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# **A systematic literature review on the disruptions of artificial intelligence within the business world: in terms of the evolution of competences**

*Shengxing YANG\**

\* Faculté Jean Monnet, Université Paris-Saclay, France

## **Abstract :**

The advancement of artificial intelligence has brought both opportunities and challenges to the business world, and its potentially disruptive impact has attracted the research interest of management scholars. This exploratory research applied a systematic literature review approach to explore the nexus between AI and competences to help both firms and individuals better address the disruptions from AI. After reviewing relevant publications from the Business Source Complete database for the past decade (2011-2021), we selected 65 articles published in leading international journals for analysis. We summarized researchers' debates and issues on AI and perspectives linked with competences. Furthermore, we synthesize two frameworks (RBV framework for firm-level; Key and STEM competences for individual-level) and an overview to gain a holistic understanding of the nexus between AI and competences. We found relatively little empirical evidence in the literature, the implementation of AI was still in its preliminary stages, and the frameworks we aggregated were "contextual sensitive". We suggest that future research could be conducted in a specific industry and yield richer insights.

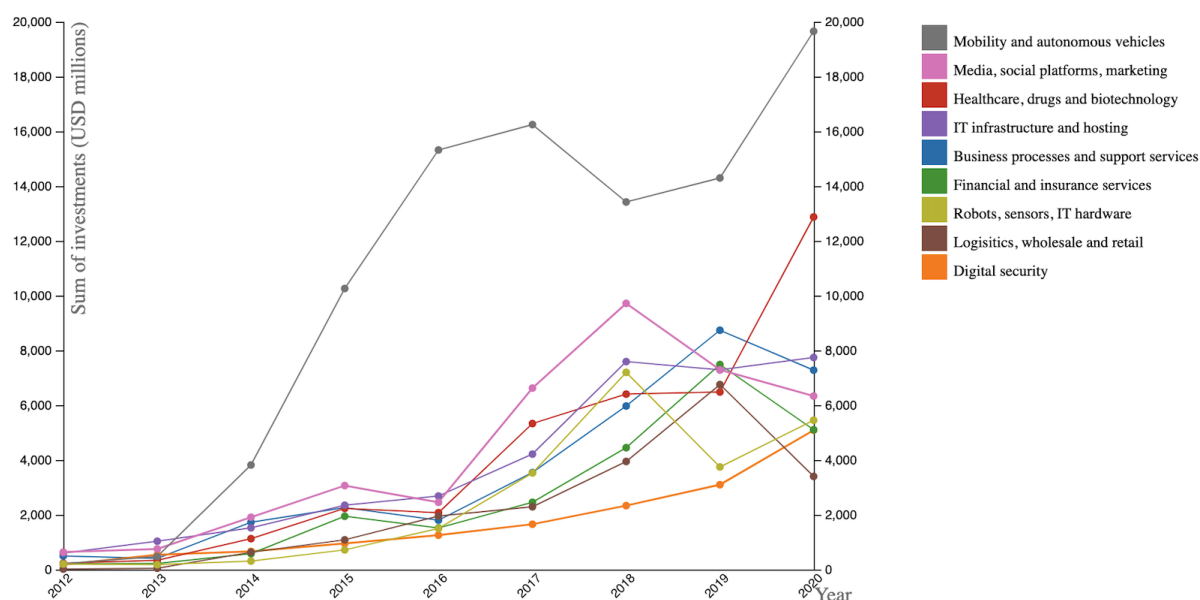
## **Keywords :**

Artificial Intelligence, Competences, Firm, Individual, Systematic literature review

# 1.Introduction

Artificial Intelligence(AI) is indeed a buzzword today, regarded as an umbrella term; it consists of a range of fancy technologies and even be hyped with “magic” power(Helo & Hao, 2021). It inevitably arouses a broad concern about its potential diverse disruptive impacts on jobs, businesses, and societies. For example, Luo et al.(2019) reported that AI was as effective as proficient workers and even four times more effective than newcomers. And, it enables machines to handle an increasing number of cognitive tasks which used to be exclusively performed by humans(Brynjolfsson et al., 2019).

According to World Economic Forum(2021), most AI systems are only excellent at particular tasks, and their capabilities are still “narrow”; most researchers expect it still takes a few decades to wait for the emergence of high-level. Nevertheless, AI has received a lot of interest from venture capitalists; shown in Figure 1, the investment in AI has surged since 2013, crossing diverse sectors and industries, especially in mobility and autonomous vehicles, suggesting the great potential and value embedded in AI.



**Figure 1 : Venture capital in AI worldwide(2012-2020)**

Source : OECD AI Policy Observatory<sup>1</sup>

However, organizations are still struggling to gain a coherent understanding of AI and take advantage of it in their daily operations(Enholtm et al., 2021). Recalling from the highlight of Tambe et al. (2019), AI is coming to be the next General Purpose Technology(GPT), which will require organizations to inject complementary firm-specific investment(e.g., cost of related training, cost of the redesign process and organization structure). Besides, in terms of individuals, AI will continually reshape their working environment, design of occupations, and play an essential role in machine-human collaboration(OECD, 2021). According to one report from McKinsey(2018), in general, there will be more need for the technological, social

<sup>1</sup> For more detail: <https://oecd.ai/en/data?selectedArea=investments-in-ai&selectedVisualization=vc-investments-in-ai-by-industry>; screenshot on 10/02/2022

and emotional, higher cognitive skills in the future, whereas less in terms of physical and manual, basic cognitive skills. Moreover, as World Economic Forum(2018) suggested, along with the acceleration of workforce transition, AI could also link with the issue of skills gaps, inequality, and polarization.

Meanwhile, a significant amount of research has been conducted to understand and demystify AI. Some are trying to figure out the possible impacts on specific occupations: Audit and Accounting(Moll & Yigitbasioglu, 2019); Some are Systematic Literature Reviews(SLR), investigating diverse functions and domains, which include Customer Relationship Management(Saura et al., 2021); Supply Chain Management(Pournader et al., 2021; Toorajipour et al., 2021); Marketing(Mariani et al., 2021; Vlačić et al., 2021); Purchasing(Allal-Chérif et al., 2021); Manufacturing(Sharma et al., 2021); Public employment(Reis et al., 2021); Public governance(Zuiderwijk et al., 2021); Agriculture(Spanaki et al., 2022). And to our knowledge, there is no related research specifically focused on the nexus between AI and competences, which consists of at least two perspectives: individual and firm. To fill this gap, we conduct this research to answer the main Research Question(RQ):

*“To what extent does Artificial Intelligence impact profiles of competences for the future?”*

We have structured this research work into six sections: the first is about the introduction, the subsequent section is about the background of this research. Then the third section is our research methodology. Following is data analysis, we then presented our insights, limitations, and future research recommendations in the discussion. We made our conclusions in the last section. What's more, we attached references and appendixes for more detailed information.

## 2. Background

### 2.1 Artificial intelligence : typology and definitions

Artificial Intelligence(AI) is not a new conception; it was first espoused in the 1950s along with better computational and storage capabilities whereas less cost(Baum & Haveman, 2020). It is easier to get confused about AI than to understand it. Following, we are trying to make a clear version of AI with: the typology of AI, definitions, and our proposed definition for AI.

#### 2.1.1. Typology of AI

The most effective way to understand AI may be derived from the research of Benbya et al.(2021), which lists AI with three criteria: intelligence, technology, and function. They also highlighted that these technologies may overlap and can hardly be compartmentalized. Following is Table 1 to display the main conceptions and applications motioned.

Criteria	Subcategories	Brief descriptions and comments
Intelligence	Weak(Narrow)	Being able to solve one specific problem solely and cannot transfer skills from domain to domain
	General	Target with a human-level skill set, especially cognitive (currently doesn't exist)

	Superintelligence	Outperformance than humanity's cognitive parts in all domains of interest(currently doesn't exist)
	Machine learning	Trying to learn from experience, detect patterns from the labeled or unlabeled training set. With subclasses: deep learning and reinforcement learning
	Natural language processing	The ability of the computer program to understand the written or spoken of human(with target language)
Technology	Robots	Robots automatically run physical activities, e.g., picks up objects
	Various automation technologies	Automation of different tasks include robotic process automation(automation of structured digital tasks and interfaces with systems)
	Rule-based expert systems	Not state-of-art, a set of logical rules from human experts
Function	Conversational	Refers to the ability of a computer to understand and respond to humanity with targeted human language(in terms of writing or speaking)
	Biometric	Based on the measurement of persons' physiological (fingerprints, facial images, hand geometry, etc.) or behavioral characteristics (voice, signature). Related applications: facial recognition, voice recognition, etc.
	Algorithmic	The key is about using machine learning algorithms, whether based on labeled or unlabeled training data.
	Robotic	Physical robots perform dedicated tasks, now becoming more and more intelligent to solve complex tasks with the help of ML and NLP, such as robotic-assisted surgeries.

