advancement will be increasingly urgent in the years to come.

This belief is starting to dominate on the top managerial levels of most companies interviewed. In general, the interviewees recognize a trend towards more focus on enhancing decision processes from the directors and management board. One interviewee mentions that the new board has advanced enterprise analytics build on AI technology as a major strategic focus. It is generally found that awareness and sense of urgency is highest among young professionals and in the upper hierarchical levels of the organizations. In contrast, an interviewee states that the older generation of managers and the bottom of the organizational hierarchy are reluctant to automatizations. It is a clear trend in the interviews that minority groups within all the interviewed companies are highly aware and motivated to enhance the decision processes, however that the majority of the organization is either unaware or simply uninterested in the matter. Even to the extent where one interviewee expresses how in some parts of the company AI and data science are well acknowledge topics, meanwhile mentioned to the vast majority of the employees, it would be encountered by an arrogant laugh.

3.2 RQ2: What are the main fields of application?

Focusing on the main fields of application of automated decision making, it must be mentioned that several prerequisites need to be fulfilled. One very critical aspect is the structure and consistency of existing data. Moreover, the unification of data is another key requirement in order to be able to apply automated decision making in various fields of work. Based on these prerequisites, it becomes obvious that repetitive, administrative, and operative tasks are more suitable as potential fields of applications than complex strategic tasks. Hence, according to our interviewees, fields of work such as invoicing, billing, logistics, warehousing, tracking of working hours, as well as holiday planning are all potential fields of applications for automated decision making. In the following, these different areas are explained in more detail.

Firstly, one specific field of application is the integration of automated decision making into already implemented IT-systems. SAP for example requires regular checks and time-consuming functionality tests, which can be automatized nowadays. This automation adds additional value and flexibility to every organization using complex IT-systems and can be seen as one practical example of machine learning.

Moreover, another concrete field of application are demand notes, which support the accounting department by automatically sending reminders to customers once the due date for payment is exceeded. Additionally, automated payment systems and digital

billing including scanning of invoices, selecting the invoice amount, and providing several recommendations, can be very valuable for every accounting department. Automatically collecting invoices of worldwide customers, critically evaluating their payment behavior, and finally creating a forecast for future invoices is another opportunity of taking advantage of intelligent systems. Consequently, these systems can support the management in their decision-making process and are a clear application area of AI.

Further examples are automated inbound logistics, which offer several recommendations such as minimum order quantities. Hence, these autonomous systems do not require manual orders, but automatically deliver several components that are necessary for production. Especially in the automotive industry, these autonomous logistic systems are already used and go hand in hand with automatizations in the production process.

Another practical field of application is HR-related holiday planning. When making an application for leave, the supervisor mostly approves these applications. Therefore, this job can also be done by an automated deterministic system. However, in the future there might be an opportunity of intelligent capacity planning including the capability of automatically checking any time-related overlaps with colleagues and therefore delivering optimised holiday planning.

Furthermore, automated controlling of working hours can be realised by tracking cell phones of employees, once they have entered the office building instead of manually clocking in every day.

Another specific example mentioned during the interviews is the application of AI in the final product when it is already delivered to the customer, and not only within the company and its business processes. More precisely, this implies for example automated reminders and notifications sent by machines, once they need maintenance and service depending on the usage or require several spare parts. Eventually, the example of “Google AlphaGo Zero” was discussed in our interviews. AlphaGo Zero does not use any human data, but learns from itself and continually progresses developing new capabilities (DeepMind, 2017, para. 4). Thus, based on the technology of self-learning machines and neural networks, there is a high likeliness that it also finds application in various business fields in the near future.

