

AI-assisted strategic and tactical workforce planning

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ABSTRACT,

This is an explorative research, which aims to answer the following research question: “What is the effectiveness of AI in mid- and long-term workforce planning?” Existing literature has been compared with new empirical data gathered through 6 interviews of experts on the area of artificial intelligence and workforce planning. Unfortunately, there is few research on the integration of AI in mid- and long-term workforce planning. This is mostly due to the novelty of this topic. This research will contribute to the theory by helping to fill this literature gap. This research’s practical contribution will include providing practical information for companies and organizations that might be on the edge of implementing AI into their workforce planning. The study found that resource allocation and demand forecasting, two parts of both mid- and long-term workforce planning, can be mostly done by tools like Microsoft Copilot, offering a high effectiveness of the process and outcomes.

The key take-aways of this study are that AI looks very promising to increase the effectiveness of the workforce planning. However, there are several limitations and obstacles that should be considered. Many organizations are resistant to AI, and a large and up-to-date dataset is required. This could lead to high costs, since the dataset would first have to be established. Fully automated AI might not be possible in very dynamic and complex environments, like health care. This is mostly due to the fact that it is hard to get consistent data in a dynamic environment, on which the AI can learn. A golden mean between AI and humans should be desired, in which AI will support humans by easing the process and in which humans will support AI by checking the accuracy, maintaining the system with new datasets and to help with decision-making in complex scenarios.

Further research might be needed at a later point to determine whether AI-supported planning turned out to be profitable and effective for different organizations. Future research could also include more research about the flexibility of AI, with regards to the ability of AI to respond and adapt to changing variables in the environment.

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Keywords

Artificial Intelligence, workforce scheduling, strategic planning, tactical planning, demand forecasting, resource allocation

I. INTRODUCTION

Workforce planning is a very important part of resource management, and therefore a critical process for companies and organizations.

Workforce planning aims to find employee shift arrangements to match a time-varying customer demand for service while keeping costs under control and satisfying all applicable regulations (Castillo et al., 2009).

Consequently, improving this process could lead to higher profits for profit-driven companies or it could lead to lower costs for purpose-driven organizations.

Almost needless to say, many organizations are trying to improve their workforce planning. However, despite the fact that workforce planning is recognized as an important process, there is still a gap in understanding the effectiveness and implications of AI integration in this process.

With the rapid developments of artificial intelligence (referred to as AI), there might just be an option to automate this workforce planning process. There have already been reports of research where a digital optimizer increased the time spent on the job by crew members from 44% to 65% (McKinsey, 2022). AI can be particularly helpful since workforce planning is a complex process in which lots of mistakes can be made by humans. Examples would be understaffing and overstaffing (Barrick et al., 2015), poor forecasting (Sanders & Graman, 2009) and non-compliance with labor laws (Remington, 2007).

But how could AI improve this? Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems (Burns & Lawton, 2023). This means that certain programs or code can be written by developers that will give machines the ability to completely schedule a whole workforce. However, it is good to differentiate between the AI's technical features and its' practical use. Even though AI can make this schedule, the final decision-making and supervision is often still the responsibility of human managers. This highlights the importance of human judgment still playing a role in workforce planning.

Traditional workforce planning would often be done by a manager, who would simply divide the needed hours over the available staff. Especially at the beginning of the industrialization, workers would just have to come in to work.

However, in the past decades there has been a bigger focus on employees' wishes (Costa et al., 2004), which is making planning more complicated by adding more requirements. Besides that, more and more policies have been coming into place, which is making the process more complex.

This paper will focus on mid- & long-term planning

of the workforce. This choice was made in order to not get into the processes too much, since these can differ a lot per industry. This way there is an opportunity to provide a comprehensive view on AI integration that can be relevant to most decision-makers and organizations. Workforce planning can be divided into strategic (long-term), tactical (mid-term) and operational (short-term) workforce planning (Bechet, 2008). Strategic workforce planning concerns making decisions about workforce sizes for example. These decisions are made based on estimations about the demand. Tactical workforce planning is mostly about "having the right number of professionals with the right skills in the right place at the right time" (Lopes et al., 2015). Operational planning is very short-term, most of it being within the timespan of a week. Operational planning could be divided into 2 subsections, namely online and offline (Hans, 2015). Online operational planning means making decisions on the fly; it is about adapting to circumstances and making decisions right now with new information. Offline operational planning is about making decisions for the upcoming week or so, with information that is at one's hand at that point. This research, however, will not focus on operational planning, since the decisions on the go seem less feasible for AI-implementation. AI namely excels in environments with bigger datasets and clear patterns. But last-minute changes can lead to unpredictable elements and can require a level of human expertise and intuition which AI does not have (Korteling et al., 2021). However, when AI keeps advancing this is definitely something to be researched in the future. Workforce planning is basically about finding a match between demand and supply. However, in certain worlds, like healthcare, demand fluctuates a lot (Liu et al., 2010, Green et al., 2006).