**Table 1 : Typology of AI**

Source: (Benbya et al., 2021)

### 2.1.2. Definitions of AI

The original definition of AI can be traced back to 1950, the famous Turing test: whether a machine could mimic human cognitive capabilities(Akter et al., 2020). However, there is still no standard accepted definition for AI(Mikalef & Gupta, 2021). We are trying to review several different definitions of AI in the literature; we summarized their applied context and listed them in Table 2.

Context	Definition
Supply Chain Management	« AI is a field in computer science encompassing the development of systems capable of performing tasks that normally necessitate human intelligence » (Pournader et al., 2021, p.2).

Organizational	« <i>AI is the ability of a system to identify, interpret, make inferences, and learn from data to achieve predetermined organizational and societal goals</i> » (Mikalef & Gupta, 2021, p.3).
Management	« <i>Artificial Intelligence (AI) represents a highly capable and complex technology that aims to simulate human intelligence</i> » (Glikson & Woolley, 2020, p.3).
IS research	« <i>We define AI as the frontier of computational advancements that references human intelligence in addressing ever more complex decision-making problems</i> » (Berente et al., 2021, p.1435).
Organizational	« <i>Defined as technologies that leverage machine-based intelligence and advanced computing capacity to mimic human "cognitive" functions, AI goes beyond conventional technologies by approximating human cognitive functions to search, analyze, and make decisions based on large-scale data</i> » (Li et al., 2021, p.1605).
Management and economic	« <i>A set of technologies that can imitate intelligent human behavior</i> » (Clifton et al., 2020, p.5).

**Table 2 : Definitions of AI in the literature**

As we can perceive in Table 2, the descriptions of AI could have different focuses based on researchers' research context. Based on the collection of definitions between 1955 and 2019, through diverse domains, Samoili et al.(2020) summarized four common mentioned characteristics of AI:

- *Perception* of the environment and real-world complexity,
- *Information processing*: collecting and interpreting inputs,
- *Decision making*, including reasoning, learning, and taking actions
- *Achievement of pre-defined goals*.

Considering the organizational and individual context we are investigating, we proposed our initial definition of AI as: "*AI is the ability of a system can automatedly process inputs(data) to support or make for decision-making, to achieve the pre-defined organizational and societal goals.*"

More specifically, we argue that AI will help to automate the programmed decision and augmenting(supporting) non-programmed decision, and to transfer the non-programmed decision into programmed decision iteratively. It is inspired by Herbert Simon's decision-making theory, in which programmed decisions are described as already established guidelines and formal patterns, whereas non-programmed decisions are ill-structured and one-time decisions(Simon, 1997).

## **2.2 Competence : firm and individual level**

Competence(also be mentioned as competency, could be used interchangeably with capability in literature, we use competence in this article) is neither a new concept, and there are confusions and debates about its definition and theory. As Le Deist and Winterton(2005) suggested, it is impossible to generate a coherent theory and definition considering its widely different used contexts. Generally speaking, it is commonly used in two levels: firm and individual.

### 2.2.1. Firm level : view of routines

Highlighting as *organizational routines and processes, collective knowledge*, the concept of competence is a hit in the literature of management science in the 1990s(Le Deist & Winterton, 2005), gaining mainly concern as the conception of “core competences” as « *Are the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies* » (Prahalad & Hamel, 1990, p. 4).

Especially as we live in the continuing digitalization world, it emerges with the implication of a new routine and process(Volberda et al., 2021). The competition landscape in the business world could change rapidly; it could be vital for firms to prepare for the coming disruption in terms of competence evolution. Also, it sounds like there is more concern about gaining a balanced view(external and internal, trade-off) when facing new challenges(Asatiani et al., 2021).

### 2.2.2. Individual level : key competences and STEM competences

At the individual level, competences are widely used in education sectors and human resource development as a competence-based approach to highlight *the important individual skills, knowledge, and attitudes needed*(Le Deist & Winterton, 2005).

Also, competences are mentioned as « *more than just knowledge and skills; it involves the ability to meet complex demands, by drawing on and mobilizing psychosocial resources(including skills and attitudes) in a particular context* » (DeSeCo, 2005, p.4). Specifically, the investigation into “key competences” highlights in the research from DeSeCo<sup>2</sup>(2005): these competences are not just important in the *labor market* but also in *private relationships, political engagement*, these *transversal* competences are defined as “key”. They considered virtuous development both for individual and society(economy). DeSeCo(2005) summarized key competences<sup>3</sup> into three categories:

- 1) Use tools interactively (e.g., language, technology)
  - Using and understanding the languages, symbols, text
  - Knowledge and information management
  - Familiarity with new technologies
- 2) Interact in heterogeneous groups
  - Relationship management
  - Teamworking skills
  - Conflicts management
- 3) Act autonomously
  - Act within the big picture (Strategic and system thinking)
  - Project management
  - Self-defend and mental maturity

Besides, as for a complementary view from Johannessen (2021), the STEM(science, technology, engineering, and mathematics) competences required by robotics and automation

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<sup>2</sup> Full name: Definition and Selection of Competencies(DeSeCo), for more information, please visit their official website: <https://www.deseco.ch/bfs/deseco/en/index.html>

<sup>3</sup> For the full version of this taxonomy(a summary), please see in Appendix A.

in some industries should also make a difference in the current and future situations, in terms of facing the challenges arise by AI.

### **2.3 Nexus between AI and competences**

To our knowledge, there currently is no research trying to draw the nexus between AI and competences from both firm and individual levels, and that's why we are trying to fill this gap by conducting this SLR to investigate the relationships as well as answering our research questions. As Cohen and Levinthal(1990) suggested from their absorptive capacity theory: the late to invest in new technologies may lead to failure of implementation in the future. It could be necessary for both firms and individuals to notice the need to evolve their competences to prepare for the future, especially facing the challenge aroused by current advancement of AI.

## **3.Methodology**

Following the steps from Xiao and Watson(2019), a "guidebook" of conducting a sound systematic literature review(SLR), this section consists of three components to justify rigorous and scientific of our research, namely: Planning, Conducting and, Reporting.

### **3.1 Planning of review**

#### **3.1.1. Research Questions**

In order to investigate the nexus between AI and competences, the first step of this research is to formulate the research questions, and it always involves an evolving loop with the protocol(Xiao & Watson, 2019). The following is our main research question and sub-questions:

The main research question: *“To what extent does Artificial Intelligence impact profiles of competences for the future?”*

Sub-questions:

- What are the current impacts of AI within the business world, i.e., opportunities, challenges, and risks?
- What has been investigated by researchers regarding the nexus between AI and competences?
- How could firms and individuals cope with the evolution of their competences called from AI?
- What heuristic research directions could this evolution bring to management scholars?

#### **3.1.2. Review Protocol**

In order to make the whole review process more rigorous, we first formulated our review protocol, more detail in Appendix B. In general, it consists of seven parts: The purpose of the study; Research questions; Inclusion criteria; Research strategies; Quality assessment criteria and Screening procedures; Strategies for data extraction; Synthesis and reporting, which also stems from the recommendations of Xiao and Watson(2019).

