

This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.

Author(s): Noponen, Niilo

Title: Impact of Artificial Intelligence on Management

Year: 2019

Version: Published version

Copyright: © Business and Organization Ethics Network (BON), 2019

Rights: In Copyright

Rights url: <https://rightsstatements.org/page/InC/1.0/>

Please cite the original version:

Noponen, N. (2019). Impact of Artificial Intelligence on Management. In T. Takala, T. Auvinen, M. Vesa, J. Tienari, P. Sajasalo, S. Heikkinen, J. Helms Mills, & M. Kallinen-Kuisma (Eds.), *Electronic Journal of Business Ethics and Organization Studies*. Vol. 24, No. 2. Special issue: Implications of Digitalization on Organizations and Leadership : Esports, Gamification and Beyond (24, pp. 43-50). Jyväskylän yliopisto, Business and Organization Ethics Network (BON). *Electronic Journal of Business Ethics and Organization Studies*.
http://ejbo.jyu.fi/pdf/ejbo_vol24_no2_pages_43-50.pdf

Impact of Artificial Intelligence on Management

Niilo Noponen

Abstract

This study focuses on the impact of advancing Artificial Intelligence systems on management during the next decade. Much of the attention around Artificial Intelligence and work revolves around the replacement versus augmentation debate. According to previous literature, rather than simply replacing tasks, machine learning tools can complement human decision making. Based on semi-structured expert interviews, this study provides tentative evidence that this may be true for managers on the highest level of organisations, but perhaps less so for operational and middle managers who may find a larger number of their tasks replaced. As routine tasks of supervision and administration can be automated, the shift towards interpersonal tasks of leadership could continue for many managers. Two possible future scenarios are formed to illustrate how Artificial Intelligence may possibly impact management. In addition, algorithmic management is recognised as an important factor in the next decade as platform economy keeps growing. Having potential to replace tasks of the operative managers, it is important to continue research on fairer algorithmic management. Also for further studies it is recommended to evaluate AI's impact on each level of managers separately, because of the disparate work tasks of operative, middle and senior managers.

Key Words: Management, Leadership, Artificial Intelligence, Algorithmic Management,

Digitalisation, Future of Work

Introduction

The research problem of this study is to empirically evaluate Artificial Intelligence's (AI) impact on managers. The impact is evaluated on the different aspects managers' work tasks may include, such as administration, supervision and leadership. In this study all people whose occupation is to lead people or manage operations are referred to as managers, despite the varying ratios they perform these tasks. Rather than evaluating managers as a homogeneous group, they are divided to operative, middle and senior levels for a more precise evaluation. The aim is not to provide a certain forecast, but to compare possible future scenarios to better understand the phenomenon.

Brynjolfsson & Mitchell (2017) state that most sectors of work and economy are at the beginning of a large transformation caused by recent advances in machine learning. Unlike previous forms of technology, the most recent breakthroughs in AI can also affect multiple highly skilled and highly paid occupations (Frank et al., 2019). Naturally a lot of debate and polar opinions exist about what this means for different professions and for the future of work. According to Makridakis (2017, 57) some technology experts claim that this AI revolution could change society even more than industrial revolution did. At the same time, others argue that the impact of AI is widely overestimated.

While the dialogue on AI and work has mainly focused on the potentially replacing effect it may have on different occupations, its impact on management has received less attention. Frey and Osborne (2013, 44-45) label managers' occupation in the category of low risk for automation. Authors such as Autor (2015) and Jarrahi (2018) have also claimed that AI offers augmented decision making rather than job replacement for managers. However, there seems to be evidence that management and leadership may be at the start of a transformation. Algorithmic management in platform and gig economy has introduced a new way

of supervising workforce (Rosenblat and Stark, 2015). Meanwhile, Auvinen (2017, 42) states that this wave of digitalisation is at a point where its first impacts on leadership can also be identified, for example with the concept of a virtual leader.

Literature review

AI – About the history and definitions

In this study the original definition by McCarthy, Minsky, Rochester and Shannon (1955, 11) is used to broadly describe Artificial Intelligence as action performed by a machine that would be considered intelligent if done by human. AI is considered a hypernym to developments within it, such as machine learning and deep learning. Many more narrow definitions exist, but for the purposes of this study, if a machine is able to perform a task previously done by a human manager, it is considered as artificial intelligence.

In its history of over 60 years, AI has seen multiple cycles of initial excitement followed by eventual disappointment (Pan, 2016, 410). In the beginning of these cycles, recent advancements led to claims such as that effectively every single human task could be performed by a machine in just a few years. As these hopes proved overoptimistic, a period of “AI winter” would follow, with less outside funding and enthusiasm for research in the field. (Kaplan, 2016, 15-16.)