In this research, a distinction will be made between classic planning and AI-assisted planning. This will allow the report to give a clearer overview of the different methods in use and to mention the strengths and limitations of AI-assisted planning. Self-planning is a popular way of planning as well, but it will not be discussed in this report since it is not relevant for strategic workforce planning. Self-planning is often done at an operational level, namely by employees instead of managers (Brown et al., 2008).

Classic planning is where a manager creates a schedule. This can be done manually or with help of basic software tools like Excel. It could involve using historical data to illustrate and predict demand for upcoming years.

AI-assisted planning will require the planning process to be organized in such a way that it can be mostly done by artificial intelligence. This can be an expensive and time-consuming process (Li et al., 2018) before one gets to the desired state. However, AI seems to be promising with regards to planning under uncertainties (Li et al., 2018).

So this is a consideration that every organization must make for themselves and there could be certain trade-offs. In order to make the right decision here, organizations should be informed about the possibilities and limitations of AI-assisted planning. This report will elaborate on this in further detail, but for AI to operate in a correct manner, quantitative and qualitative data are needed. However, since this technology is so new, there is relatively little literature research on this. Besides that, a lot of the literature is focused on short-term shift scheduling, and not so much on mid- and long-term planning. The feasibility and long-term effectiveness of AI integration into workforce scheduling remains underexplored, which highlights the importance of this study. This report will therefore focus on the following research question:

“What is the effectiveness of AI in mid- and long-term workforce planning?”

This study is conducted in a use-oriented way instead of a design-oriented way (Bailey & Barley, 2020). There are already plenty of options with AI, therefore it is not that interesting to look at the design of these systems anymore. It is more interesting to see how these technologies can be used and whether they can be adapted to. Consequently, this report will focus on the impact AI can have on mid- and long-term workforce planning, where it will explore the possibilities of AI without actually creating or training any systems. Subsequently, this report will hope to provide some more clarity on the benefits, but also the limitations of AI-assisted workforce planning.

II. THEORY

General AI

Artificial intelligence is the theory of human intelligence being exhibited by machines (Helm et al, 2020). The main components of AI are machine learning and deep learning. These are also often referred to as subsets of AI.

To elaborate on these three components briefly:

- Artificial intelligence
Developing computer systems to perform tasks that would normally require human intelligence
- Machine learning
Giving computers the ability to learn without being explicitly programmed to do a certain task
- Deep learning
Algorithms with brain-like logical structures, enabling it to ‘learn like humans’.

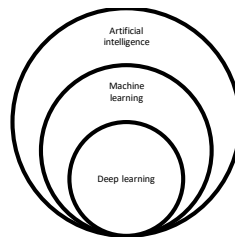


Figure 1 Graphical representation of AI subsets

For integration into workforce scheduling, machine learning is most likely the best solution. Machine learning’s ability to handle large datasets, predict trends and optimize scheduling based on parameters makes it the most feasible option.

Without delving too deep into the technical aspects of machine learning, these are some aspects that machine learning could already help with (McKinsey & Company; SutiSoft, 2023):

- Predictive analysis
Future staffing needs can be predicted based on historical data and trends.
- Optimization
Algorithms can help to balance factors like employee availability, labor laws and organizational needs.
- Automation
It can reduce the manual work of scheduling by automating routine tasks so managers can focus on more complex decision-making.

Mid- & long-term planning

This report will focus on mid- and long-term planning. Mid-term workforce planning is also known as tactical planning, whereas long-term workforce planning is also known as strategic planning.

To help understand this planning process, a distinction will be made between the design phase and the use phase of the process.

The design phase

First a step back will be made, towards the design phase. This could help achieve some more knowledge about the process and will work up to a conceptual model.

An aspect of planning, which is an aspect of both strategic and tactical planning, that will be discussed in this report, is demand forecasting (Dall et al., 2015).

Demand forecasting is a method that has been used for ages. One could say it was already being used hundreds of years ago. Farmers knew that the demand for bread was basically steady for all year, so they knew they could keep producing it. Hunters knew there would be an increased demand for animal fur when the colder months were coming. Demand forecasting can therefore simply be summarized as using history as a guideline for the future. However, there is obviously more to it nowadays.