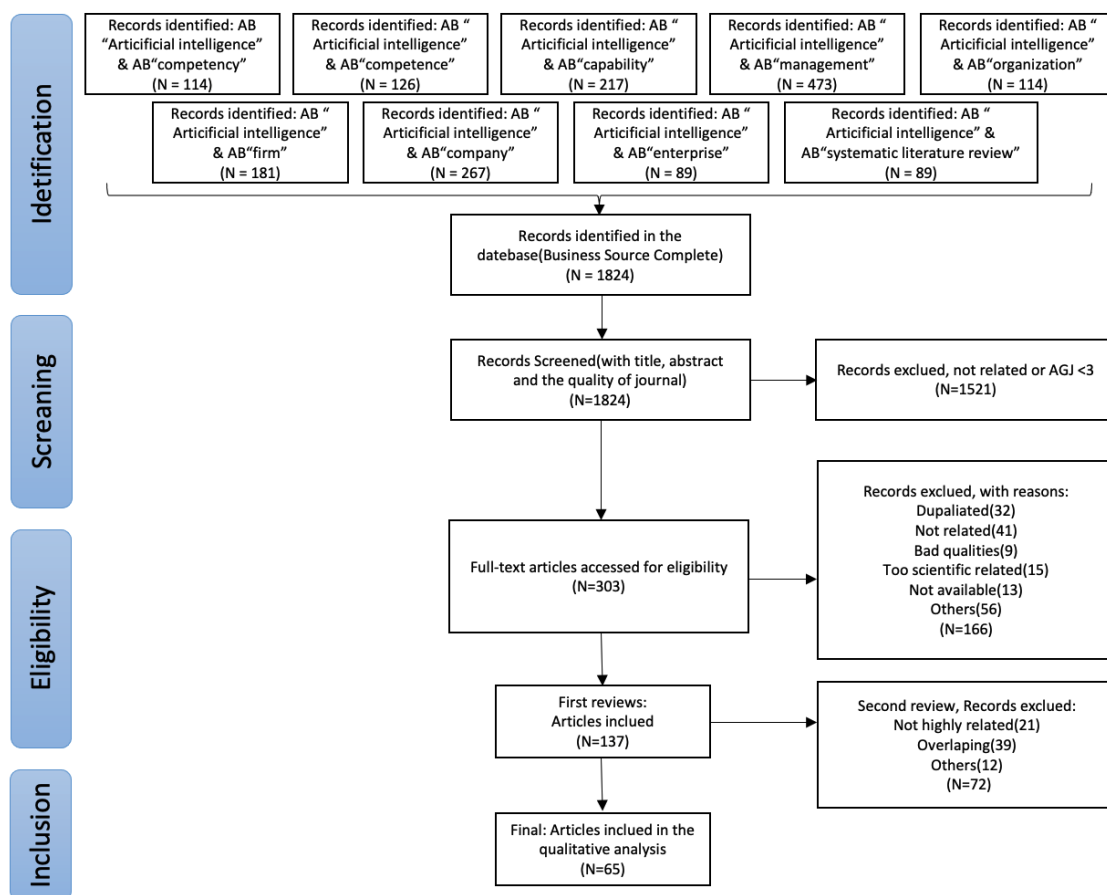


As we are trying to figure out the impact of AI within the business world, we use the most famous database: EBSCO "Business Source Complete". Besides, to guarantee the quality of the article feed in this research, we borrowed the approach from Pereira et al.(2021). We only considered the peer-reviewed articles and ranked them as 3, 4, or 4\* in AJG<sup>4</sup>(Academic Journal Guide).

### 3.2 Conducting of review

The review process lasted for around one month; we searched the articles in the database of Business Source Complete with nine combinations of keywords index in the abstract(AB). It generally indicates three concerns we were looking for:

- 1) *The direct link* with competences and AI, thus we investigated with competence, competency, capability, which also link with individuals;
- 2) What are the *perspectives from management and firms*, thus we investigated with management, firm, company, organization, enterprise;
- 3) *Supplement* from current SLRs, thus we investigated with other systematic literature reviews concerning AI.



**Figure 2 : Processing of review**

Source: (Enholm et al., 2021; Xiao & Watson, 2019)

<sup>4</sup> Please see more detail in: <https://charteredabs.org/academic-journal-guide-2021-view/>

Figure 2 summarizes the whole review process. At the first stage, we identified 1824 records, and then we applied the inclusion criteria by screening the title, abstract, and published journal to conduct the further full-text assessment. Around three hundred articles were left for the next stage for eligibility. After thoroughly reviewing the 303 articles, we excluded the papers duplicating, not highly related, not available, etc. We filtered out our sample of articles in the number of 137, we also marked the rank of the paper we chose<sup>5</sup>(N=137) from 0 to 5(0 indicates less important, 5 indicates very important), which was based on our judgment.

Then, we applied the second round of review to ensure the quality of the overall articles and the relateness with our topics, as in the first round we have limited versions of what precisely the articles are talking about. Finally, we included 65 articles in our study<sup>6</sup>.

### 3.3 Reporting of review

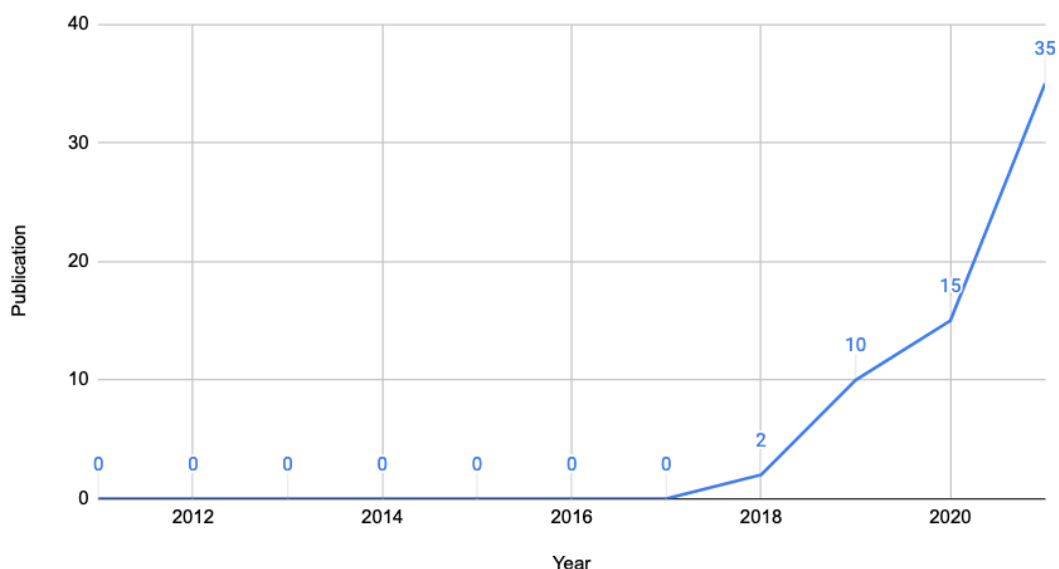
Based on the review processing, the reporting of review are the following sectors: data analysis, discussion, and our conclusions. Precisely, the data analysis consists of three parts:

- 1) General description of our sample(Number, domains, etc);
- 2) The impact of AI highlighted literature(debates and issues related);
- 3) AI-related competences.

## 4.Data Analysis

### 4.1 General description

First is the general description of the data sample; we have 65 articles. Figure 3 shows that 35 out of 65 are published in 2021, consisting of about 54% of the total sample(excluded three will be published in 2022).

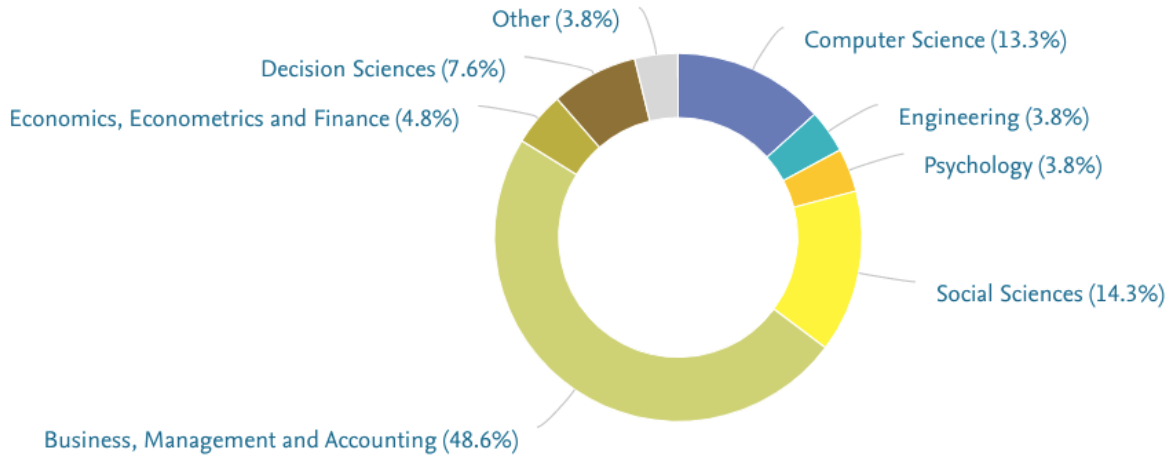


<sup>5</sup> Based on this, we made key notes for 19 articles, the notes see in Appendix C, and records of 65 articles in Appendix D.

<sup>6</sup> As for time and labor limited, and considering the number of eligible article at the first review step, we did not apply backward and forward search in our research.