Still throughout the years, the AI field has given numerous demonstrations of advancement. From Arthur's (1959) checkers program to AlphaZero's (Silver et al., 2017) chess and Go mastering reinforcement learning algorithm, many of the mainstream milestones have been beating human players in games. At the same time AI has increasingly been used to tackle numerous real world problems, such as cyber-attack detection and credit card transaction reviews (Kaplan, 2016, 39).

According to Remes (2018, 32-39) the rapid adaptation of AI programs in various industries during the last ten years has happened because programmers now have enough data and computing power to develop deep learning systems, based on the neural network research of previous decades. As it stands though, even the most sophisticated deep learning software can be incredibly efficient in the task it is trained to do, but completely clueless when assigned a different task. Still, even as the coveted artificial general intelligence may be years away, these learning systems do have demonstrated benefits in the growing number of tasks they are assigned to (Frank et al., 2019).

AI in organisations

The role of technology in leadership and management has been recognised for some time. E-leadership is defined by Avolio, Kahai and Dodge (2001, 617) as IT-mediated means to produce change in organisations. Reviewing the theory, Avolio, Sosik, Kahai and Baker (2014, 106) state that both the science and practice of leadership has dragged behind the adoption of advancing technology in organisations. They argue that rather than focusing on predicting the most desirable practices, the leadership field has reactively studied the impact technology already has had.

According to Auvinen (2017, 37) leadership is shifting from the scientific management of the last century towards structures of lower hierarchy in order to enhance creativity, participation and digital innovations. Also Auvinen et al. (2019) claim that there has been an epoch change in leadership as the embodied presence of the leader has seemed to transform into digital platforms. The need for actual leadership has not disappeared, but the methods of communication and presence of the leader have

been somewhat digitalised.

Another example of digitalisation is in the area of platform economy, where algorithmic management is used to connect customers and workers. Lee et al. (2015) define algorithmic management as managerial functions performed by software algorithms and their supportive devices. Lee et al. point that in addition to the newer companies in the platform economy, algorithmic management has been increasingly introduced to optimise, allocate and evaluate work in traditional occupations from warehouses to coffee shops.

This arrangement between the worker and the digital manager raises a completely new dynamic. Algorithmic management has been praised for the potential freedom it provides workers, but it has faced criticism for the exploitative information asymmetries that favour the company (Rosenblat and Stark, 2015, 3758). In her thesis, Tammisalo (2019, 63-64) concludes that while employees in a financial institution prefer the more emotionally intelligent feedback of human managers, they also see the value of the instant input that AI can enable as a part of the feedback.

There has been some conversation about what the advent of novel technology means for managers. A study by Frey and Osborne (2013, 40-45) claims that while workers in many fields are in a high risk of automation, managers are less likely to be replaced as their work consists of tasks demanding social intelligence. Similarly as Pulliainen (2019, 84) states in her thesis, many senior level managers are not worried about replacement as they see AI as a complementary tool they can use to be more efficient. Other studies support this augmenting view as well. Jarrahi (2018, 577) highlights the potential of an AI system with vast computational capability paired with the more holistic intuition of a human manager. Autor (2015, 5) claims that historically scholars and journalists alike have overstated the labour replacing power of advancing technology, while missing that automation also augments human skills, creates new work tasks and increases productivity and demand.

Still according to Makridakis (2017) some people in the field of AI claim that this time it is different, as task after task can be replaced. People supporting this revolutionary view of AI maintain that as far as demand for their labour, most workers of today are comparable to horses at the end of the 19th century. While optimists among this group believe that in the end this increased productivity will create a utopia for all, pessimists fear that it will lead to a dystopia for most. (Makridakis, 2017.)

As Arntz, Gregory and Zierahn (2016, 4) point, it is quite unlikely that in the near future every single task performed in an occupation could be automated. For example even if one day self-driving trucks replace drivers, human drivers may still be needed for other tasks such as loading and offloading goods. Therefore a task based approach is used in this study.

Based on the literature, AI can impact managers directly by replacing or augmenting certain work tasks. AI can also affect managers indirectly by causing changes in their working environment. Therefore the effects of AI can be divided to four levels: global level, level of society, level of organisational structure and level of managers' work tasks.

In this hierarchy, changes can trickle up or down the levels. For example, if a country has a goal of being a global leader in AI technology, it may allocate funds of the society to empower AI development and education, which in turn could change the way organisations and their managers operate.

Furthermore, for more precise inspection, managers are split into three groups: operative managers, middle managers and senior managers. Operative managers are considered the lead-

ers of the workforce, middle managers are the leaders of operational management and the highest level senior managers are the leaders of middle management.

Methodology

Research strategy in this study is qualitative and interpretative (Eskola and Suoranta, 1998). The empirical data consists of six semi-structured thematic interviews (Kovalainen and Eriksson, 2008). The interviewees have been chosen using purposeful sampling (Patton, 2002). Using knowledge and expertise of AI as the requirement for participation, a high ranking group of authorities in research, data science and consultancy were selected.

