AI, RPA, ML and Other Emerging Technologies: Anticipating Adoption in the HRM Field

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DOI: 10.34190/ECIAIR.19.025

Abstract: Emerging technologies such as artificial intelligence, robotic process automation and machine learning bring a profound change to the way organisations operate. The study by Frey and Osborne (2013) studied the likelihood of some 700 individual occupations being 'lost' to computers and robots. They found that 47% of the studied jobs were at risk of obsolescence. The phenomenon is not new – many jobs have disappeared and human labour has diminished (MGI 2011; Breshanan, 1999). This development makes the human resource management (HRM) function a nerve centre that facilitates the transformation to this new world of work. Frey and Osborne see the role of human resource managers as being in the top fifth percentile in terms of its likelihood to continue to exist. However, HRM needs to understand the emerging technologies to 1) understand what they mean for jobs across different departments, and 2) understand how HRM jobs and processes themselves will be impacted by the intrusion of these emerging technologies. This study sheds light on views held by the HRM community on the impact of novel technologies. The results indicate that the main drivers of tech intrusion to HRM are related to processing speed and reduced costs. The main obstacles are the uncertainty over the choice of technology and the cost of implementation. Different technologies have varying potential when screened against individual HR functions. The individual emerging technologies also have a varying lead time to their wide usage by HR across companies.

Keywords: Artificial Intelligence, robotics, emerging technology, technology adoption, HRM

1. Introduction

Human resource management is defined as an internal organisational function that ensures employees have access to channels of due process and gives them a voice to enhance the efficiency and equity of the employment (Kaufman 2001; Godard 2014), thus highlighting the 'human' element of HRM. Lately the efficiency view underlining 'resource management' has defined HRM as involving the 'management of human skills and talents to make sure they are used effectively and in alignment with an organization's strategic goals' (Morgan-Youssef and Stark 2014).

The advances in technology challenge HRM policy and practice. Weiss and Rupp (2011) see that in the hunt for organisational performance, the actual individual has been overlooked. Technology is affecting the work of the future with two faces: a smart one and a dark one (Holland and Bardoel, 2016). From a positive perspective, the use and control of information systems create opportunities to innovate when, where and how we work (Harvey 2010). Howcroft and Taylor (2014) argue that we are seeing a wave of technological change in the way we work. On the positive side, the change may be creating a renewed interest in how work is conceptualised – that would be the 'smart side' of technology. However, the same technological advances provide opportunities for electronic monitoring and the surveillance of work and employees, and cause increased strain both inside and outside the workplace (Holland, Cooper, & Hecker, 2015). This is the 'dark side' of technology for HRM.

Technological change is inevitable for HRM, but the correct choices and timings of technology adoption are difficult to decide. The move towards technology-embracing HRM was encapsulated in the term e-HRM (e.g. Yusoff et al. 2010), which provided the HR function with organisational effectiveness through computerised practices. This enables the increase and maintenance of improved knowledge management and the creation of intellectual and social capital (Lengnick-Hall and Moritz, 2003). The discussion about the relationship between technology and HRM has focused largely on the opportunities – and possible problems – that artificial intelligence (AI) has brought to HRM. Some claim that AI has already changed HR with modern tools (Barman

and Das 2010), while some researchers still discuss AI from the prospective point of view. Rana (2018) suggests a collaborative approach by highlighting the complementary role of HRM in the effective utilisation of AI: organisations should focus on implementing AI as a supporting tool for HR and not overrule the role of HR. Ideally, humans and AI systems should complement each other, leading to a rise in both (Jennings 2018). A further complication arises from the fact that AI often refers to a certain degree of autonomy exhibited in systems, digital tutors, self-acting machines and other AI-based applications (Gasser and Almeida, 2016).

To fill in the gaps between conceptual studies and HR practice and to drill down to the level of individual sub-segments, we chose technologies to complement AI: machine learning, robotic process automation, smart robots, mixed reality and virtual assistants. The core research questions asked were:

- How do different technologies rate in an adoption timeline?
- How do those technologies affect HRM processes?
- What are the driving forces and obstacles to tech adoption in HRM, and what are the professional consequences of the development?