**Figure 3 : Years of publications**

After we upload the article information into Scopus, based on its categories, as Figure 4 indicates, 48,6% of them are filled into the Business, Management, and Accounting. Following are Social Sciences(14,3%) and Computer Science(13,3%).



**Figure 4 <sup>7</sup> : Domain of publications**

Source: From Scopus

We have also categorized each article. More detail is listed in Appendix D. As for a general summary, Table 4 displaces the accumulated crossing information about the articles' research methods and the domains(industries). N/A represents the most significant amount, which links to conceptual framework building or argument within AI's impact on general business, economy, and social environment. Excluding N/A items, Marketing and Supply Chain Management are the two most frequently investigated domains. Besides, various research methods have been applied, with slightly more qualitative than quantitative research.

Domain/Industry	Qualitative	Quantitative	Mixed	LR	SLR	N/A	Grand Total
Accounting				1			1
Agriculture					1		1
Auditing		1				1	2
Customer relationship Management		1			1	1	3
Healthcare	1	1				1	3
Human Resource Management		1				1	2
Information system	1					2	3
IT sector	1						1

<sup>7</sup> Four articles are not available in scopus, so the figure is based on N=61

Domain/Industry	Qualitative	Quantitative	Mixed	LR	SLR	N/A	Grand Total
Manufacturing	1				1		2
Marketing	2	1		1	2		6
Pharmaceutical			1				1
Policy	1						1
Public employment					1		1
Public Management				1	1		2
R&D			1				1
Supply Chain Management	2	1			2		5
Telecommunication	1						1
N/A	1	3	2	2		21	29
<b>Grand Total</b>	<b>11</b>	<b>9</b>	<b>4</b>	<b>5</b>	<b>9</b>	<b>27</b>	<b>65</b>

**Table 3 : Method and Domain(Industry) of selected articles**

#### 4.2 The impact of AI: related debates and issues

Through the literature, researchers claim different views about the impacts and potential challenges of AI. There are three primary AI-related debates:

- *Hype-Fear*(Willcocks, 2020);
- *Augmentation-Automation(Replacement)*(Raisch & Krakowski, 2021; Tschang & Almirall, 2021);
- *Occupation-Process*(Fleming, 2019; Huang & Rust, 2018).

The Hype-Fear debate mainly concerns two opposite effects of AI's implementation: one is about to gain massive benefits and fast adoption, whereas another fears job loss and being replaced by machines, which could lead to aversion and side effects. The second debate is quite similar to the first one; it argues whether AI will augment humans or replace humans with automation. The third debate is about the unit of analysis that should be focused on when considering the potential impact of AI. However, we can claim safely here that Artificial General Intelligence(AGI) which is highlighted to have generalized human cognitive capabilities, does not exist; the current AI is still regarded as "*Narrow AI*"(Glikson & Woolley, 2020). Besides, AI seems even more disruptive if it combines with other advanced technologies, such as the cloud and blockchain(Akter et al., 2020; Gregory et al., 2021; Tschang & Almirall, 2021).

While there is a massive voice about the current and potential business value of AI, a growing body of research equally highlights the issues with AI, which we divide into two broad categories: bias, ethics, ideology, and inscrutability; cost and bounded automation. These issues are relatively interrelated.

- 1) *Bias, ethics, ideology and inscrutability*: tagged as “*black-box effects*”, researchers alerted that AI is still subject to the datasets it is trained on and the designers who based on their ideologies to develop it, which make it can exist bias and can lead to ethical issues, discrimination, for example(Asatiani et al., 2021; Clifton et al., 2020; Tambe, Cappelli, et al., 2019; Vesa & Tienari, 2020). Vesa and Tienari (2020) proposed “*rationalized unaccountability*” to highlight the issue of one possible point of accountability of AI implementation, regarding AI as a panacea and the scapegoat when problems emerge.
- 2) *Cost and bounded automation*: obviously, the cost related to AI-specific investment, AI talents cannot be out of consideration(Fleming, 2019; Pournader et al., 2021). According to Fleming(2019), social concerns, which consist of the price labor, the power relationship within the organization, and the nature of the task, need to consider and raise “bounded automation”, indicating firms replace manual labor economically.

### 4.3 AI-related competences

Through the literature, researchers proposed different views into the competences related with AI, and currently we found more from firm-level than individual-level.

#### 4.3.1. Firm-level

Based on different contextual and potential impact of AI, researchers proposed several interesting AI-related competences. For example, *AI innovation capability*(Lou & Wu, 2021); *AI capability*(Mikalef & Gupta, 2021); *Data governance capability*(Janssen et al., 2020). Table 4 displaces the main capabilities that occurred in our review, and it should be noted that the first two are both based on the resource-based view(RBV) <sup>8</sup>to formulate the AI capabilities. The other focuses are mainly on data governance and the issue related to value co-creation.

Context	Capability	Detail
Drug discovery industry; RBV; IT capability	AI innovation capability(AIIC): « the ability to develop, use, and manage AI resources in combination or copresent with other resources and capabilities to conduct scientific discovery and R&D effectively» (Lou & Wu, 2021, p.1453).	Tangible resources, Personnel-based resources, and AI-enabled intangible resources;1. Tangible: data, infrastructure, and algorithms used for R&D; 2. Human resource: having AI skills, as embodied in the employees, is important to have “ <i>common language</i> ”, balance and combination within AI skills and domain expertise, cross-disciplinary skills needed. 3. Intangible: firm practices and knowledge assets that can empower and foster the use of AI
Organizational; RBV	AI capability: « An AI capability is the ability of a firm to select, orchestrate, and leverage its AI-specific resources » (Mikalef & Gupta, 2021, p.4).	1. Tangible resources: data, technology, and basic resources; 2. Human skills: technical and business skills; 3. Intangible resources: inter-department coordination, organizational change capacity, and risk proclivity.
Big Data Algorithmic Systems	Data governance capability	Organizations’ personalized style to define, apply and monitor rules and permissions to guide and ensure accountability for the proper functioning of

<sup>8</sup> For more detail and a historical overview of resource-based view theory, one possible source: [https://www.valuebasedmanagement.net/methods\\_barney\\_resource\\_based\\_view\\_firm.html](https://www.valuebasedmanagement.net/methods_barney_resource_based_view_firm.html)

Context	Capability	Detail
(BDAS)		data and algorithms throughout their lifecycle within and across organizations(Janssen et al., 2020).
Manufacturing	AI capabilities <sup>9</sup>	Data pipeline, Algorithm development, and AI democratization (Sjodin et al., 2021)
Industrial, B2B	System Management Capabilities; Commercialisation-based Capabilities; Interpersonal Capabilities	System Management Capabilities: applying the technical knowledge and hard skills to implementing industrial AI collaboration; Commercialisation-based Capabilities: application of knowledge, skills, and available resources to active commercial goals; Interpersonal Capabilities: maintain the relationship(Li et al., 2021).

**Table 4 : AI capabilities**

#### 4.3.2. Individual-level

In contrast to different views within firm-level competences, there are only two papers directly investigated individual-level competences in our sample.

One is based on the interviews with managers in multinational corporations in IT sector, Jaiswal et al.(2021) highlighted five critical skills employees need to upskill within the AI context: *data analysis, digital, complex cognitive, decision making, and continuous learning skills*.

The other one formulized the "job replacement theory", specifically in the context of service sector, which consists four ordinal and parallel intelligences: *Mechanical; Analytical; Intuitive; Empathetic*(Huang & Rust, 2018). Huang and Rust(2018) argue the advancement of AI could gradually substitute or replace these intelligences.

## 5. Discussion

### 5.1 Result of data analysis

#### 5.1.1. General descriptions

We can easily see that the topics related to AI are getting more and more concerning from researchers as the publications are surging. Also, considering the articles we flited are from excellent journals, this trend indicates that more and more AI-related excellent academic work is conducting. Besides, it seems several domains attract more attention from researchers than others, such as marketing and SCM. And the implementation of AI in the firm is fairly in its early stage. Considering the variety of AI technologies and complexities within different businesses, there actually is less empirical evidence related to the real-world impact of AI. Hopefully, we can have a deep and holistic understanding of the impact of AI in the coming future.