As part of the ethical guidelines, the participants were asked for the permission to record and transcribe the interviews. The interviewees were also granted anonymity to allow the expression of personal opinions independent of affiliation. Therefore the informants' identities are codified and in the analysis section they are referred to as Experts 1-6. The more detailed overview on the empirical data is represented in the figure 1.

A similar set of questions were given to each expert, still providing freedom for the interviewee to focus on the aspects they

Informants	Job title	Duration of interview	Transcribed pages
Expert 1	Director of Research	33:39	7
Expert 2	Consultant	44:53	9
Expert 3	Principal Software Architect	24:51	5
Expert 4	Research Professor	42:56	8
Expert 5	Data Scientist	42:26	10
Expert 6	Consultant	43:04	9

Figure 1 Detailed overview on the empirical data

saw most important on each topic. The questions are based on 1. How AI can replace managers' work tasks during the next decade and 2. How much AI can replace managers' work tasks during the next decade. Because of the difficulty of the topic, the main questions were sent to each participant for familiarisation before the interview. For practical purposes, the interviews were conducted on Skype. Before the actual interviews, two practice interviews were conducted to adjust the questions to better focus on the relevant themes.

Content analysis was used to group the data and to search for repetitive themes and patterns in it (Eskola and Suoranta, 1998). In expert interviews data collection and analysis often merge together, because the interview questions are customised for the expert group (Alastalo and Åkerman, 2010, 377-381). In this case it means that the divisions used in this study (as laid out at the end of chapter "AI in organisations") largely shaped the structure of the questions in the interviews and the data analysis that followed. The interview tapes were transcribed and listened to carefully, to ensure correct understanding of the experts' ideas. Because of the nature of expert interview, no hidden meanings were searched for within the interviewees' speech, instead their answers were taken at face value. Experts' opinions were grouped and colour coded based on each topic to make analysis easier and more direct. Within these themes the answers were examined for similarities and differences.

Using the empirical data as a guide, two possible futures scenarios were formed to illustrate AI's possible impact on management. According to Godet (1994, 44) a scenario is a basic concept of futures studies that tells what logical chain of events leads to a plausible situation in the future. Scenarios can be divided to possible, probable and desirable scenarios. Possible scenarios are all the futures that can be envisioned as possible. Unlike probable and desirable scenarios, possible scenarios don't have to be as rigorously tested, because the function is to expand understanding of the potential events. Possible scenarios are evaluated by the logicity and plausibility of the events depicted. (Amara, 1991, 646-647.) As with any study regarding future, the three principles of futures studies apply: future cannot be perfectly foreseen, future is not predetermined and future can be influenced with acts and choices (Rubin, 2004).

As a limitation of this study, a relatively small sample size was used to gather the data. This study deals only with possible future scenarios, and does not make any statement of their probability. For probable or desirable scenarios, a Delphi method could be used. It is also important to remember that this study tries to chart out the impact of AI on managers' work tasks, from which is not possible to draw straightforward conclusions on what it might mean for their employment. For more extensive scrutiny on the topic, more research is needed.

Analysis

Revolutionary view

Based on the empirical evidence, the expert opinion on the impact of AI on management can be roughly split into two groups: revolutionary and evolutionary. The revolutionary group believes that due to the unforeseen capabilities of AI technology, managers' work tasks will be greatly affected on all levels.

These experts believe machine learning systems can be used in various white collar work tasks previously thought too difficult to replicate by machines. After decades of comparatively slow AI development for practical applications, the possibilities set by computing power have finally caught up with the neural network algorithms of old, leading to the breakthroughs of the last decade (Remes, 2018, 32-39). Some of the experts expect that the rate of change starts to grow exponentially in the coming years.

Expert 3: It is all about training. The pace of training the learning models starts to grow exponentially. In ten years I believe AI can teach AI and the exponential curve gets steeper. Based on human managers' history it is possible to make good conclusions, forecasts and finally decisions. That's why I believe management as it is now understood can be quite light when it comes to humans. Machines will be able to do almost all decisions and can make more logical insights based on better algorithms than humans can alone.

The growing capabilities of processing units indeed set the limits for AI development. Big datasets need a lot of computing power to fine tune the models, making it energy intensive and expensive. Therefore the most ambitious projects are mostly limited to the biggest players. Novel methods specifically built for AI, such as Cerebra's AI chip, may however change the landscape and make it possible for smaller organisations to develop models swiftly (Freund, 2019).

As the capabilities of AI systems grow larger, some of the experts suggest that managers should focus more on understand-

ing the technology. Many of them also suggest that positions such as Chief Technological Officer will become more important in the future.

Expert 1: Managers must increasingly think on how they use their time. Managers should probably be some in AI courses learning those tools more, instead of getting involved with routine or detail management. They should focus more on the big picture and focus on mastering A.I and robotics technology.