2. Literature review

2.1 Nature of emerging technologies and their adoption

Companies of today live in the context of technological change to a greater extent than we have seen before. As an example, the ICT market research and consultancy firm Gartner targets strategic planning by highlighting technologies that will potentially have an impact across business (Fenn, 2011). These technologies are called emerging technologies. Whereas the aggregate and often quoted Gartner hype cycle contains (only) some 50 technology areas, there are in total 2,000 individual technologies under Gartner's follow-up. In addition to uncertainty about technology, the market size, behaviour and uncertainty over the amount, intensity and tactics of the competition are also highly ambiguous (Mohr et al., 2011). According to Cozzens et al. (2010) emerging technologies is a concept that is often used but rarely defined. They also present both challenges and opportunities for technology strategies. By its nature, an emerging technology is rather difficult to forecast as there is no historical data available (Daim et al. 2006). Brey (2012) states there are technologies that can still be called emergent since they are at an early stage of development and have not yielded many applications or led to many societal consequences.

Technology adoption is a gradual and stage-based process. To describe the process, Davis (1985) created the technology acceptance model (TAM). The model by Davis (see Figure 1) looks at technology acceptance from the level of a unique decision-maker/individual.

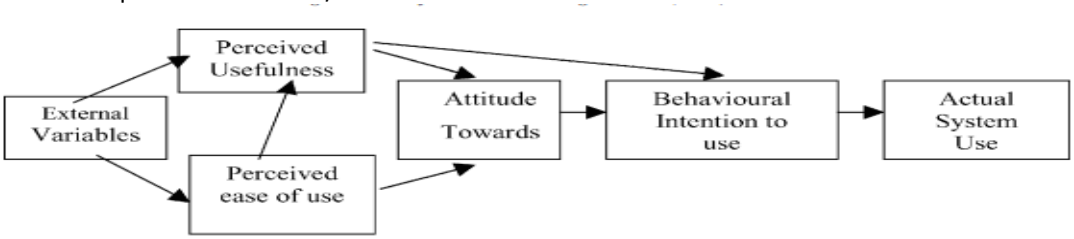

Figure 1: Technology acceptance model (Davis, 1985)

The model by Davis has since been developed (e.g. by Venkatesh and Davis, 2000) to incorporate more variables that decide whether an emerging technology gets adopted by its potential clientele. There are more rational attributes than in the original model. Relevance to the job to be done and the quality of system output are seen as predecessors of useful perception and thus adoption decision (see Figure 2)