3.3 RQ3: Who are the key stakeholders in the decision making of automated processes?

To begin with, it can be observed that in the majority of the interviewed companies, projects are initiated on several hierarchical levels. For example on the one hand, executive management is highly interested in developing the company in this regard,

however on the other hand, also on more operative levels, employees are testing to which extent new technologies could be implemented. This applies in particular to employees that are currently performing a lot of manual routine activities. Hence, operative management, which is in charge of these employees, is still showing more initiative than board members. In addition, the creation of specific innovation teams is a method to actively tackle innovative business and improvement initiatives. Also, due to shifts in management from an older to a younger generation, various changes are likely in the near future. As the average age on lower levels is rather high, resulting in a greater lack of creativity and innovative thinking with regard to automation, upper management levels are increasingly pushing several ideas towards the employees. Therefore, it can be suggested that whether a hierarchy level is consisting of younger or more elderly employees has a considerable impact on where ideas are developed and brought forward.

Apart from that, the financial aspect has to be considered. In general, if projects and specific solutions require a rather high budget, they are initiated top-down. Nevertheless, there is an ongoing discussion amongst special expert groups, developing specific use cases which are then presented to the top management. This is for convincing upper hierarchy levels in general, but also to raise awareness on lower levels, so that all involved parties see the advantages of automated decision-making, data science, and AI, and start to propose potential solutions. The latter is especially important if one wants to go from idea to execution, as this is not possible without the basis of the firm. The final decisions are then taken by either the executive management or operative management. Still, lower hierarchical levels have an important stake in deciding whether an initiative has potential to be implemented or not. Only one interview partner stated that a complete top-down approach is in place.

Considering which departments are involved in the final execution, it can be said that all levels and different kinds of departments of a company have to participate, as digitalization is influencing a variety of processes and operations. A cross-functional approach can therefore be seen as key, as only this way employees start to identify with the projects they are part of. Hence, product managers, controllers and sales employees should be included. Even if IT is the main enabler regarding the final implementation, ideas are coming from other areas within the company. Hence, every specialty department additionally has to be enthusiastic about the project and carry it forward. If this is the case, the execution can even become automatic and self-impelling. Regarding the implementation phase, another option is to consult external experts, with expertise in the field.

3.4 RQ4: What are/were the expected/experienced outcomes?

The interviews conducted indicate that the expected outcomes of using automated decision making can be broken down into three separate areas:

- Reduction of complexity
- Reduction of costs
- Better objective decision making.

Several interviewees repeatedly stated that the result of automated processes should reduce the workload for their staff by removing tasks which are considered repetitive and non-value adding. For instance, it is mentioned that much of the workload of highly educated and specialized personnel consists of tasks which are monotonous by nature and do not create any value. Essentially, these tasks are taking up time which could be better spent elsewhere. By implementing automated decision processes, more employee resources are available for staff to undertake value adding activities. This sentiment is shared by an interviewee framing it as “giving people the opportunity to focus on what is really important instead of being bogged down by the unnecessary”. Removing complexity results in more efficient processes which increases the speed at which a company is able to operate.

A topic which is closely related to complexity is cost. The research shows that automated decision-making efforts are often made because companies are attempting to cut down on their expenditures. Any form of automation should be able to reveal areas where companies can save resources. Using an example in procurement where AI would combine orders to trigger the highest possible discounts from the suppliers, the interviewee theorized that this technology could bring about major cost advantages. Whereas the cost savings do not take effect immediately, the investments to develop and implement such a system are high. Accordingly, cost advantages arise in the long run, whereas higher costs arise in the short to mid run.

Another major topic discussed during the interviews was the quality of the decision-making process. It is argued that a proper automated system is able to make better objective decisions than any human could ever make. Due to the fact that a system has a greater ability to take all facts into account to make a decision, it stands to reason that any subjectivity is removed. For instance, automated decision-making systems could be used to offer better products or services to customers by analyzing maintenance cycles. Automated processes appear to be especially useful when products are highly standardized. As the product variation remains small, automated processes can deliver better forecasts, reliability and quality.