Evolutionary view

The evolutionary group believes that even though AI may impact managers in many ways, even replace some tasks, it will not cause any unforeseen changes in managers' work. They believe that while machine learning systems can automate some repetitive managerial tasks, the focus will merely shift to softer leadership skills. These tasks of motivation and encouragement are arguably harder to automate.

Expert 6: You don't have to manage routines and processes. Instead it will be managing human capacity, interaction and empathy. In the narratives there's been a lot about soft leadership skills. This I believe will be more common, leading individuals.

This view of the second group is consistent with Laitinen's (2018, 45) claim that we live in a society of work, in which political, cultural, social and economic factors define the meaning of work for the individual – while technology only defines what work is done within these parameters.

Similarly Autor (2015, 5-7) points that technological change also complements labour, raising the demand for non-automated tasks. Autor claims that workers in tasks complemented by automation benefit more than workers in tasks that are replaced. Based on the expert interviews, it thus seems likely that the impact of AI may be kinder for managers competent in interpersonal tasks such as communication, employee motivating and creative decision making, as the skills can be used to complement automated tasks. On the other hand, technological change may not be as welcome for managers whose skills are based on routine administrative tasks such as reporting, work supervision and synchronisation.

In his book Graeber (2018) defines a bullshit job as employment that is so unnecessary that even the employee cannot justify its existence – yet they have to pretend this is not the case to keep receiving their salary. Why this is a matter for this paper is because among the anecdotal evidence gathered for Graeber's book is a number of testimonies by middle managers, HR managers and administrators, who confess that their work lack any meaning. Some middle managers claim that as their subordinates are mostly completely fine without their supervision, they perhaps have to invent unnecessary tasks to justify their existence, while their own bosses don't know what they do. Naturally this is not a claim that all middle managers are unnecessary. Too many conclusions can't be drawn from these personal stories, but it does make analysing changes in work more complicated. We tend to assume that other people are doing something useful, but who really knows what other people do at their jobs? Can a manager be replaced if their work was not needed in the first place?

AI's impact on different levels of management

Perhaps unsurprisingly, most of the interviewed experts believe that AI's impact is higher on operative and middle managers than on senior managers. On average the experts estimate that

during the next ten years a third of the work tasks of operative and middle managers can be automated. For the senior managers the assumption is that slightly less than a quarter of the work tasks can be replaced by different AI methods. The interviewees explain that the two lowest levels of management contain more repetitive tasks of supervision that are easier to automate.

Expert 2: Automating operative tasks, such as administration, synchronising timetables, filling out work sheets and checking whether somebody did their work, is a very straightforward process.

Expert 5: The tasks that can be replaced are administrative, for example if you have a factory manager that uses a lot of time to adjusting duty schedules. And usually you should as it's not very difficult. And if it saves half of a managers working hours, it is quite a valuable thing. I think that type of administration, excel optimisation and managing different matters will decline radically. How much it can replace a manager depends obviously on how much their work consists of that type of tasks.

The experts view that the amount of work for middle managers is connected to the number of operative managers they supervise. Along with the tasks of managers themselves, the overall demand of managers' work may also fluctuate if the number of workers they supervise increases or decreases. For example, if a large number of workers are replaced because of automation or another reason, the amount of managerial tasks needed could also drop.

This potential shift to less managers may be desired by some. While Auvinen, Riivari and Sajasalo (2018) highlight the need for the emotionally intelligent embodied leader, they also note that traditional leadership theories have been contested in favour of new-age approaches emphasising self-leadership, digitalisation and flexibility in a time of constant change. To enhance productivity, some organisations have chosen to ditch middle management, giving more freedom and responsibility to the employees. According to one of the experts, some professionals prefer lower levels of hierarchy and more shared governance.

Expert 6: In a study young managers in expert organisations thought that the flatter the organisation the better. In a sense the number of managers or middle managers goes down and there will be smaller team structures, in which leadership is shared between people.

Meanwhile it seems that the complementary aspects of AI benefit senior management the most. Many of the foreseeable advancements in AI seem to make senior managers jobs easier. For example high level decision making can be facilitated with dashboard systems giving real time information and suggestions of action.

Expert 4: There may be these dashboard systems that condense information and extend it in a sense. And they make some recommendations that in this situation you should proceed like this: before we have proceeded like this, and this way of operating has created these types of results.

Unlike the others, one of the experts believes that in the future, the impact of AI may be greater on the highest level of management. This is based on the idea of automated decision making: with enough data on human managers' decisions and

their consequences, machine learning programs can be trained to select the most desirable decision for each situation. Meanwhile this expert believes that when dealing with the challenges of leading the workforce, an algorithm may not be enough.

Expert 3: In operative management you need things that a computer cannot re-place. Hands-on teaching, especially in human resource management. AI can't analyse a person in ten years as well as another human being.

Most of the other experts also believe that while the repetitive tasks can be replaced, managers can use more of their time to focus on tasks demanding softer leadership skills. Even though many tasks can be replaced, leadership is still necessary.