Methods like trendlines, percentage adjustments, 12 months-moving averages and seasonalized forecasts (Ozcan, 2014) are often used for demand forecasting. These methods are generally used at a strategic planning level, and they can work well for forecasting. However, managers should realize that their environment can be very dynamic. This means that managerial judgment will be very important to take internal and external variables into account (Cote & Tucker, 2001). Demand forecasting can also be done on a strategic level. At a strategic level a hospital could look at long-term trends like the aging of a population, which could lead to more demand (World Health Organization, 2018). This will give them more data about whether they should increase their supply.

This demand forecasting can also help in the resource allocation process.

Resource allocation is also a form of both strategic and tactical planning (Dall et al., 2015).

Resource allocation is making sure the right resources are at the right place at the right time. One could take the Covid-19 pandemic as an example. Hospitals could speculate that there would be more contaminations and more hospitalizations in the winter months. They could therefore start taking measures in order to make sure that there would be enough respirators to comply with demand.

However, people that can provide health care are not unlimited and neither are the resources. Due to the fact that limitation is inherent to the human condition, demand will always exceed supply in health care (Kluge, 2007).

Therefore, it is very important for managers to make sure resource allocation happens carefully.

The planning of the workforce is one of the hardest and most important problems managers face (SHRM, 2019). This is especially the case in health care, where service levels must be provided to maximize the outcome and minimize the financial costs (Lopes et al., 2015). It is a process revolving around a lot of complexity and should be flexible. Unlike many other resource allocation problems, workforce planning revolves mostly around people. This means that the decision environment tends to get very dynamic and workforce planners face an extremely heterogeneous set of employees (De Bruecker et al., 2014).

Certain characteristics of employees will be discussed on how they influence the planning process. The first one would be the flexibility of the internal employees. This could affect the tactical planning mostly. If a manager knows that employees can work in different locations and roles, it could make the resource allocation more effective (Hopp, 2004). However, the flexibility of employees depends on a lot of factors. Their flexibility is influenced by, but not limited to, the leadership style of the manager (Bass, 1985), the current work-life balance (Kossek & Ozeki, 1998) and their overall job satisfaction (Judge et al., 2001).

Autonomous employees, employees that are able to take on responsibilities and make certain decisions by themselves, can help managers by being more independent. This means that this can help the resource allocation, since it will allow the employees to rotate through different jobs and roles and work with different machines (Ortega, 2001). Organizations could choose to educate their managers and decision-makers in this subject through means such as courses and workshops. Because people that understand more about the AI, are more able to provide feedback to the developers, which could increase the efficiency of the tool (Ransbotham et al., 2017).

Another element of workforce planning is the workforce. The workforce consists of the aforementioned employees, but it also includes a few other characteristics that are based on organization size: namely the workforce size and number of locations. Resource allocation gets a lot tougher when there are multiple locations to allocate the resources to, or when there is a variety of workforce rules that requires certain resources to

always be present (Sier, 2005). More employees in your workforce, or having them spread over multiple locations, simply means more planning to do. This does not always necessarily make the work harder, but it gives more opportunity for mistakes. Two other factors affecting the complexity of the workforce, regard the employees. Employee availability and workforce diversity can make the workforce more complex. A low availability of the employees gives less wiggle room while making schedules and might make a manager reconsider their staffing needs with respect to their strategic planning. As shortly mentioned before in a different context, a highly diverse workforce can ease the resource allocation process. Simply because having multiple skillsets will allow managers to make employees perform different roles and tasks (Ortega, 2001).

The last two factors are mostly about the environment an organization operates in. Labor agreements can put certain constraints, limitations and requirements to resource availability, making it harder to create a planning. A highly variable demand can also make it harder to create schedules since it is harder to make the schedule comply with an ever-changing demand (Petropoulos et al., 2018).

The use phase

For the use part of the planning process, there would be different actors and roles.

The most important roles are the manager and planner.

For strategic planning the manager has the biggest responsibility. A manager would mostly be involved with the demand forecasting and resource allocation. A planner could help with this since they often know more about the practical application of schedules.

Depending on the compliance with employees' wishes, the schedule could improve work-life balance and the overall satisfaction of employees. The schedule should however not only take the employees' wishes into account, but it should also be an effective schedule, meaning that it balances the demand (required staffing hours) and supply (working hours of staff) and that it does not contain any mistakes.