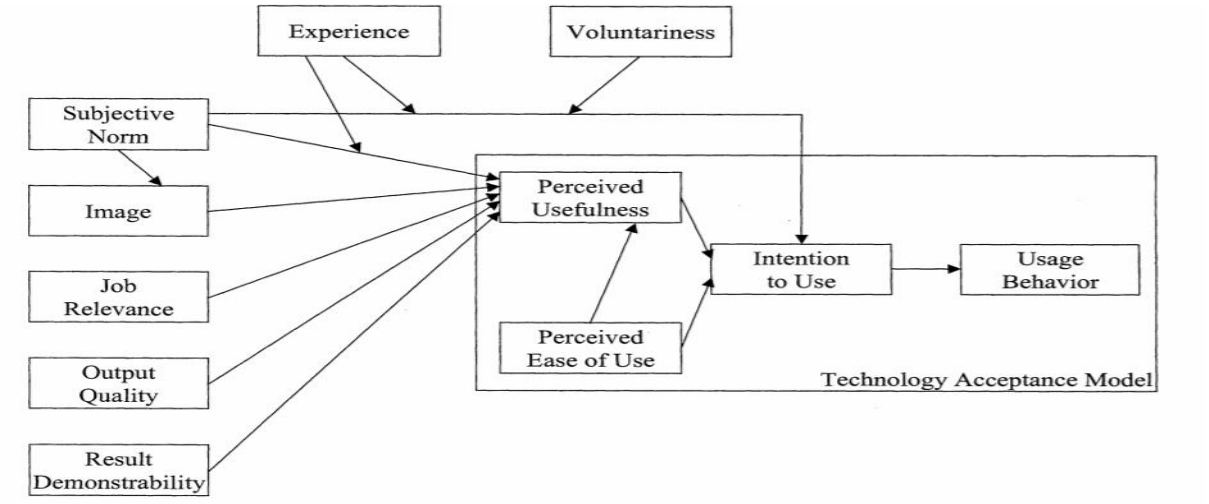

Figure 2: Technology acceptance model – improved version (Venkatesh and Davis, 2000)

New technologies also affect power positions, values systems and processes within companies adopting new technologies. Möller et al. (2002) state that innovation and change impose emerging value systems. There are radical changes in old value activities, as well as the creation of new value activities. In the context of this study, that is, HRM in firms, this may lead to new business partners and process constellations for the HRM function in a firm and its network. This impact on professional and organisational status can affect the level at which new technologies are embraced. Competence-destroying innovations require new skills and knowledge in the development (Tushman and Anderson 1986). If an organisation can grasp the opportunity with new technology, it is competence-enhancing (ibid.). Competence-enhancing discontinuities improve performance based on existing know-how.

The Chasm group, led by Geoffrey A. Moore (Moore 1995; 1999), approached technology adoption from a market perspective, helping technology providers to understand technology adoption and to act strategically in different stages (see Figure 3).

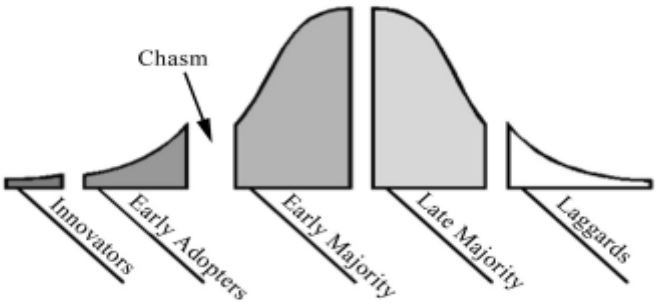

Figure 3: Technology adoption life-cycle curve (TALC) (Moore, 1999)

The TALC model proposes that in the B2B as well as the B2C market the total accessible market for a new technology consists of five different categories: innovators (just some 3% of the total market), early adopters (approximately 14%), the early majority (34%), the late majority (34%), and laggards (approximately 14%). The TALC model explains the inertia that leads to a 5–10 year prognosis of market adoption time for new technologies (see next chapter 2.2.).

2.2 Nature of evolutionary path of emerging technologies and current technologies in hype

One of the models illustrating the dynamic nature of emerging technologies is the hype cycle model by Gartner, published in 1995. The hype cycle establishes the expectation that (most) technologies progress through a repeating pattern of overenthusiasm and disillusionment. Cycle analyses aim to provide a view of the relative maturity of technologies within a certain segment (Linden et al., 2003).