Shifts in the working environment also affect managers' work. Between both countries and companies, global competition for AI supremacy may further accelerate the adaptation of new technologies. On national level experts believe that data protection legislation may decelerate the development and adaptation of AI systems, especially in public organisations. On the other hand, increased government funding can hasten AI development and provide more opportunities for organisations. As the experts point out, companies may be encouraged to utilize bold approaches to digitalisation as they seek the gains of the first player on the market, as Uber, Netflix and Spotify have done in their respective industries. Perhaps most crucially regarding this study, algorithmic management can make operative management redundant in companies using the methods of platform economy.

Algorithmic management in platform economy

Most experts identify platform economy as a factor that can cause disruption to the way organisations manage their workers. According to the opinions of the interviewees, it seems likely that the platform economy model will become more common in various industries. One can claim that with processes of algorithmic management, organisations are able to replace a large chunk of the tasks of operative management.

Expert 2: I guess that platform economy type thing – organising operations, which operative management is – will become more common. Certain tasks can be automated completely. For example in Uber, taxi automation is automated now. You don't need managers for that.

Expert 3: I would say there will be more of this in different industries. Energy sector, insurance sector, these traditional industries will have more of these which will change the way of operating quite radically.

As the interviewed experts note, the ways of platform economy may not only change organisation structures, but the relation of employment and leadership as well.

Expert 6: When talking about AI and work, the influence is not just on work or tasks, because as AI enables larger and better systems of platform economy, it also transforms employment relationships. This allows the development of shorter, fixed-term employment resembling freelancing, which changes leadership away from leading teams. For example in Uber they don't really have (the drivers as) employees. Then there is the question of does it change motivation and commitment, potentially having multiple employers.

Since its initial boom a decade ago, this sharing economy was

met with wide-spread enthusiasm as it has been portrayed of creating the flexible jobs of the modern age, where workers can become their own bosses (Rosenblat, 2018). However, studies such as Lee et al. (2015) and Schneider (2018) have demonstrated some of the problems arising in platform companies such as Uber and TaskRabbit. According to Rosenblat and Stark (2015) Uber's algorithmic management creates power asymmetries, which has led to cases of worker and customer exploitation.

Based on the workers' cries of exploitation under their algorithmic managers it seems that it has been harder to optimise for worker satisfaction than for the creation of monetary value for shareholders (Rosenblat and Stark, 2015). These examples point to a call for more research on how to make these platforms more just. After some initial disappointments in the platform economy there still exists hope for more shared governance and ownership – for example with platform cooperatives, as suggested by Schneider (2018).

Discussion

In light of the data, it seems that the impact AI may have on operative and middle management during the next decade may be somewhat understated. For senior managers however, the impact may be one of augmentation.

With technology such as automated decision making and dashboards that provide real time information, a smaller number of managers may be needed for supervisory and administrative tasks. Still, most of the interviewed experts stress the increasing importance of interpersonal leadership. Managers of any level excelling in soft leadership skills may be in higher demand in the near future, which corresponds to the longer progression of leadership shifting away from the scientific management of last century, demonstrated by Auvinen (2017).

Algorithmic management is interesting in the sense that it seems to be heading in opposite direction of this long time trend of leadership. Many companies operating in platform economy are implementing methods that could be described as scientific management, with clearly defined specific tasks, roles and objectives. In a sense the platforms are often designed to make workers operate as reliably as machines. One way to explain this phenomenon is that some of these platform economy jobs are precursors for further automation. For example in the future, more rides may be conducted by self-driving cars instead of Uber drivers and restaurant takeout orders may be delivered by drones instead of Deliveroo riders.

The nature of this virtual manager poses some interesting questions. According to Sintonen and Auvinen (2009) the ownership of leadership power is ambiguous and blurred. As they claim (Sintonen and Auvinen, 2009, 107) it is the story rather than the leader as a person who leads. In other words, the members of an organisation follow the meaning integrated in the story rather than the leader as a person. When leadership integrates into digital platforms, the question of who is actually leading can become even more blurred. One could argue that in principle a leader can have more direct control and exact orders than before by using algorithmic management. But at the same time it is not always clear how a machine learning algorithm makes decisions, even to the programmer in charge of optimising it – let alone for the person who commissioned it. Indeed, the responsibility of programmers seems to be growing as these platforms control the work of millions of people around the world. In these situations the goals and values that are directly or indirectly affecting the algorithm are essential in

shaping how it operates.

Even with the concerns raised in this study, it is good to remember that the recent and future breakthroughs of AI are part of the technological progress that has arguably raised the quality of life and increased productivity during the last centuries. The main issue remains the same: what actions to take to make sure the spoils are evenly shared between people.