3.5 RQ5: What are the challenges expected/experienced from idea to implementation?

During the analysis process we could identify three categories of challenges which are expected or experienced during the implementation of systems supporting automated decision making. These can be structured as follows:

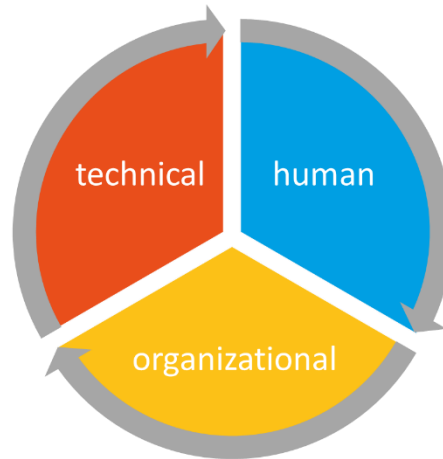


Figure 1: Implementation challenges. Own illustration. Graphic adapted from PIKON Deutschland AG.

One of the main hurdles encountered by the participating companies is related to the collection and unification of data. As mentioned by various interviewees, it is very difficult to collect structured data. This can be associated to the fact that departments and subsidiaries, which grew and developed over time, often use different systems and methods of collecting data, without considering the future merge of data sources. Also, having operations at different production sites enhances the problem of unifying data. Therefore, it can be suggested that, the more complex an organization's structure is, or the more decentralized information is collected, the more severe this problem is. Depending on the industry, also the limited availability of data is an essential hurdle to implementing systems which support automated decision making. The less standardized the processes and data, the more challenging it is to detect patterns which could be used to develop a reliable model for data analysis. Hence, it is essential to facilitate the connection between different systems, with the aim of enhancing the data flow. Another issue experienced related to the technical aspects is that, especially when it comes to complex processes, it is often not easy to confirm whether a decision was correct or not, suggesting that technical developments within AI still need to be improved in order to find more applications.

As framed by one of the interviewees, implementing automation processes does not only depend on technical aspects, but to an equal extend on the human mindset towards

it. A critical cause for people being cautious towards AI related topics is described to be lacking knowledge. Currently, systems supporting autonomous decision processes appear to be a big black-box which is processing data, where the exact steps are not verifiable and comprehensible. Limited understanding about the functioning and application of AI can be explained by a lack of time among employees, who are caught up in their daily business without spare time to immerse into this topic. Additionally, negative reporting by media channels is fueling mistrust among employees, wherefore benefits would need to be highlighted more intensely. Especially in an environment ruled by lacking trust and acceptance, attention has to be paid when implementing automation processes, in order to prevent a contra-productive response from the workforce. In case of missing confidence in the technology, employees might perform parallel double-checks in analog systems, resulting in a waste of resources. In order to increase acceptance and interest among employees, it is in a first step important to properly educate management levels on the topic of AI and all its implications. Not fully understanding the capabilities of AI solutions also triggers existential fears among employees, resulting in resistance. Another challenge mentioned by one of the participating interviewees is a general lack of time to fully dive into the topic of digitalization and AI, due to the complexity and broad field of applications. Therefore, ad-hoc problems are given priority and investigating AI supported solutions is being postponed.

The third category of challenges are organizational issues, specifically related to potential risks. As implied by one of the interview partners, the company is more cautious to implement AI solutions if the risk factors are high. Depending on the industry, mistakes can not only lead to immense financial damages, but could cost human lives. Also, legal aspects need to be resolved before engaging into AI in order to clarify who is responsible in case of faulty procedures and undesired outcomes.

Apart from the challenges mentioned in the field of technological developments, human mindsets and organizational risks, automatization of decision processes is often considered lower priority against alternative projects. One interviewee argued that industries relying less on standardized processes and with lower customer pressure to engage into AI supported systems see their current main priorities in creating a digital workplace and focusing on enterprise corporate management as well as customer relationship management activities. One also has to keep in mind the competitive environment of companies, which encourages market players to focus on digital business models and optimizing competitive capabilities, before allocating resources at the optimization of internal processes. Companies which are already more engaged into the deployment of automated decision making are increasingly investing in and focusing

on the standardization of global processes and the collection of data to build the foundation for a future implementation of AI supported systems and enhancement of efficiency. Due to current developments, investigating cloud technologies and their implications is also interesting for the interviewed companies, but is evaluated critically, as data protection guidelines have to be taken very seriously.