Besides that, in order for the schedule to be eligible and effective, the rules should be interpreted correctly by the manager and the schedule will need to comply with laws and regulations. Lastly, the planning process should become more efficient. This simply means that it should cost less effort and/or resources to create a long-term schedule.

Demand forecasting however, works a bit differently. The most important aspect would be

historical data, since one can see what happened before and make assumptions based on these observations. AI is particularly good at this job (Aung et al, 2021), and data analysts have been doing it through Excel for years already. Something that is harder for AI, is the tacit knowledge of people. The biggest challenge here is to record as much tacit knowledge as possible, on which the AI can learn. This process will take time while the AI can learn from the feedback it receives (Sutton and Barto, 2018).

Upcoming trends can be analyzed by AI, through the scanning of hyperlinks, contents and usage data (Bing Liu, 2011). However, sometimes it can be useful if humans intervene here and manually make corrections to the demanded forecast in order to ensure correctness (Schumaker & Chen, 2009). Imagine a company that is forecasting its staffing needs for the upcoming year. The AI system will use various data sources, such as historical staffing levels, industry trends and projected business growth. However, it could occur that there is a big product launch upcoming, which is not included in the data of the AI. A human manager could intervene here and use their knowledge to increase staffing levels close to the product launch e.g. Two key considerations to be mentioned as well, are from a humanistic and a technological aspect. A higher employee involvement in the planning process can increase the employee satisfaction and work-life balance. This is because being in the process gives the employees the ability to manage their work and non-work roles a bit better (Allen et al., 2013). One could imagine that if a manager makes a long-term decision which leads to understaffing, that employees would have to work more shifts or with more pressure. This could have a really bad effect on employee satisfaction and work-life balance.

This enlarged involvement might also increase the effectiveness of the schedule, since it can lead to more optimal staffing levels, a better adherence of the schedule and better operational efficiencies (Kronos, 2011).

Besides that, the more effective the implemented algorithm is, the more sped up and accurate the planning process can become (Van den Bergh et al., 2013). So, humans could stay in control and keep the responsibility of the workforce planning, but AI can help them with the planning process.

Conceptual model

While taking all these variables into account; a conceptual model has been created:

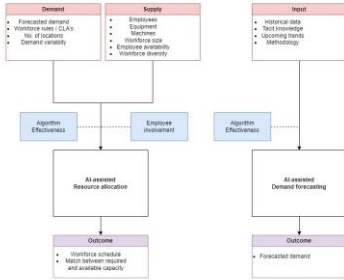


Figure 2 Conceptual model of AI-assisted resource allocation and AI-assisted demand forecasting

This model helps understand the processes better as it illustrates the variables that have been studied and their expected relationships.

TAM model

In order to implement game-changing technology like AI, it is important to understand how the users will perceive this implementation. The Technology Acceptance Model (TAM), as proposed by Davis (1989), is a framework that helps predicting user acceptance based on perceived usefulness and perceived ease of use. This could help ensure a smoother transition into an AI-assisted environment. The main users of AI-implementation into resource allocation and demand forecasting, would be managers and planners. According to the TAM, planners and managers will more likely embrace the technological change if they perceive AI as useful and as something that can help them execute their tasks more efficiently (Davis, Bagozzi, & Warshaw, 1989) However, the opposite is true as well. Managers and planners might see AI as a complex tool, especially in cases where interpretation is important (Legris, Ingham, & Collette, 2003). This will decrease the perceived ease of use and therefore lower the acceptance of the AI-implementation. This once again stresses the importance of educating and guiding the users when implementing new systems.

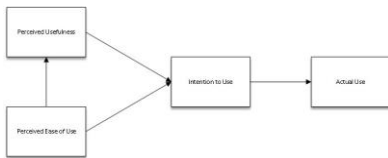


Figure 3 Technology Acceptance Model

So, what does that mean for implementing AI? One would want to increase the perceived usefulness and perceived ease of use as much as possible. End-users of the processes that will be supported by AI, should be educated based on what is happening exactly. This will prevent a “black box”-scenario from happening, where the users have no idea how it works. This is important since that scenario leads to a lower perceived usefulness of the system, due to a lack of understanding and confidence in the system. The perceived ease of use can also be increased by making sure that the system does not get too complicated, that changes will be gradually introduced and by giving workshops on the systems.