Conclusion

Previous literature (Frey and Osborne, 2013; Autor, 2015; Jarrahi, 2018) recognise the potential of advancing AI technologies, but estimate that for managers the impact will be one of automation rather than replacement. Based on the expert interviews conducted for this study, it seems that AI may augment highest level senior managers more than operative and middle managers, whose work tasks could be more prone for automation. The methods of platform economy may also affect operative management the most.

The findings implicate the importance of just algorithmic management systems as the model of platform economy seems to spread. More research is still needed on the various aspects necessary for a solid algorithmic management system. Leadership and management scholars could surely have valuable insight on this matter.

In addition, two groups could be distinguished of the experts – revolutionary and evolutionary. The former believe AI has transformational potential for most occupations, including managers. On the other hand, the evolutionary view stresses that new technology mainly complements managers' skills. While other tasks may be automated, the skills that are harder to replace become more important. As routine administrative tasks may be automated, interpersonal leadership skills could become even more crucial in the future.

Based on the revolutionary and evolutionary views as well as the indications by Amara (1991, 646-647), two possible scenarios can be mapped out for management in the next decade or so. The extensive forecast of advancing technologies by Kuusi and Linturi (2018) is used as a loose guideline for this author's imagination. The aim is to provide two opposing scenarios to broaden the understanding of how AI can possibly impact management - not to speculate which one is more likely to happen.

In the revolutionary scenario, the continuing AI development sweeps across industries, transforming societies with unprecedented velocity. AI enhanced technological breakthroughs keep lowering the marginal costs of goods – most importantly food and energy production become largely automated. A large percentage of permanent workforce from cashiers to radiologists switch to freelance work in gig economy. The need for operative and middle managers plummets as their administrative tasks are automated, and old and new companies alike adopt the ways of platform economy. In companies with expert workers, employees prefer lower hierarchy and shared governance. People get used to the reliable, sincere and immediate feedback in their fine-tuned algorithmic management platforms. From Jürgen Klopp to Gandhi and Gandalf, organisations can perhaps choose as their leader a virtual version of a football manager, a historical figure or a fictional leader that matches their mission and story. In addition to human relations management, most of the human managers' tasks left can be performed mainly by the senior management. A smaller group of leaders is able to

choose the direction their organisation takes, augmented with automated decision making systems and dashboards that provide real time information. As an organisation is able to change its whole operating model for each day of the week if the algorithms so suggest, leadership and management theories of old have to be rewritten.

In the evolutionary scenario, AI continues to develop and disrupt industries, although not as widely as in the revolutionary scenario. Industries keep adopting the new possibilities of automation, but for the managers the impact is not as strong as for some of the workers. As societies are built around working individuals, people whose tasks were automated are retrained for new tasks created by AI, such as supervisors of automated road and drone traffic. Platform economy doesn't transform industries as much as originally expected, mainly impacting some of the new companies and industries only. Algorithmic management becomes more common, but human administration and oversight is still preferred, especially in more traditional organisations. Even though some of the repetitive supervisory and administrative tasks are automated, the complementary effects of AI help operative, middle and senior managers to better focus on interpersonal leadership skills. Operative and middle management are impacted slightly more than senior management after the adoption of slightly flatter organisational structures. As the shift from management to leadership continues, much of the responsibility of leaders contain tasks of employee motivation, engagement and satisfaction. Even though technological breakthroughs in AI and other fields continue, the role and tasks of leaders and managers evolve gradually, but do not transform into something completely different.

Even though the rate of change in these scenarios is different, what is common is that in both changes caused by AI are not predetermined. Just like a hammer, AI can either be used as a tool for creation or destruction. Technological progress cannot and should not be stopped, but to make sure it is headed in a preferred direction, good leadership is needed – maybe now more than ever.

Some suggestions for further research can be recommended based on this study, as leadership and management seem to be entering some uncharted digital waters. First, in further studies on AI's impact on management, it is recommended to specify the level of managers considered. AI impacts each level differently because each group consists of widely different tasks. Therefore, instead of referring to managers as a homogeneous group, analysing each group separately could provide more accurate results.

Secondly, the conversation of the embodied leader in an organisation, by Sintonen and Auvinen (2009) for example, could be revisited in the age of the virtual leader. Because programmers have an increasing amount of power and responsibility, it may be interesting to study who is actually in charge in the creation and operation of a digital management platform – the programmer, the supervisor, the story or perhaps the shareholder.

Finally, algorithmic management changes how organisations are able to guide and control their workers. Many of the previous studies (Rosenblat and Stark, 2015; Schneider, 2018), have rightly focused on the workers' point of view, but more research is needed to study how algorithmic management is currently changing leadership and management and what direction it should be taken in the future.