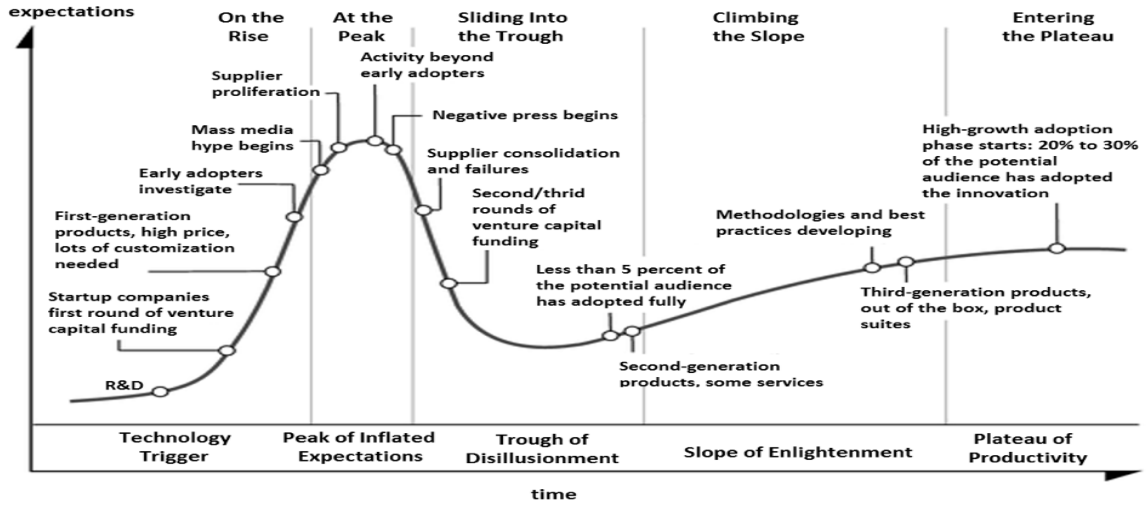

Figure 4: Gartner's General Hype Cycle

The message confirmed by various scholars and technology analysts is that while most technologies have a volatile appeal to their potential customers and developers, the opportunities of a new technology tend to be overvalued in the early stages compared to the difficulties in building sound products and services, and having business success with emerging technologies.

2.3 Emerging technologies and HRM

The modern view of HRM states that there needs to be integration between strategy and HRM. The basic premise is that organisations require HR practices that support a direction that differs from those organisations adopting alternative strategies (Delery and Doty, 1996). However, in 2005 Hoffman stated that there had been more conceptual than actual progress. Bowen and Ostroff (2004) propagated the processual view of HRM, where the strength of HRM as a system has gained a foothold from a human-centric view. Thus, L´Écuyer et al. (2019) have proposed that the (IC) technology angle of HRM – previously referred to as e-HRM – and the strategic HRM view must in be aligned in the future. And since strategy is always future-oriented and concerns the direction and rearrangement of resources (Mintzberg, 1989), HRM needs to comply with emerging technologies as possible enablers of HRM development.

What technologies, then, are those that will impact HRM the most? And which subprocesses of HRM do those technologies have the potential to transform? The existing research lists various elements of HRM evolution via technology. There are difficulties in creating an aggregate link to a) studies focusing on one technology area only, b) one function of HRM only, or c) a combination of the two previous ones. For example, artificial intelligence (AI) is treated as a technology per se, and as such it shows large impact potential. Gartner, for example, no longer treats AI as single technology or technology area, but divides it to sub-segments (see Figure 5 below). There have been and still are many notions of the impact of AI on HRM, for example as a technology that is penetrating recruitment processes within HRM (e.g. Rafter et al., 2000; Upadhyay & Khandelwal, 2018).

Tan (2018) views HRM digitalisation by stating that innovations in data science and analytics optimise learning and performance. On the other hand, 'one of the biggest impacts of artificial intelligence (**AI**) on HR is and will continue to be around performance management' (Buck and Morrow, 2018). Starn (2019) presents multiple drivers, use cases and technology options already in use in forest industry companies in Sweden, where an exemplary company 'is stepping up efforts with a two-year long program that will look at all its processes and evaluate where they can be made more efficient by using robots' (ibid.).

The amount of technologies that have transformation potential for HRM is almost limitless and the technologies are likely to overlap and be interrelated. The choice of technologies studied is impacted by the hypes as well as personal and professional priorities. The candidates for technology (areas) can be found both from general sources such as hype cycles (see Figure 5 below) and/or by aggregating individual studies.