The options of AI in planning

The developments of artificial intelligence have been very promising (Russell & Norvig, 2016). Artificial intelligence could be quite helpful to implement in workforce planning. It is very easy for humans to make a small mistake, especially since planning can become boring and repetitive. AI does not care about repetitive tasks however. And besides that, AI does not forget the small details as long as it is programmed correctly. One of these applications can already be seen at Tonos Care, who have been interviewed for this report as well. Tonos Care can be seen as a pioneer, forerunner and innovator of AI-integration into workforce planning. They have already managed to create algorithms that enable health institutions to get hundreds of possible scenarios for their schedule with the click of a button (Tonos Care, 2023). However, Tonos Care focusses on schedules on a weekly basis, in other words, short-term planning. But their work can be used as an inspiration of what is possible and what could be achieved in mid-term and long-term planning. One very recent option for mid-term planning could be Copilot. Copilot is an AI-assistant, available to certain enterprises per 1 November 2023. Copilot can use historic and private company data to create a demand forecast (Microsoft, 2023). It can be fed a prompt by a manager like: “How many patients can we expect in February next year?”. Copilot will use the historic data to make a forecast on this. The higher the quality and the quantity of the data, the more accurate the forecast can be (Barocas & Selbst, 2016).

Limitations of AI

But that is also one of the biggest challenges of AI, getting enough data, which is also of high quality (Zorg & ICT-Beurs, 2023). An error in the code, data or prompt could result in a less efficient process or even a completely wrong result (Dignum, 2017). Therefore, the rising question is whether AI could completely replace a manager with regards to making a schedule, or whether the environment in certain areas, like health care, is so dynamic that it will always need human judgment (Topol, 2019).

Benefits of AI-implementation

Research shows that machine learning, which is a part of AI, could help with demand forecasting (McKinsey, 2023). This is a process that can make an algorithm ingest data, identify patterns within it and predict relationships and future situations based on these patterns (Aung et al, 2021). Whereas a student could beat his master, the algorithm is only as accurate as the data it gets fed. Inaccurate or outdated data can therefore result in wrong results (Barocas & Selbst, 2016). This is valid for resource allocation as well. As explained before, resource allocation is almost a game of the best assignment of resources to tasks with multiple constraints at play. These constraints are basically the required demand and laws. A match must be created between the required and available capacity. This includes, but is not limited to, certain working hours, costs and machinery. These constraints should be balanced when allocating the resources. With an improved demand forecast, resource allocation can be done at forehand which can increase efficiency and thus lower costs. If things must happen last-minute, moving machinery to another location for example, it will be costlier (Van den Berg and Zonderland, 2011). AI can also learn from feedback by methods such as reinforcement learning (Sutton and Barto, 2018) and can therefore respond to changes in demand or other constraints. This adaptive learning and real-time adjustments are some of AI's strengths and can be very valuable in long-term workforce planning by leading to lower costs and improved decision-making (Powell and Meisel, 2020). A quite recent example of this, would be the COVID-19 pandemic. During this time, it became clear to hospital managers that the demand would stay high due to the virus. The AI is not aware of this, and it will therefore give wrong forecasts. A manager could give feedback to the AI and alter the data and instructions in such a way that the AI will take this new information into account when making a forecast.

III. RESEARCH DESIGN

Research approach

This report is based on existing literature on artificial intelligence, workforce planning and on the possible integration of artificial intelligence in workforce planning. The latter is very limited, but the existing research is quite recent. Due to the scarcity of this literature, a qualitative exploratory research has been conducted. This is done to explore the possibilities of implementing AI into workforce planning. Exploratory research can be done in order to find at an early stage whether a topic is worth pursuing and/or investing time and money in (Bhat, 2023). It also helped identify information gaps for latter research. Since the existing literature is sparse, but possibilities should still be explored, information will also be gathered through structured interviews.

Research design

This research is based on interviews with experts in the fields of Artificial Intelligence and workforce planning. Time limitations and the fact that there are not many experts on AI-implementation in workforce planning forced the research sample size to be quite small.

A selection of interviewees was made based on what organizations they work for: these organizations should at least have a background with either AI or workforce planning. Unfortunately, the combination of these two is in very short supply. Tonos Care was basically the only company that fully met these requirements, therefore that has been the most extensive interview. By also interviewing experts from planning companies, a clearer image was created about the requirements and limitations of planning. All these experts have been contacted via online meetings and via the Zorg & ICT – Beurs, which is a fair with a lot of IT-companies, some of which are focused on AI. The following sample was researched:

- CEO of Tonos Care
Tonos Care is a company that offers solutions for healthcare professionals to create flexible capacity schedules with artificial intelligence. As mentioned before, they are a pioneer in the area of AI-integration into short-term workforce scheduling.
- A professor at the Department of Computer Science of the National Tsing Hua University
- A final decision-maker of Intus
Intus is an organization that provides planning software of all kinds, think about

self-rostering, holiday-planning, schedule generator and capacity plannings.