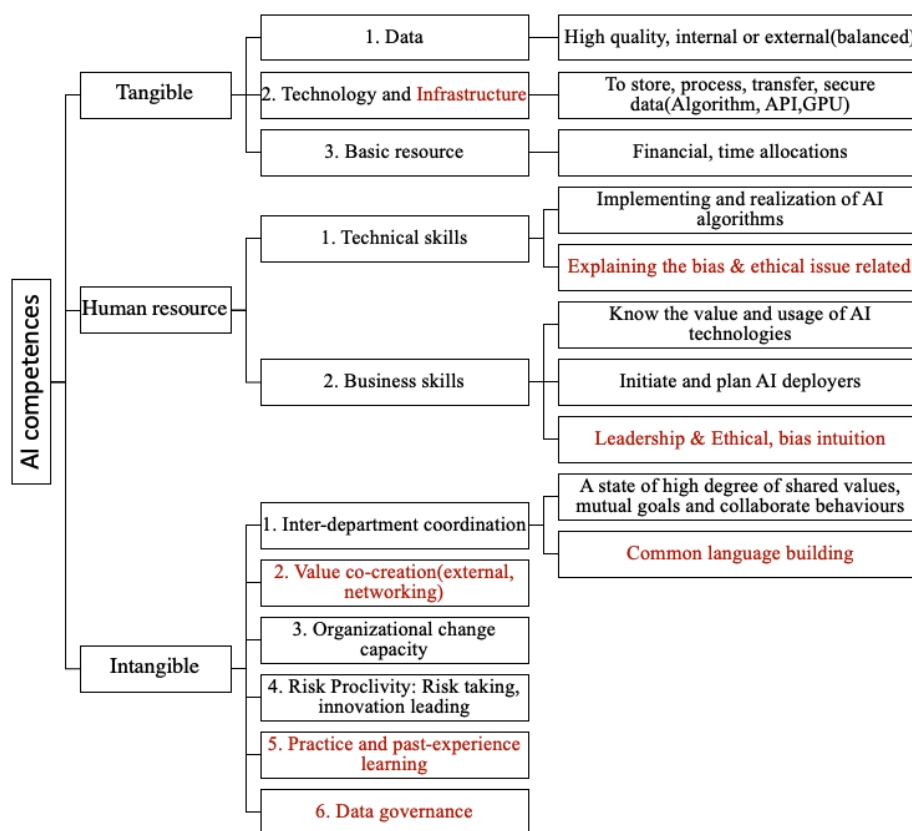
<sup>9</sup> More detail of these definitions please see in their paper, they also offer a detail framework.(In order to make the table more concise, we haven't list more detail within this capability)

### 5.1.2. Evolving competences: to harness the potential of AI

We can perceive that AI is associated with both risks and opportunities through related debates and issues. In order to harness the potential of AI, evolving related competences could be the key. We are trying to draw a fundamental overview based on our SLR, into two-level: firm-level and individual-level:

#### 1) Firm-level

Based on our literature review, RBV seems to be appropriate to formulate the competences building of AI at the firm level. This framework shows a generalized formulation to build competence and reflects the need aroused by AI. Based on the framework from Mikalef & Gupta(2021)and other capabilities and insights we come across through literature, which are listed in Table 3, we modified and summarized this framework, see Figure 5.



**Figure 5 : A modified RBV framework based on the work from Mikalef & Gupta(2021)**

Source: (Grant, 1991; Mikalef & Gupta, 2021; Janssen et al., 2020; Li et al., 2021; Lou & Wu, 2021; Sjödin et al., 2021)

*Notes: the parts in red are modified and extended based on our review*

More specifically, we added infrastructure into the tangible block to cover some specific equipment needed for AI usage(Lou & Wu, 2021). In the human resource block, inspired by the risk and bias within current AI, we highlighted the need of intuition within ethics, bias, and the explanation within the AI technologies implemented(Lou & Wu, 2021). Last, for the intangible block, we added the need to build the “common language” to boost coordination

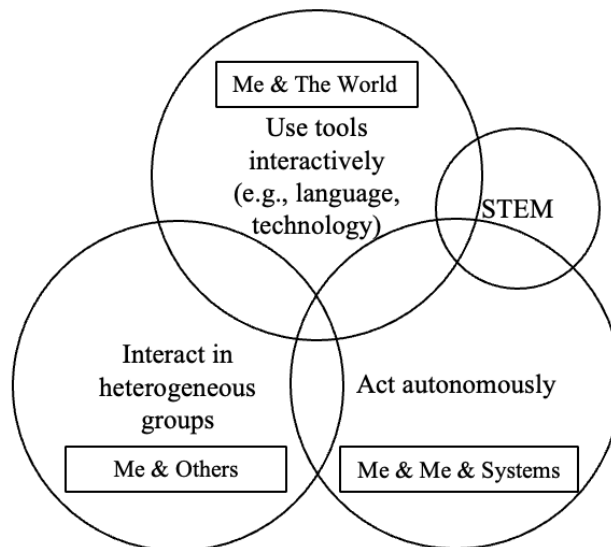
across departments(Lou & Wu, 2021); we highlighted the importance of having external networks to create value co-creation(Li et al., 2021; Sjödin et al., 2021), learn from past experience(Lou & Wu, 2021), and have personalized data governance(their own rules and styles) (Janssen et al., 2020; Sjödin et al., 2021).

What’s more, we also found some issues aroused in the validation of the framework from the work of Mikalef & Gupta(2021); for example, the following two questions are not validated: « D2. We integrate data from multiple internal sources into a data warehouse or mart for easy access; T1. We have explored or adopted cloud-based services for processing data and performing AI and machine learning » (Mikalef & Gupta, 2021, p.16).

We believe this is because there is no universal approach to implementing AI in the enterprise. Not to mention the variety of AI technologies, it is reasonably reflecting the specific needs of firms based on their stage(industries, size, etc.). That’s why the framework we summarized could also be “sensitive” to the different firms according to their position and approaches. But at this stage, this framework may offer some insights for the firm to evolve its competences related to AI.

## 2) Individual-level

Similar to the firm level, for the individual level, the competences calling from AI could be sensitive to the need required from their position. Based on our SLR, we can see that AI could potentially drive the skill transition, but fewer insights we obtained. However, we found what we mentioned in the background: key and STEM competences could generate a kind of fundamental framework for the individual level.



**Figure 6 : Key and STEM competences**

Source: (DeSeCo, 2005; Johannessen, 2021)

Showing in Figure 6, we concluded key competences’ three different dimensions and summarized the linkages between AI:

- 1) Dimension 1: “Me and the world”  
Actively using the tools and technologies to investigate the world.

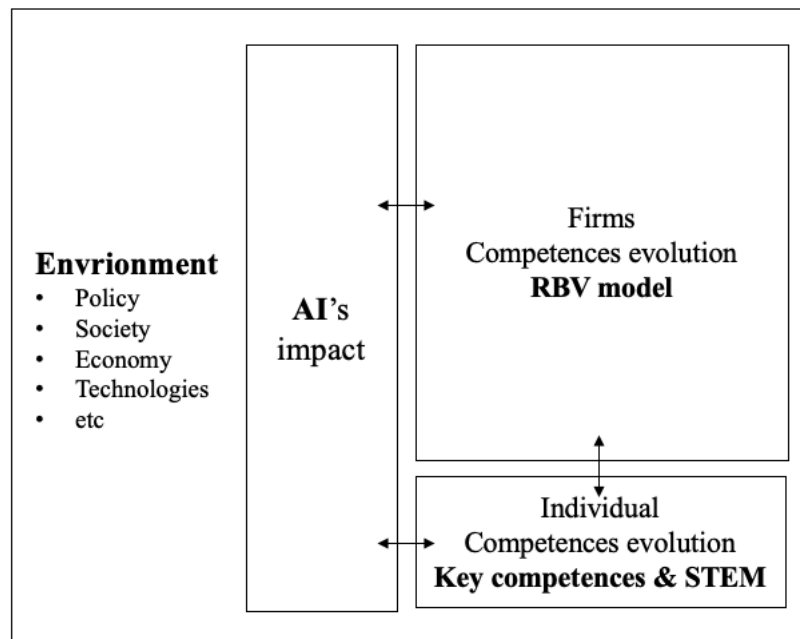


- Linkage: *fundamental need to access the AI.*
- 2) Dimension 2: “Me and others”  
 To link with others and boost cooperation.  
 Linkage: *cooperated in AI's deployment and development.*
- 3) Dimension 3 “Me and Me and the systems”  
 To understand the rules within the system and also align within personal needs.  
 Linkage: *have a big picture within the ethical usage within AI.*

In general, these key competences could help the individual be agile in most situations they could experience in both work and life when they come across AI consciously or unconsciously. However, they may also need to build STEM competences to help formulate “common languages” for coordination within AI(deployment and development). We claim this framework could be a fundamental overview to further formulize specific competences for individual, considering the requirement of industry, firm, and position.