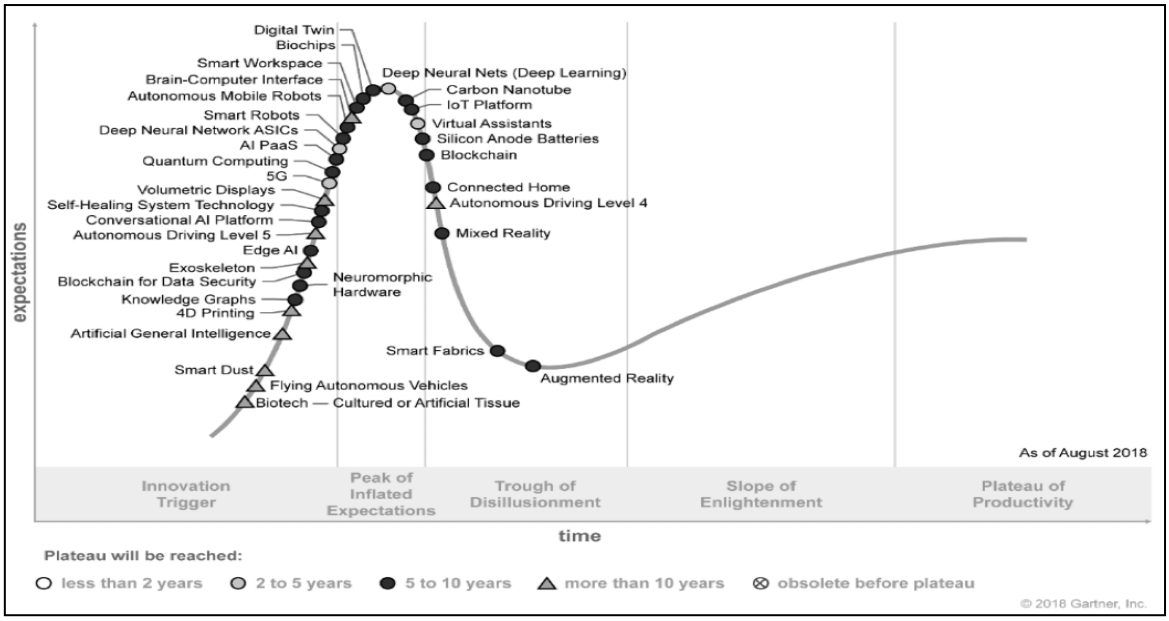

Figure 5: The latest emerging technologies hype cycle by Gartner (2018)

Given the lack of official and final definitions of emerging technologies in the scope, the research group compiled various sources definitions (see Table 1) for them for this purpose. The aim was to have definitions that were approximately the same length, were readable and could be internalised in the timeframe of the online survey (it was indicated at the start of the online survey that it would take 12-15 minutes). The technologies chosen and the definitions for them were:

Table 1: The definitions of technologies used in this study (by authors – compiled from multiple online sources)

Artificial intelligence *= field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving and pattern recognition.*
Machine learning *= an application of artificial intelligence (AI) that provides systems with the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves.*
Mixed reality *= the result of blending the physical world with the digital world. Typically, a user remains in the real-world environment while digital content is added to it; moreover, a user can interact with virtual objects.*
Smart robot *= an artificial intelligence (AI) system that can learn from its environment and its experience and build on its capabilities based on that knowledge. Smart robots can collaborate with humans and learn from their behaviour.*
Virtual Assistant (VA*) = a conversational, computer-generated character that simulates a conversation (voice- or text-based) information to a user via the web, a kiosk or mobile interface. A VA incorporates natural-language processing, dialogue control, domain knowledge and a visual appearance that changes according to the content and context of the dialogue.*
Robotic Process Automation (RPA) *= software that can be easily programmed to do basic tasks across applications just as human workers do. The software robot can be taught a workflow with multiple steps and applications. RPA software is designed to reduce the burden of repetitive, simple tasks.*

The impact these technologies had on HRM subprocesses (see section 2.4.) in terms of magnitude and lead time were then studied in the empirical part of the research.