4 Limitations

Naturally, this research entails several limiting factors which need to be commented on. The first limitation can be found in the topic itself, as a broad variety of definitions revolves around AI/data science, which leads to many different opinions across the companies reviewed regarding what the technology is meant to accomplish. On an enterprise level, the interviews have shown that the companies are on very different stages when it comes to implementing automated decision-making processes; while some companies are actively engaged in making their first steps, others are currently not involved in any form. This circumstance leads to the fact that the results cannot directly be compared with one another.

Another issue which needs to be addressed is the number of interviews conducted. Due to time constraints and the requirements set by the research sponsors, only a limited amount of companies was interviewed. As the sample size with five conducted interviews is fairly small, results may be diluted. On a technical level, all of the interviews were done via telephone or through Skype, which may bring issues in and of itself. These communication channels, while practical in use, cannot provide the same amount or quality of data than a face-to-face interview would, where not only spoken word but also gestures and expressions could be analyzed.

In addition, the interviews were conducted solely with experts in IT or process engineering who may have a different view regarding this topic than staff members from other departments. It would have been highly interesting to analyze statements from different areas in organizations that may not have such a great knowledge on this subject compared to their expert colleagues. For instance, conducting interviews with members of the upper echelons of the managerial hierarchy would have been highly valuable, as those people are actively involved in steering a company.

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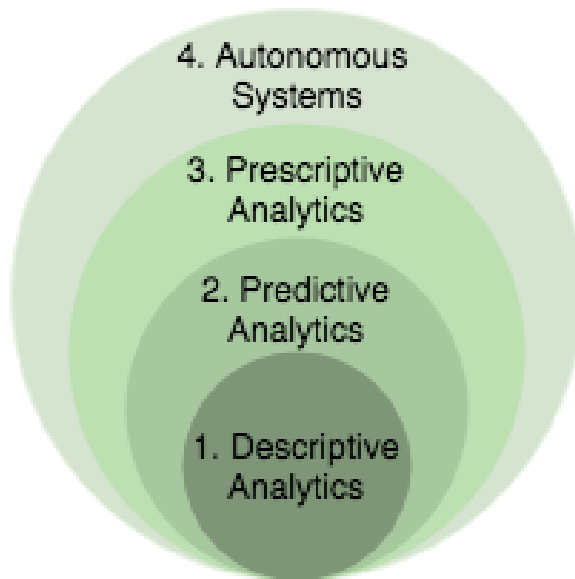
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Appendix 1 – One-Pager

4 Levels der Automatisierung

Künstliche Intelligenz kann für die Aufbereitung von Daten und deren Analyse benutzt werden.

Automatisierte Entscheidungsfindung kann in vier aufeinander aufbauende Stufen dargestellt werden:



Level	Beschreibung
1	<i>Data supported human decisions</i>
2	<i>Model supported human decisions</i>
3	<i>Human-supervised automated decisions</i>
4	<i>Automated decisions</i>

----- Anwendungsbeispiel -----

Es muss darüber entschieden werden, welche Zahlungsmöglichkeiten (z.B. Kredit, Skonto, Direktüberweisung) dem jeweiligen Kunden angeboten werden sollen.

Level 1: Ein Überblick über die finanzielle Situation des Kunden wird anhand verschiedener KPIs aufgezeigt.

Level 2: Die Analyse prognostiziert in welchem Zeitraum der Kunde die Rechnung begleichen wird, woraufhin der Mensch eine Entscheidung treffen kann.

Level 3: Basierend auf den Prognosen erhält man Empfehlungen, welche Zahlungsmodalitäten dem Kunden zur Auswahl gestellt werden können.

Level 4: Die geeigneten Zahlungsmethoden werden vom System automatisch ausgewählt und dem Kunden angeboten.