### 5.1.3. An overview of nexus between AI and competences

In this section, we are trying to draw an overview of the nexus between competences and AI. As Figure 7 shows, the impact of AI and the evolution of firms' and individuals' competences are interrelated. For example, AI could lead to the evolution of firms, and could further guide to the evolution of the individual. We should also mention that environment will also have huge impacts in terms of policy, economy, society, technological advancement, and others. It also reflected the AI debates and issues we summarized from the literature.



**Figure 7 : An overview for nexus between AI and competences**

### 5.2 Research limitations

This research obvious exited a range of limitations, which are summarized into the following categories:

- *Researcher bias*: the primary research conductor from a business-orientated academic background has less deep knowledge of the inscrutability of AI technologies, and he is not a native English speaker;
- *Process limitation*: with limited time and could still pass some interesting papers related (Especially based on the rank of AJG, could possibly pass some important articles), and the backward and forward researching is not available for this research;
- *Source limitation*: obviously, more sources can take into consideration, for example, the conference paper and consulting documents; also, the language could include more than English;
- *Manual bias*: as some part of this research consist manual parts which could exist some errors, for example, overlooking some articles through screening;
- *Business secrets*: this may lead to bias in business research. For example, the responders can avoid telling the truth and, even worse, say something wrong or opposite, besides, it may make it more difficult for management researchers to conduct related research;
- *Theory bias*: this research investigated less into the theory of competence and may need a complementary literature review of competence.

### **5.3 Future research recommendations**

Concerning the future research, as the frameworks we summarized in this article are still at the early stage, they may generate more value if researchers could apply and modify them to a specific industry to gain more empirical evidence (Case studies, interviews, etc.) as well as in more detail. Also, future investigation into different levels of positions' (for example, top, senior, middle managers) need of AI competences could also be valuable.

## **6. Conclusions**

It's fair to say that there still exists a significant number of questions and curiosities surrounding the definition, impact, and "magic" of AI. Our research is trying to contribute in one direction, specifically within competences.

We conducted a systematic literature review to demystify the nexus between AI and competences in this research. After reviewing 65 papers, we summarized two related frameworks (RBV framework for firm-level; Key and STEM competences for individual-level) and an overview to have a preliminary understanding the nexus between AI and competences. We figured out there was currently less empirical evidence of the value of AI and how could firms and individuals harness the potential benefits and minimum risks. More possible interesting topics worth investigating regarding the evolution of competences calling from AI. It could be valuable if the research involves a specific industry or sector.

## **References**

- Akter, S., Michael, K., Uddin, M. R., McCarthy, G., & Rahman, M. (2020). Transforming business using digital innovations: The application of AI, blockchain, cloud and data analytics. *Annals of Operations Research*, 1–33.
- Albrecht, T., Rausch, T. M., & Derra, N. D. (2021). Call me maybe: Methods and practical implementation of artificial intelligence in call center arrivals' forecasting. *Journal of Business Research*, 123, 267–278.
- Allal-Chérif, O., Simón-Moya, V., & Ballester, A. C. C. (2021). Intelligent purchasing: How artificial intelligence can redefine the purchasing function. *Journal of Business Research*, 124, 69–76.
- Asatiani, A., Malo, P., Nagbøl, P. R., Penttinen, E., Rinta-Kahila, T., & Salovaara, A. (2021). Sociotechnical Envelopment of Artificial Intelligence: An Approach to Organizational Deployment of Inscrutable Artificial Intelligence Systems. *Journal of the Association for Information Systems*, 22(2), 325–352.
- Bader, V., & Kaiser, S. (2019). Algorithmic decision-making? The user interface and its role for human involvement in decisions supported by artificial intelligence. *Organization*, 26(5), 655–672.
- Bailey, D. E., & Barley, S. R. (2020). Beyond design and use: How scholars should study intelligent technologies. *Information and Organization*, 30(2), 100286.
- Baum, J. A. C., & Haveman, H. A. (2020). Editors' Comments: The Future of Organizational Theory. *Academy of Management Review*, 45(2), 268–272.

- Benbya, H., Pachidi, S., & Jarvenpaa, S. L. (2021). Special Issue Editorial: Artificial Intelligence in Organizations: Implications for Information Systems Research. *Journal of the Association for Information Systems*, 22(2), 281–303.
- Berente, N., Bin Gu, Recker, J., & Santhanam, R. (2021). Managing Artificial Intelligence. *MIS Quarterly*, 45(3), 1433–1450.
- Borau, S., Otterbring, T., Laporte, S., & Fosso Wamba, S. (2021). The most human bot: Female gendering increases humanness perceptions of bots and acceptance of AI. *Psychology & Marketing*, 38(7), 1052–1068.
- Brock, J. K.-U., & von Wangenheim, F. (2019). Demystifying AI: What Digital Transformation Leaders Can Teach You about Realistic Artificial Intelligence. *California Management Review*, 61(4), 110–134.
- Brynjolfsson, E., Rock, D., & Tambe, P. (2019, May 6). *How Will Machine Learning Transform the Labor Market?* <https://www.hoover.org/research/how-will-machine-learning-transform-labor-market>
- Chen, J., Li, K., Zhang, Z., Li, K., & Yu, P. S. (2022). A Survey on Applications of Artificial Intelligence in Fighting Against COVID-19. *ACM Computing Surveys*, 54(8), 1–32.
- Clifton, J., Glasmeier, A., & Gray, M. (2020). When machines think for us: The consequences for work and place. *Cambridge Journal of Regions, Economy and Society*, 13(1), 3–23.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1), 128.

- Commerford, B. P., Dennis, S. A., Joe, J. R., & Wang, J. (2020). Man Versus Machine: Complex Estimates and Auditor Reliance on Artificial Intelligence. *SSRN Electronic Journal*.
- Cybulski, J. L., & Scheepers, R. (2021). Data science in organizations: Conceptualizing its breakthroughs and blind spots. *Journal of Information Technology*, 36(2), 154–175.
- DeSeCo. (2005). *The definition and selection of key competencies: Executive summary*. OECD. <https://www.oecd.org/pisa/35070367.pdf>
- Enholm, I. M., Papagiannidis, E., Mikalef, P., & Krogstie, J. (2021). Artificial Intelligence and Business Value: A Literature Review. *Information Systems Frontiers*.
- Felten, E., Raj, M., & Seamans, R. (2021). Occupational, industry, and geographic exposure to artificial intelligence: A novel dataset and its potential uses. *Strategic Management Journal*, 42(12), 2195–2217.
- Ferràs-Hernández, X. (2018). The Future of Management in a World of Electronic Brains. *Journal of Management Inquiry*, 27(2), 260–263.
- Fleming, P. (2019). Robots and Organization Studies: Why Robots Might Not Want to Steal Your Job. *Organization Studies*, 40(1), 23–38.
- Glikson, E., & Woolley, A. W. (2020). Human Trust in Artificial Intelligence: Review of Empirical Research. *Academy of Management Annals*, 14(2), 627–660.
- Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, 33(3), 114–135.

- Granulo, A., Fuchs, C., & Puntoni, S. (2021). Preference for Human (vs. Robotic) Labor is Stronger in Symbolic Consumption Contexts. *Journal of Consumer Psychology*, 31(1), 72–80.
- Gregory, R. W., Henfridsson, O., Kaganer, E., & Kyriakou, S. H. (2021). The Role of Artificial Intelligence and Data Network Effects for Creating User Value. *Academy of Management Review*, 46(3), 534–551.
- Hartmann, P., & Henkel, J. (2020). The Rise of Corporate Science in AI: Data as a Strategic Resource. *Academy of Management Discoveries*, 6(3), 359–381.
- Helo, P., & Hao, Y. (2021). Artificial intelligence in operations management and supply chain management: An exploratory case study. *Production Planning & Control*, 1–18.
- Huang, M.-H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, 21(2), 155–172.
- Jaiswal, A., Arun, C. J., & Varma, A. (2021). Rebooting employees: Upskilling for artificial intelligence in multinational corporations. *The International Journal of Human Resource Management*, 1–30.
- Janssen, M., Brous, P., Estevez, E., Barbosa, L. S., & Janowski, T. (2020). Data governance: Organizing data for trustworthy Artificial Intelligence. *Government Information Quarterly*, 37(3), 101493.
- Johannessen, J.-A. (2021). *Artificial intelligence, automation and the future of competence at work*. London ; New York: Routledge, Taylor & Francis Group.