2.4 Modern HRM process

Currently, HRM as a whole is seen to be under the influence of technology intrusion, and will be even more so in the future. Holzer (2018) points out that 'the digitalization process is currently affecting and shaping various business functions, and so is also Human Resources Management at organizations highly influenced by it'. Any meaningful study on emerging technology impact needs, however, must divide HRM into subprocesses. The literature divides HRM functions into a plethora of divisions. The models can be sequential, reflecting the stage-based model of an employee in an organisation, starting from their inception and moving to development, or being tied to different roles of HR within the organisation, such as those of a functional

expert or a human capital developer. Some models use cyclical models where all functions and activities are connected via the core of the cycle. One such model is by McKee and Wortham (2014) (see below):

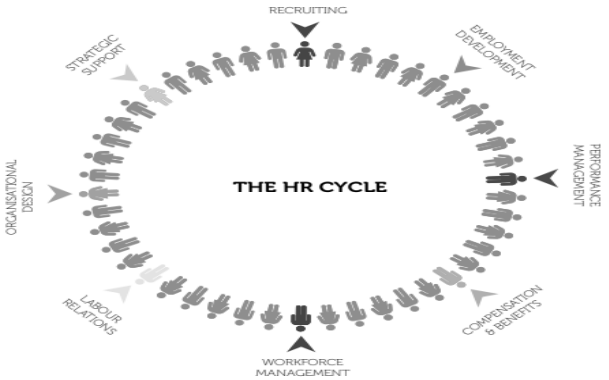

Figure 6: HR Cycle (by McKee and Wortham, 2013)

The model of Dessler (2017) lists 15 functional area capabilities that 'the new HR manager' needs to master. The model bears a resemblance to earlier cycle and role models, but some of the critical capabilities are clearly contextual (such as legal issues, strategy, structure), and some more action-oriented (talent acquisition, workforce management, risk management). This study uses the selected functional areas combining the models above. The functional areas subjected to analyses were: resource planning-quantitative (e.g. shift planning); resource planning-qualitative (e.g. skill and talent scanning); recruitment, training and development; performance management and evaluation; career management; compensations; and health and safety.

3. Research methodology, data collection and analysis

The empirical research for this paper was conducted as a quantitative study based on an online survey (using the Webropol survey platform) in April–May 2019. The target was to screen views from the HR community on the subject area and check the soundness of the researchers´ question setting for larger data collection, which would test hypotheses related to the phenomenon, scheduled for the autumn of 2019 and early 2020. The research approach can be described as an exploratory one, since the earlier research on the topic area had typically had a wider focus, either by treating HRM as a single entity and ignoring its subprocesses, or by treating technological development as one entity (e.g. by naming it digitalisation or e-HRM) rather than as specific technology areas.

For data collection the authors used their HRM network via messages both via e-mail as well as the LinkedIn networking platform. Messages at this stage were sent to some 200 people. The survey was in English to ensure clarity of the definitions. The respondent pool gathered by the end of May 2019 consisted of 22 people.

This is not yet large enough to run full-scale statistical analyses and test hypotheses, but via descriptive statistics (see Chapter 4: Results) indications of adoption rationale and the direction of emerging technologies within HRM could be identified. The questionnaire was answered anonymously, but respondents were asked demographic data (size, industry and location of their company, size of their HR department, their own position and HR experience) before moving onto the research questions where the impact (on which HR process, how strongly, when in time) of each emerging technology was assessed. At the end the drivers for and against tech intrusion into HR were asked about, as well as the impact on HR costs and roles in such a new technology-rich context.

Largely, the respondent pool met the target for diversity. The respondents differed in terms of the size of the organisation they work for (some 24% were from organisations with 0–10 people and 31% from those with 1000+ people, with the rest in categories in between), the size of their HR department (50% in departments with fewer than five people working full-time, whereas 14% in departments with 50+ working full-time) and professional experience (e.g. 23% of respondents had worked under three years on HRM tasks, whereas 50% had more than 10 years' experience in HRM). Geographically the sample was heavily concentrated, as 85% were operating in Finland. The survey consisted of both Likert-scaled assessments (e.g. the expected impact of a technology on an HR function, and the time it would take until wide adoption of a technology) as well as multiple choice option (e.g. in terms of the main drivers and obstacles of tech intrusion into HRM). Due to the

low n-number, the results were analysed using averages and means only to describe the data, while more sophisticated quantitative analyses will be done later with a larger set of empirical data, as the data collection is still going on.