References

- Alastalo, M. and Åkerman, M. (2010) Asiantuntijahaastattelun analyysi: faktojen jäljillä. Teoksessa Ruusuvaari J. Nikander P. & Hyvärinen, M. (toim.) Haastattelun analyysi. Tampere: Vastapaino. Available at: <https://jyu.finna.fi/Record/jykdok.1159091> (Accessed: 16 January 2019).
- Amara, R. (1991) 'Views on futures research methodology', *Futures*, 23(6), pp. 645–649. Available at: [https://jyu.finna.fi/PrimoRecord/pci.sciversciencedirect_elsevier0016-3287\(91\)90085-G](https://jyu.finna.fi/PrimoRecord/pci.sciversciencedirect_elsevier0016-3287(91)90085-G).
- Arntz, M., Gregory, T. and Zierahn, U. (2016) 'The Risk of Automation for Jobs in OECD Countries: A COMPARATIVE ANALYSIS', OECD Social, Employment, and Migration Working Papers, (189), p. 34. Available at: <https://jyu.finna.fi/PrimoRecord/pci.proquest1790436902>.
- Autor, D. H. (2015) 'Why Are There Still So Many Jobs? The History and Future of Workplace Automation', *The Journal of Economic Perspectives*, 29(3), pp. 3–30. doi: 10.1257/jep.29.3.3.
- Auvinen, T. (2017) Johtaminen ja Tarinankerronta Organisaatioissa Digitaalisessa Vallankumouksessa, *Electronic Journal of Business Ethics and Organization Studies*. Available at: <http://ejbo.jyu.fi/> (Accessed: 22 April 2019).
- Auvinen, T. et al. (2019) 'Evolution of strategy narration and leadership work in the digital era', *Leadership*, 15(2), pp. 205–225. doi: 10.1177/1742715019826426.
- Auvinen, T., Riivari, E. and Sajasalo, P. (2018) 'Lessons learned from traditional and "new-age" leadership', in Eskola, A. (ed.) *Navigating Through Changing Times: Knowledge Work in Complex Environments*. New York: Routledge, pp. 95–112. Available at: [https://books.google.pt/books?hl=en&lr=&id=h3o4DwAAQB&oi=fnd&pg=PT128&dq=Auvinen+T,+Riivari+E+and+Sajasalo+P+\(2018\)+Lessons+learned+from+traditional+and+"new-age"+leadership.+In:+Eskola+A+\(ed\)+Navigating+through+Changing+Times.+New+York:+Routledge,+pp.+](https://books.google.pt/books?hl=en&lr=&id=h3o4DwAAQB&oi=fnd&pg=PT128&dq=Auvinen+T,+Riivari+E+and+Sajasalo+P+(2018)+Lessons+learned+from+traditional+and+"new-age"+leadership.+In:+Eskola+A+(ed)+Navigating+through+Changing+Times.+New+York:+Routledge,+pp.+)
- Avolio, B. J. et al. (2014) 'E-leadership: Re-examining transformations in leadership source and transmission', *Leadership Quarterly*, pp. 105–131. doi: 10.1016/j.leaqua.2013.11.003.
- Avolio, B. J., Kahai, S. and Dodge, G. E. (2001) 'E-leadership: Implications for theory, research, and practice', *The Leadership Quarterly*, 11(4), pp. 615–668. doi: 10.1016/S1048-9843(00)00062-X.
- Brynjolfsson, E. and Mitchell, T. (2017) 'What can machine learning do? Workforce implications: Profound change is coming, but roles for humans remain', *Science*. American Association for the Advancement of Science, pp. 1530–1534. doi: 10.1126/science.aap8062.
- Eskola, J. and Suoranta, J. (1998) *Johdatus laadulliseen tutkimukseen*. Tampere: Vastapaino. Available at: <https://jyu.finna.fi/Record/jykdok.747009> (Accessed: 8 October 2018).
- Frank, M. R. et al. (2019) 'Toward understanding the impact of artificial intelligence on labor', *Proceedings of the National Academy of Sciences of the United States of America*. National Academy of Sciences, pp. 6531–6539. doi: 10.1073/pnas.1900949116.
- Freund, K. (2019) Cerebras Unveils AI Supercomputer-On-A-Chip, *Forbes*. Available at: <https://www.forbes.com/sites/moorinsights/2019/08/19/cerebras-unveils-ai-supercomputer-on-a-chip/#63dbc812fe8a>.
- Frey, C. B. and Osborne, M. A. (2013) *The future of employment: How susceptible are jobs to computerisation?* Oxford: Oxford Martin School. Available at: https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf (Accessed: 21 February 2019).
- Godet, M. (1994) *From anticipation to action a handbook of strategic prospective*. Paris: Unesco Publishing. Available at: <https://jyu.finna.fi/PrimoRecord/pci.gbv257210202>.
- Graeber, D. (2018) *Bullshit Jobs: A Theory*. New York: Simon & Schuster.