- Langer, M., König, C. J., & Busch, V. (2021). Changing the means of managerial work: Effects of automated decision support systems on personnel selection tasks. *Journal of Business and Psychology, 36*(5), 751–769.
- Le Deist, F. D., & Winterton, J. (2005). What Is Competence? *Human Resource Development International, 8*(1), 27–46.  
<https://doi.org/10.1080/1367886042000338227>
- Leone, D., Schiavone, F., Appio, F. P., & Chiao, B. (2021). How does artificial intelligence enable and enhance value co-creation in industrial markets? An exploratory case study in the healthcare ecosystem. *Journal of Business Research, 129*, 849–859.
- Li, jingyu, Li, mengxiang, Wang, X., & Bennett Thatcher, J. (2021). Strategic Directions for AI: The Role of CIOs and Boards of Directors. *MIS Quarterly, 45*(3), 1603–1644.
- Li, Mengxiang Li, Xincheng Wang, & Thatcher, J. B. (2021). STRATEGIC DIRECTIONS FOR AI: THE ROLE OF CIOS AND BOARDS OF DIRECTORS. *MIS Quarterly, 45*(3), 1603–1643.
- Li, S., Peng, G., Xing, F., Zhang, J., & Zhang, B. (2021). Value co-creation in industrial AI: The interactive role of B2B supplier, customer and technology provider. *Industrial Marketing Management, 98*, 105–114.
- Lloyd, C., & Payne, J. (2019). Rethinking country effects: Robotics, AI and work futures in Norway and the UK. *New Technology, Work and Employment, 34*(3), 208–225.
- Longoni, C., Bonezzi, A., & Morewedge, C. K. (2019). Resistance to Medical Artificial Intelligence. *Journal of Consumer Research, 46*(4), 629–650.

- Lou, B., & Wu, L. (2021). *AI on Drugs: Can Artificial Intelligence Accelerate Drug Development? Evidence from a Large-scale Examination of Bio-pharma Firms*.
- Luo, X., Tong, S., Fang, Z., & Qu, Z. (2019). Frontiers: Machines vs. Humans: The Impact of Artificial Intelligence Chatbot Disclosure on Customer Purchases. *Marketing Science*, mksc.2019.1192.
- Ma, L., & Sun, B. (2020). Machine learning and AI in marketing – Connecting computing power to human insights. *International Journal of Research in Marketing*, 37(3), 481–504.
- Makarius, E. E., Mukherjee, D., Fox, J. D., & Fox, A. K. (2020). Rising with the machines: A sociotechnical framework for bringing artificial intelligence into the organization. *Journal of Business Research*, 120, 262–273.
- Mariani, M. M., Perez- Vega, R., & Wirtz, J. (2021). AI in marketing, consumer research and psychology: A systematic literature review and research agenda. *Psychology & Marketing*, mar.21619.
- McKinsey. (2018). *Skill shift: Automation and the workforce of the future*.  
<https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce>
- Mikalef, P., Conboy, K., & Krogstie, J. (2021). Artificial intelligence as an enabler of B2B marketing: A dynamic capabilities micro-foundations approach. *Industrial Marketing Management*, 98, 80–92.



- Mikalef, P., & Gupta, M. (2021). Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. *Information & Management*, 58(3), 103434.
- Moll, J., & Yigitbasioglu, O. (2019). The role of internet-related technologies in shaping the work of accountants: New directions for accounting research. *The British Accounting Review*, 51(6), 100833.
- Munoko, I., Brown-Liburd, H. L., & Vasarhelyi, M. (2020). The Ethical Implications of Using Artificial Intelligence in Auditing. *Journal of Business Ethics*, 167(2), 209–234.
- Nowik, P. (2021). Electronic personhood for artificial intelligence in the workplace. *Computer Law & Security Review*, 42, 105584.
- OECD. (2021). *The impact of Artificial Intelligence on the labour market: What do we know so far?* (OECD Social, Employment and Migration Working Papers No. 256; OECD Social, Employment and Migration Working Papers, Vol. 256).
- Pereira, V., Hadjielias, E., Christofi, M., & Vrontis, D. (2021). A systematic literature review on the impact of artificial intelligence on workplace outcomes: A multi-process perspective. *Human Resource Management Review*, 100857.
- Pournader, M., Ghaderi, H., Hassanzadegan, A., & Fahimnia, B. (2021). Artificial intelligence applications in supply chain management. *International Journal of Production Economics*, 241, 108250.
- Prahalad, C. K., & Hamel, G. (1990). The Core Competence of the Corporation. *Harvard Business Review*, 16.

- Puntoni, S., Reczek, R. W., Giesler, M., & Botti, S. (2021). Consumers and Artificial Intelligence: An Experiential Perspective. *Journal of Marketing*, 85(1), 131–151.
- Raisch, S., & Krakowski, S. (2021). Artificial Intelligence and Management: The Automation–Augmentation Paradox. *Academy of Management Review*, 46(1), 192–210.
- Reis, J., Santo, P. E., & Melão, N. (2021). Influence of artificial intelligence on public employment and its impact on politics: A systematic literature review. *Brazilian Journal of Operations & Production Management*, 18(3), e20211114.
- Samoili, S., López Cobo, M., Gómez, E., De Prato, G., Martínez-Plumed, F., Delipetrev, B., & Joint Research Centre (European Commission). (2020). *AI watch: Defining Artificial Intelligence: towards an operational definition and taxonomy of artificial intelligence*. Publications Office of the European Union.
- Saura, J. R., Ribeiro-Soriano, D., & Palacios-Marqués, D. (2021). Setting B2B digital marketing in artificial intelligence-based CRMs: A review and directions for future research. *Industrial Marketing Management*, 98, 161–178.
- Schuelke- Leech, B., Jordan, S. R., & Barry, B. (2019). Regulating Autonomy: An Assessment of Policy Language for Highly Automated Vehicles. *Review of Policy Research*, ropr.12332.
- Sharma, A., Zhang, Z., & Rai, R. (2021). The interpretive model of manufacturing: A theoretical framework and research agenda for machine learning in manufacturing. *International Journal of Production Research*, 59(16), 4960–4994.

- Shneiderman, B. (2020). Human-Centered Artificial Intelligence: Reliable, Safe & Trustworthy. *International Journal of Human-Computer Interaction*, 36(6), 495–504.
- Simon, H. A. (1997). *Administrative behavior: A study of decision-making processes in administrative organizations* (4th ed). Free Press.
- Sjödin, D., Parida, V., Palmié, M., & Wincent, J. (2021). How AI capabilities enable business model innovation: Scaling AI through co-evolutionary processes and feedback loops. *Journal of Business Research*, 134, 574–587.
- Spanaki, K., Sivarajah, U., Fakhimi, M., Despoudi, S., & Irani, Z. (2022). Disruptive technologies in agricultural operations: A systematic review of AI-driven AgriTech research. *Annals of Operations Research*, 308(1–2), 491–524.
- Tambe, P., Cappelli, P., & Yakubovich, V. (2019). Artificial Intelligence in Human Resources Management: Challenges and a Path Forward. *California Management Review*, 61(4), 15–42.
- Tambe, P., Hitt, L. M., Rock, D., & Brynjolfsson, E. (2019). *IT, AI and the Growth of Intangible Capital*.
- Teerasoponpong, S., & Sopadang, A. (2022). Decision support system for adaptive sourcing and inventory management in small- and medium-sized enterprises. *Robotics and Computer-Integrated Manufacturing*, 73, 102226.
- Tong, S., Jia, N., Luo, X., & Fang, Z. (2021). The Janus face of artificial intelligence feedback: Deployment versus disclosure effects on employee performance. *Strategic Management Journal*, 42(9), 1600–1631.

- Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P., & Fischl, M. (2021). Artificial intelligence in supply chain management: A systematic literature review. *Journal of Business Research*, 122, 502–517. <https://doi.org/10.1016/j.jbusres.2020.09.009>
- Tremblay, M. C., Kohli, R., & Forsgren, N. (2021). THEORIES IN FLUX: REIMAGINING THEORY BUILDING IN THE AGE OF MACHINE LEARNING. *MIS Quarterly*, 45, 455–459.
- Tschang, F. T., & Almirall, E. (2021). Artificial Intelligence as Augmenting Automation: Implications for Employment. *Academy of Management Perspectives*, 35(4), 642–659.
- Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and Design in the Age of Artificial Intelligence. *Journal of Product Innovation Management*, 37(3), 212–227.
- Vesa, M., & Tienari, J. (2020). Artificial intelligence and rationalized unaccountability: Ideology of the elites? *Organization*, 135050842096387.
- Vlačić, B., Corbo, L., Costa e Silva, S., & Dabić, M. (2021). The evolving role of artificial intelligence in marketing: A review and research agenda. *Journal of Business Research*, 128, 187–203.
- Volberda, H. W., Khanagha, S., Baden-Fuller, C., Mihalache, O. R., & Birkinshaw, J. (2021). Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms. *Long Range Planning*, 54(5), 102110.
- Willcocks, L. (2020). Robo-Apocalypse cancelled? Reframing the automation and future of work debate. *Journal of Information Technology*, 35(4), 286–302.