4. Results

The question of current intrusion of technologies into HRM can be discussed based on findings on whether the technological level of HRM is in line with the overall technological level of the company (in terms of the products and services offered as well as the current processes on a general level within an organisation). The results indicated that product and service offering of the firm is slightly more technologically intensive than the internal firm processes overall, and HRM lags slightly behind the other processes. There is, however, an indication that HRM is already on the move towards technology intensity, as 50% of respondents already feel their HRM is at a high or very high level in terms of technology intensiveness

Which technologies, then, are those that will affect the HRM of the future more intensively than others? Figure 8 below shows an example of the assessment of one technology (in this case AI) across HRM sub-processes. The longer the horizontal bar in the figure, more impact it is expected to have on that subprocess.

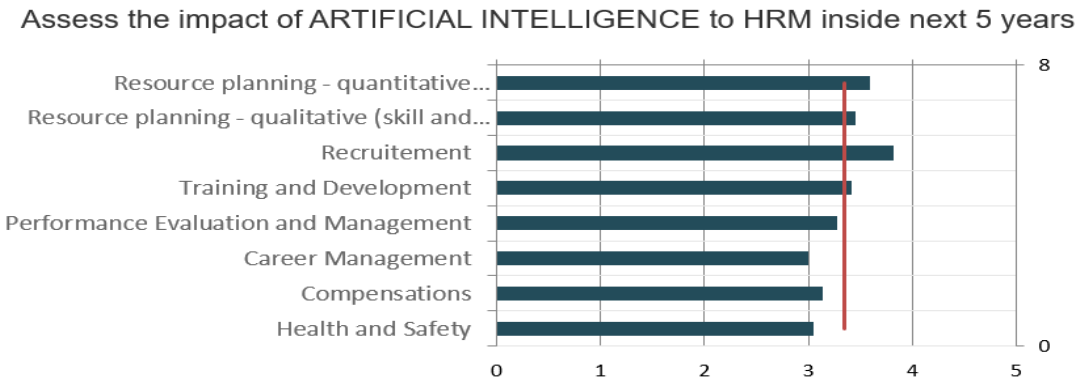

Figure 7: Examples of the assessed impacts results – the potential impact of artificial intelligence on HRM

In a similar manner, all the five other technologies were subjected to analysis. In addition to impact, a separate question was asked about the perceived lead time to the wide adoption of the technology in the HRM field (see Table 2).

Table 2: Assessment of time to wide technology adoption within HRM

Assess the lead time to impact of different emerging techs - WHEN DO YOU ASSESS THE TECHNOLOGY WILL BE APPLIED WIDELY in HRM in companies

	Already in use	0-1 years	1-3 years	3-5 years	5-10 years	10+ years	Will not be used in HRM
Artificial Intelligence	6	2	6	2	4	0	1
	28,57%	9,53%	28,57%	9,52%	19,05%	0%	4,76%
Machine Learning	3	2	8	2	4	1	1
	14,29%	9,52%	38,1%	9,52%	19,05%	4,76%	4,76%
Mixed Reality	1	2	4	8	2	2	2
	4,76%	9,53%	19,05%	38,1%	9,52%	9,52%	9,52%
Smart Robots	0	1	5	5	6	1	3
	0%	4,76%	23,81%	23,81%	28,57%	4,76%	14,29%
Virtual Assistants	4	0	8	3	4	1	1
	19,05%	0%	38,09%	14,29%	19,05%	4,76%	4,76%
Robotic Process Automation	4	5	4	4	2	1	1
	19,05%	23,81%	19,05%	19,05%	9,52%	4,76%	4,76%
Total	18	12	35	24	22	6	9

To summarise the findings, an overview combining the impacted areas of specific technologies and their lead times was compiled into Table 3.