- Jarrah, M. H. (2018) 'Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making', *Business Horizons*. Elsevier Ltd, 61(4), pp. 577–586. doi: 10.1016/j.bushor.2018.03.007.
- Kaplan, J. (2016) *Artificial Intelligence*. Oxford: Oxford University Press. Available at: <https://jyu.finna.fi/Record/jykdok.1692732>.
- Kovalainen, A. and Eriksson, P. (2008) 'Qualitative Methods in Business Research: Narrative Research', in Sage Publications Inc. 1 Oliver's Yard, 55 City Road, London England EC1Y 1SP United Kingdom: SAGE Publications Ltd, pp. 210–227. doi: 10.4135/9780857028044.
- Laitinen, A. (2018) 'Kuinka suhtautua työn lopun myyttiin?', *Tiedepolitiikka*, 43(4), pp. 44–49.
- Lee, M. K. et al. (2015) 'Working with Machines', in *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. 1603-1612. New York: ACM Press. doi: 10.1145/2702123.2702548.
- Linturi, R. and Kuusi, O. (2018) *Suomen sata uutta mahdollisuutta Yhteiskunnan toimintamallit uudistava radikaali teknologia*. Helsinki: Tulevaisuusvaliokunta. Available at: <https://eduskunnankirjasto.finna.fi/Record/selma.416167> (Accessed: 7 March 2019).
- Makridakis, S. (2017) 'The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms', *Futures*, 90, pp. 46–60. Available at: [https://jyu.finna.fi/PrimoRecord/pci.sciversciencedirect_elsevierS0016-3287\(17\)30004-6](https://jyu.finna.fi/PrimoRecord/pci.sciversciencedirect_elsevierS0016-3287(17)30004-6).
- McCarthy, J. et al. (1955) 'A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence. Dartmouth College', in. Available at: <http://jmc.stanford.edu/articles/dartmouth/dartmouth.pdf> (Accessed: 11 March 2019).
- Pan, Y. (2016) 'Heading toward Artificial Intelligence 2.0', *Engineering*, pp. 409–413. doi: //doi-org.ezproxy.jyu.fi/10.1016/J.ENG.2016.04.018.
- Patton, M. Q. (2002) *Qualitative research and evaluation methods*. Thousand Oaks: Sage Publications. Available at: https://books.google.pt/books/about/Qualitative_Research_Evaluation_Methods.html?id=FjBw2oi8El4C&redir_esc=y (Accessed: 21 September 2018).
- Pullinen, I. (2019) *Tekoäly haastaa johtajuuden – oletko valmis?* University of Jyväskylä. Available at: <https://jyx.jyu.fi/handle/123456789/64691>.
- Remes, J. (2018) 'Mutta mistä tekoäly tulee - kuka sen kehittäisi ja millä voimin?', *Tiedepolitiikka*, 43(4), pp. 32–39.
- Rosenblat, A. (2018) *Uberland: How Algorithms Are Rewriting the Rules of Work*. Oakland, California: University of California Press. Available at: <https://www.jstor.org/stable/10.1525/j.ctv5cgbm3> (Accessed: 24 October 2019).
- Rosenblat, A. and Stark, L. (2015) 'Uber's Drivers: Information Asymmetries and Control in Dynamic Work', *SSRN Electronic Journal*. doi: 10.2139/ssrn.2686227.
- Rubin, A. (2004) 'Tulevaisuudentutkimus tieteenalana. TOPI – Tulevaisuudentutkimuksen oppimateriaalit. Tulevaisuuden tutkimuskeskus, Turun yliopisto.' Available at: <https://tulevaisuus.fi/perusteet/tulevaisuudentutkimus-tiedonalana/>.
- Samuel, A. (1959) 'Some studies in machine learning using the game of checkers', *IBM Journal of Research and Development*, 4(1.2), pp. 211–229. doi: 10.1147/rd.441.0206.

- Schneider, N. (2018) 'An internet of ownership: Democratic design for the online economy', *Sociological Review*. SAGE Publications Ltd, 66(2), pp. 320–340. doi: 10.1177/0038026118758533.
- Silver, D. et al. (2017) 'Mastering Chess and Shogi by Self-Play with a General Reinforcement Learning Algorithm'. Available at: <http://arxiv.org/abs/1712.01815> (Accessed: 23 October 2019).
- Sintonen, T. and Auvinen, T. (2009) 'Who is Leading, Leader or Story? The Power of Stories to Lead', *Tamara Journal*, 8(2), pp. 95–109. Available at: <http://www.tamarajournal.com/index.php/tamara/article/view/317> (Accessed: 22 October 2019).
- Tammisalo, J. (2019) OVI KÄVI, MUTTA KUKA TULI SISÄÄN? KÄSITYKSIÄ TEKOÄLYN POTENTIAALISTA VUOROVAIKUTUKSEN OSANA FINANSSIORGANISAATIOSSA. University of Jyväskylä. Available at: <https://jyx.jyu.fi/handle/123456789/64870>.

Author

Niilo Noponen

PhD student at Jyväskylä University School of Business and Economics, Finland
Email: niilo.v.noponen@jyu.fi