- An intelligent automation developer at New Dawn Robotics
- The founder of Permento BV
- A representative of Insight Enterprises Netherlands

These interviews have been conducted in cooperation with Tzu en Peng (Peng, 2023).

So, this sample has been selected based on the fact that they were all focused on either artificial intelligence or planning.

They have all been interviewed on their vision on AI, and the possibilities and limitations of AI. For these interviews a more informal approach has been adopted. However, certain questions were made on forehand, in order to ensure data quality. This is elaborated on in the interview protocol. But the choice to stay mostly informal has been made to create a more relaxed atmosphere, which could help the interviewees to share more information (Research-Methodology.net, 2023). This choice aligns with the research being exploratory, where at the same time qualitative data was prioritized above quantitative data. Due to the flexibility of the interviews, different themes and perspectives were mentioned by the interviewees as well, which increased the depth of the analysis.

The interviews have been recorded at the time and have been transcribed in order to be analyzed.

Interview protocol

In order to ensure the privacy of the interviewees, only the company names and positions will be named. All interviewees have been asked for permission to use their input for this report, as well as permission to be recorded if applicable. They have been made aware what the report was about and how their input would be used.

The interviews have been conducted with the help of an interview protocol. This was important since experts from different fields were interviewed, from different companies; it had to be made sure that the information relevant to this report was asked. This also helped in the analysis of the results, meaning that the answers of experts to questions could be compared. The questions mainly focused on the experts' vision on AI, their ambition for their own AI-supported application, what challenges they were facing themselves and who they are targeting with their AI-supported applications. These topics have been split up into more specific questions, which can be found in appendix 2. The answers to these questions had to be analyzed in order to help apply it to this exact situation, namely the implementation of AI into mid- and long-term workforce planning.

Operationalization of the main variables

Key variables in this research, aligned with the Technology Acceptance Model (TAM), are the perceived usefulness (effectiveness) and perceived ease of use (feasibility) of implementing AI into workforce planning. The feasibility, which is parallel to the TAM's perceived ease of use, is based on the literature and the experts' opinions on costs, limitations and possibilities.

The effectiveness, parallel to the TAM's perceived usefulness has been a bit harder to measure, since this report was supposed to be mostly empirical and qualitative. There is a serious information gap in the literature with regards to actual numbers about the effectiveness of AI-implementation in workforce planning. However, some experts dared to mention hard numbers, which have been used in order to assess the effectiveness. Consequently, the knowledge and perspectives of other academic literature and of the interviewees have helped to assess the effectiveness and feasibility of implementing AI in long-term workforce planning.

Analysis plan

The interviews have been transformed into transcripts so they could be carefully read. The analysis has been conducted via a thematic analysis approach, as described by Braun and Clarke (2006). In these transcripts, it was important to recognize certain themes and patterns via an inductive process. There has been open coding, where key points, themes and concepts mentioned by interviews have been noted. Part of this had already been done during the interviews. These initial codes were put in broader categories in order to see whether there were any recurring visions / opinions about the perceived usefulness and ease of use. Then these themes were interpreted in context of the existing literature to reach a deep understanding of the subject. Due to the small sample size, it was not feasible to create word clouds or use other qualitative analysis frameworks. Due to this thematic analysis, a deep and nuanced understanding of the data has been acquired. This has helped to create a proper evaluation of the perceived usefulness and ease of use.

IV. RESULTS

AI-assisted workforce planning tools.

The most practical finding from the interviews, was the software from Tonos Care. Their software allows hospital managers to create weekly schedules through AI. It is based on very rapid algorithms that they have made themselves.

Interview results

The results of the interviews are split up between the two main variables, namely the perceived usefulness and the perceived ease of use of AI-integration into workforce scheduling. Please note that these results are personal opinions and experiences of the interviewees, or findings that they have researched themselves.

Perceived usefulness

The potential for AI to assist in demand forecasting and resource allocation has been expressed by the interviewees at Zorg & ICT – Beurs in Utrecht. They also mentioned that AI will get even better at this when it gets used more often. This has also been expressed by the CEO of Tonos Care:

“...that means that with the outcomes and with the data you can make very interesting, well prediction is a big word, but at least the forecast. And that's based on the data you need and the results you get out.”

However, he also stated that the system will probably never become fully automated since healthcare planning is very complex and the human input and decision-making is invaluable. His ideology is that AI will support humans, not fully take over all the work.