Table 3: Impact areas of emerging technologies into HRM processes and expected lead time

Tech area	HR processes most impacted by the tech area	HR processes least impacted by the tech area	The median expectation of time to wide adoption
Artificial intelligence	Recruitment, quantitative resource planning	Career management, health and safety	1–3 years
Machine learning	Quantitative resource planning, recruitment	Career management, health and safety	1–3 years
Mixed reality	Training and development, health and safety, recruitment	Compensations, career management	3–5 years
Smart robots	Training and development, recruitment	Compensations, career management	3–5 years
Virtual assistants	Training and development, recruitment	Compensations, quantitative resource planning	1–3 years
Robotic process automation	Quantitative resource planning, qualitative resource planning	Career management, performance evaluation and management	1–3 years

Additional questions arising from the literature review were related to the motivators and obstacles for tech adoption within HRM community and the impact they have over HR as a specialist function and profession – is technology capacity-enhancing or -destroying for those currently within HRM? Is it resource-saving vs. resource-demanding? The main motivators to embrace technology in HRM were clearly the search for cheaper and faster HR processes (73 and 68%). The main obstacle was uncertainty of technology choice (68%), cost of implementation (55%) followed by employee and managerial resistance (both 33%).

Both the cost and importance effect showed similar non-linear curves: at short intervals the cost curve was seen to rise – with savings to follow. The importance of the HRM function was in a similar way seen to rise first, but the lowering of regard for HRM was predicted to take place over time. The wider impacts on cost and the role of HRM functions were seen to take place at 3–5-year intervals.

5. Discussion

This study set out to predict the adoption of emerging technologies in HRM, and thus contribute to the academic research on HRM futures as well as to shed light on this transformation process in a way that serves the practitioners of HRM in the development of their organisations.

Our contributions to the development of theory point to two directions. Firstly, our results propose that the earlier models of technology adoption should be further developed by including additional elements of 1) uncertainty of correct technology choice, and 2) uncertainty of the cost of implementation and the resulting return on investment. In addition, the impact of novel technologies on the professional role and content of corporate functions such as HRM can cause inertia of transformation that was not previously built into theory frameworks on technology adoption. The results indicate that emerging technologies may serve as competence-enhancing factors for HRM professionals and functions, changing over time into competence-destroying elements, as the theories of radical innovation propose.

Secondly, the results of this study show that theoretical constructs that treat HRM as a single whole entity as well as the use of the umbrella term ‘emerging technologies’ to describe the development are too broad to bring meaningful results. Our empirical data proposes that dividing both HRM and technology into more specific elements shows a big variation on the impact and lead time that technologies will have on HRM.

The practical implications of our work, primarily for technology providers, technology buyers with and within HRM as well as HRM professionals, suggest that 1) HRM will see a big change towards technology intrusion, especially in a 3–5 year time span, but also that 2) different technologies are expected to serve in very different ways once a single HRM process is in question. The hype cycle curves look at issues on a very high aggregate level across industries and functions, whereas both the current reality and future evolution is more granular.

6. Conclusions

Our results underline that it is important to understand the strong undercurrent of technology adoption as such, with its drivers and obstacles. Along the same lines, having a wide view on HRM as a function and profession and its position regarding technology is recommendable, before delving into the specifics of either technology and/or HRM. Focusing on a selected number of technologies (that are often interwoven or dependent) and clearly expressed HRM processes is likely to yield more meaningful results. In the constantly changing and rapidly enhancing technological environment, the validity of results from cross-sectional studies is questionable. In this respect, the results from our empirical study have limited validity in terms of time. Due to the nature of the creation of a respondent pool, views on the relationship between technology and HRM may be biased. Potentially, people who felt competent and involved with the issue may have been more likely to participate, making the findings overly positive towards tech intrusion. Future studies should seek to create test samples and/or the categorisation of technology-intensive/non-intensive companies to confirm the findings.

The next stages of this research aim to gather a sufficiently large dataset in terms of number of respondents (and socio-cultural coverage) to apply a full-scale statistical analysis. This will most likely require the survey to be translated into local languages, as the English-only survey may be difficult for many involved in national/local HRM. On the other hand, the specificity of keywords, especially in technology, may suffer from multiple language conversions.

The addition of qualitative and case studies would also be needed to better understand the rationale and decision-making process of different stakeholders and their relationships with each other in the technology adoption process towards practical HR activity.

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