Due to the novelty of implementing AI into workforce planning, it was hard for a lot of experts to provide facts about the effectiveness; but there were certain speculations. The CEO of Tonos Care could give some actual numbers that were found with their product:

“...to realize that AI makes a big difference in efficiency, gaining efficiency. We see a bandwidth in practice now for at least 8%.”

“...we've seen 22% as well, which is a lot and also sometimes, not a very nice surprise for any care organization or the managers because they start to realize that they maybe did something wrong in the past.”

Besides these numbers, representatives at the Zorg & ICT – Beurs mentioned that implementing AI could potentially save costs and increase employee satisfaction levels. It was also mentioned that the speed and accuracy of AI in generating work schedules save considerable time and increase planning accuracy. This means that there is a better match between the required and the available capacity, which was one of the outcomes of the conceptual model of resource allocation.

It was mentioned by multiple interviewees that AI can be used for managing complicated workforce requirements. The CEO of Tonos Care stated that AI could be used to make predictions and forecast for staffing needs on a yearly basis.

Perceived ease of use

The most important finding about the perceived ease of use came from the CEO of Tonos Care. He stated the following:

“We get very positive feedback as soon as people used or have used it to see the result. We get negative feedback before people using it.”

The CEO of Tonos Care also stated that an AI-assisted system, whether it is used for resource allocation or demand forecasting, will probably never become fully automated since healthcare planning is very complex and the human input and decision-making is invaluable. His ideology is that AI will support humans, not fully take over all the work.

These AI-assisted systems cannot be built and neglected, people are needed on maintaining. It should also be checked for accuracy as the system is built by humans.

According to multiple interviewees, who were trying to sell their AI product to customers, organizations are often hesitant because creating / transforming data can be pricey and overwhelming. These organizations should start building AI subject by subject, so it is manageable. A so-called AI learning-phase. This means that they could start collecting data for one product, and then end up using demand forecasting for one product at first. The Final decision-maker at Intus believes that employees should be involved in the planning process:

“We are quite fond of involving the employees in the planning process and we feel that the best results can be achieved by involving them as much as possible. So basically, the planning is done by the employees. So, there's no real way of replacing that with AI, I think.”

V. ANALYSIS AND DISCUSSION

The results show that most of the views and expertise align with the existing theory and literature. The data requirements were already discussed by Barocas & Selbst (2016) and the need for human involvement was discussed by Cote & Tucker (2001) and Topol (2019). This need for human involvement is getting backed by data from the interviews as well. There are many more examples to name, however, it is more interesting to look at what unique insights the interviews have led to. These findings give a clearer view on the perceived usefulness and ease of use of integrating AI into workforce planning according to the TAM.

Perceived usefulness

A consensus, achieved between the literature and the interviewees, that should be noted, is that AI can be particularly great at predictive tasks. AI could support managers and planners in both demand forecasting and resource allocation. However, it has to be noted that AI will probably be more effective in demand forecasting, due to its strength in analyzing and interpreting large datasets to predict future trends (Aung et al., 2021). Resource allocation, however, involves more complex decision-making processes where human judgment will still play an important role. But, for both of these tasks, the increase in speed, accuracy and efficiency has been highlighted a lot (Tonos Care; McKinsey & Company; SutiSoft, 2023).

Perceived ease of use

One of the most important findings, that will influence the ease of the adoption of an AI-assisted system, is the fact that huge and qualitative datasets are needed in order for AI to perform well (Li, Gao, Liang, Huang, & Bi, 2018; Ransbotham, Kiron, Gerbert, & Reeves, 2017).

Another interesting insight to highlight, would be the fact that companies are often hesitant to start using AI, and are providing negative feedback. But after implementing AI into their workforce planning, it shows that this negative feedback mostly turns into positive feedback (Tonos Care, 2023). Costs and the overall complexity seem to be the main factors for this phenomenon (Zorg & ICT-Beurs, 2023). It was proposed that companies can tackle this problem by building AI subject by subject, which makes it way more manageable. This, however, might not necessarily reduce costs. But it will show the impact that AI can have, and it will become clearer in an earlier stage, so the benefits might start to outweigh the costs.

After analyzing the expert interviews and comparing and enriching it with the existing literature, one could slowly start to tend to the conclusion that implementing AI into long-term workforce planning could be interesting for a lot of organizations. Whereas these organizations might believe that traditional workforce planning might have its' advantages, the arguments for accuracy, speed and efficiency are heavily in the favor of AI. However, this success of AI might not be applicable to every single organization. This is determined by a few factors, for which the conceptual model will be recalled: These include, but are not limited to, the willingness of the employees, the workforce size, the variability in demand and so on. If there is not enough historical data on the demand, AI might never be able to learn to make an accurate demand forecast. However, it should be noted that there are exceptions where smartly designed algorithms can achieve the desired result as well. Another finding is that most processes should not be dehumanized by completely leaving it up to AI. This would require an incredibly complex and extensive dataset, and even then, AI might not be able to completely comprehend certain circumstances. This is especially the case in very dynamic environments (Topol, 2019). So, for both the traditional methods as the AI, there will be human involvement. However, the involvement in AI might require a higher technical ability from the employees. But this can be achieved by training and educating employees.

To conclude and summarize the discussion of the Technology Acceptance Model, the following matrix is drawn. This helps giving a clear overview of the differences and similarities between the effectiveness of AI-implementation into resource allocation and demand forecasting.

Table 1 TAM results

	<i>Demand forecasting</i>	<i>Resource allocation</i>
<i>Perceived ease of use</i>	Moderate	Moderate
<i>Perceived usefulness</i>	High	Moderate

Limitations

There are certain limitations to this research, which also offers chances for future research. Artificial intelligence is still in its' early stages, and while there are already many options, the options will become more advanced in the future. New research might be needed when new options become available, to shine a new light on this matter. Due to these early stages, the research sample was small. There was only one organization as of yet that actually integrated AI into workforce planning. It must be said that these early adopters of AI, that have been interviewed, might also be a bit biased and overly enthusiastic about AI. Therefore, it was extra important to keep the existing literature close and stay to the facts, while still listening to the expertise of the experts. Besides this fact, the interviews at the Zorg & ICT-Beurs have also been conducted in public. This might have refrained the interviewees from talking about the negative points of AI, since they were mostly there to sell their product to customers.

Implications

This report mainly provides new insights about the AI-integration in mid-term and long-term workforce planning, a topic which is underexplored by both the literature as well as organizations. It explores the possibilities of using AI in processes like resource allocation and demand forecasting. This research identified an initial resistance towards AI, which has to be considered when adopting AI-supported processes (Zorg & ICT-Beurs, 2023). This means that there is often a low perceived usefulness (TAM model) within companies that are adopting AI, which increases as time progresses. The report found tools like Copilot, which works really easily with just a simple prompt. This tool has a very high perceived ease of use. Future research could include more research about the flexibility of AI, with regards to the ability of AI to respond and adapt to changing variables in the environment. Besides that, it could include more information and research on a more diverse sample of actual end-users of Artificial Intelligence, instead of just early adopters. And research at a later point, could determine whether AI-implementation leads to a more effective planning process.

Conclusion

To conclude this report and to inform organizations and managers that could be on the edge of adopting AI in their workforce planning; the initial research question "What is the effectiveness of AI in mid- and long-term workforce planning?" is answered.

AI looks very promising to increase the effectiveness of the workforce planning in general. However, there are several limitations and obstacles that should be considered. In order to get an effective end result, a big and qualitative dataset is needed. This could lead to high costs, since the dataset would have to be established. It is advised to go in a so-called "AI-learning-phase", in which one starts to learn the AI subject by subject. This might make the process less complex, and costs can be spread out over a longer period. Besides that, it might take away some of the initial resistance towards AI by showing progress in an early stage.

AI can partly take over the processes of resource allocation and demand forecasting when it comes down to mid- and long-term workforce planning, where AI looks to be a bit more effective for demand forecasting compared to resource allocation. Machine learning, which is a part of AI, can help find a match between either demand & supply for resource allocation, or it can identify trends and make a demand forecast based on historical data. Tools like Microsoft Copilot, available per 1 November 2023, are already able to offer this to certain organizations. However, fully automated AI might not be possible and should probably not even be desired in very dynamic environments like health care. A golden mean should be desired, in which AI will support humans by easing the process and in which humans will support AI by checking the accuracy, maintaining the system with new datasets and to help with decision-making in complex scenarios. So, all things considered, it is still tough to say an actual effectiveness, expressed as a number, of AI in mid- and long-term workforce planning. But it can already be confidently stated that AI can be effectively integrated, by using tools like Copilot, into mid-term and long-term workforce scheduling as long as companies can comply with aforementioned conditions.

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VII. APPENDICES

1. Form of consent for the interview with the CEO of Tonos Care.
2. Interview Questions
3. Transcript interview Intus
4. Transcript interview Tonos Care
5. Transcript interview Professor

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