Wirtz, B. W., & Müller, W. M. (2019). An integrated artificial intelligence framework for public management. *Public Management Review*, 21(7), 1076–1100.

World Economic Forum. (2018). *The Future of Jobs Report*. World Economic Forum. [https://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](https://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf)

World Economic Forum. (2021). *Positive AI Economic Futures*. World Economic Forum. [https://www3.weforum.org/docs/WEF\\_Positive\\_AI\\_Economic\\_Futures\\_2021.pdf](https://www3.weforum.org/docs/WEF_Positive_AI_Economic_Futures_2021.pdf)

Xiao, Y., & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, 39(1), 93–112.

Zuiderwijk, A., Chen, Y.-C., & Salem, F. (2021). Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda. *Government Information Quarterly*, 38(3), 101577.

## Appendixes

### Appendix A. Key Competences taxonomy

Key competences	Description	Sub level	More detail
Using tool interactively	It opens up the possibilities of individuals perceive and relate to the world  Reason :1. to keep up to date with technologies; 2. to adapt tools to own purposes; 3. to conduct active dialogue with the world.	Use language, symbols and texts interactively	Effective use; spoken and written language skills; computation and other mathematical skills
		Use knowledge and information interactively	It consists several requirements: 1. recognise and map what is not known; 2. Could identify, locate and access to the appropriate information source; 3. Could evaluate the value of information and its source; 4. Can organise the knowledge and information
		Use technology interactively	The awareness of the new ways of the technologies could be used into their daily lives(own circumstances and goals), to incorporate technologies into their own practices, producing familiarity to further extended usage. (Link with technologies innovations and advances)
Interacting in Heterogeneous Groups	The aim is to learn, live and work with others  Reasons : 1. to deal with diversity in pluralistic societies; 2. the important of	Relate well to others	Enable individuals to initiate, maintain and manage personal relationships; being able to respect and appreciate the value, beliefs, cultures and histories of others( to create an environment where they feel welcome, included and thrive)
		Co-operate, work in teams	To balance the commitment and their own priorities, share leadership and supporting for others. Can be concluded as: 1. Present ideas and listen to others; 2. understanding of the

	empathy; 3. the important of social capital.		dynamics of debates and following an agenda; 3. construct tactical or sustainable alliances; 4. to negotiate; 5. to make decisions that allows for different shades of opinion
		Manage and resolve conflicts	As a part of social reality, derived from divergent needs, interests, goals or value; Thus it call for individuals to be able to: 1. Analyse the issues and interests at stake(e.g., power, recognition of merit, division of work, equity), the origins of the conflict and the reasoning of all sids, recognising that there are different possible positions; 2. Identify areas of agreement and disagreement; 3. Reframe the problem; 4. Prioritise needs and goals, deciding what they are willing to give up and under what circumstances.
Acting autonomously	It assume the possession of a sound self-concept and the ability to translate needs and wants into acts of will:decision, choice and actions Reasons : 1. to realise one's identity and set goals, in complex world; 2. to exercise rights and take responsibility; 3. to understand one's environment and its functioning.	Act within the big picture	Make personal actions and decisions fit with big pictures, could account for the past experiences and the social, economic and institutional norms. It consists of several parts: 1. understand patterns; 2. have an idea of the system in which they exit(i.e. understand its structure, culture, practices, and formal and informal rules and expectations and the roles they play within it, including understanding laws and regulations, but also unwritten social norms, moral codes, manners and protocol. It complements an understanding of rights with knowledge of the constraints on actions; 3. identify the direct and indirect consequences of their actions; 4. choose between different courses of action by reflecting on their potential consequences in relation to individual and shared norms and goals
		Form and conduct life plans and personal projects	Future oriented, individuals need: 1. define a project and set a goal; 2. indentify and evaluate both the resource to which they have access and the resources they needs; 3. prioritise and refine goals; 4. balance the resources needed to meet multiple goals; 5. learn from past actions, projecting future outcomes; 6. monitor progress, making necessary adjustments as a project unfolds
		Defend and assert rights, interests, limits and needs	It implies the abilities: 1. understand one's own interests; 2. know written rules and principles on which to base a case; 3. construct arguments in order to have needs and rights recognised; 4.suggest arrangements or alternative solutions

Source : (DeSeCo, 2005)

## Appendix B. Protocol of systematic literature review

### 01 The purpose of the study

As for one part of my thesis topic as “Data, AI, Platformisation, Next generation of competences”, this study is the first step to discover the nexus between AI and competences and intends to answer research questions, based on the reviewing state-of-art research within management science.

### 02 Research questions

The main research question: “To what extent does Artificial Intelligence impact profiles of competences for the future?”

Sub-questions:

- What are the current impacts of AI within the business world, i.e. opportunities, challenges and risks?
- What has been investigated by researchers in terms of the nexus between AI and competences?

- How could firms and individuals cope with the evolution of their competences call from AI?
- What heuristic research directions could this evolution bring to management scholars?

### **03 Inclusion criteria**

1. Topic related: Especially from the management, economic, law(social science). Not specialized into scientific domain(i.e. if the article is about the a specific algorithm or more technology oriented, it will not be considered);
2. Academic oriented: peer-reviewed research papers(from journals), which means the consulting reports and blogs, etc. will not be considered;
3. Quality of Journals: high quality, according to the AJG(for 3, 4 and 4\*);
4. Language: English;
5. Time scope: 2011-2021 (last ten years);
6. Conducting searching time:(08/12/2021 & 18/12/2021);

### **04 Research strategies**

#### 4.1 Keywords:

Process during 08/12/2021:

- AI(or artificial intelligence) + competency;
- AI(or artificial intelligence) + competence;
- AI(or artificial intelligence) + capability;
- AI(or artificial intelligence) + management;

Process during 18/12/2021:

- AI(or artificial intelligence) + organization;
- AI(or artificial intelligence) + company;
- AI(or artificial intelligence) + firm;
- AI(or artificial intelligence) + enterprise;
- AI(or artificial intelligence) + systematic literature review.

4.2 Time scope: from 01/01/2011 to 2021(the searching date: 08/12/2021 & 18/12/2021)

4.3 Backward and forward search

4.4 Database: Business source complete

4.5 Storage: Dropbox & Excel& Zotero, using index

### **05 Quality assessment criteria and Screening procedures**

It consists two steps:

- 1) First, is to check the abstracts and conclusions as well as the methodology to have a view about the quality and the results of the research are convincing or not.

- 2) If the results and methodology are validated, then access the full text to have a further judgement.

Plus: Making the categories and coding for different topics, e.g. the methodology them use, industries they focus, also lists the key articles.

## 06 Strategies for data extraction

Combining with Dropbox and Excel to do the extraction, make them align with the notes.

## 07 Synthesis and reporting

Making metrics, other visualization tools to investigate the possible gaps and conduct further insights.

### Appendix C. Notes for key articles

Title	Authors	Comments
Transforming business using digital innovations: the application of AI, blockchain, cloud and data analytics	(Akter et al., 2020)	They listed vivid cases about how firms apply AI into their business, crossing different industries, highlighted the hybridization, integration, recombination, and convergence of the ABCD technologies (AI, blockchain, cloud, and data analytics)
The Rise of Corporate Science in AI: Data as a Strategic Resource	(Hartmann & Henkel, 2020)	They offered tentative explanations named "data as a strategic resource" about why digital corporations are engaging in the fundamental AI research: 1. they are lead users of advanced AI, they can profit most from the advancement of this field. Thus they have huge incentives; 2. Conducting AI research needs access to massive datasets; owning these datasets can also attract complementary scientists; 3. Data can play as complementary assets to ensure an appropriate large share of value creation. They argued the data could secure firms' competitive advantage.
Artificial Intelligence and Management: The Automation-Augmentation Paradox	(Raisch & Krakowski, 2021)	They based on the three famous books about AI robotic and the workforce to conduct the insights, as (Books) the ideas promoted in books are organizations should focus on augmentation rather than automation. They conclude that augmentation and automation are interdependent in terms of time and space; only focusing on one part could lead to a vicious circle for the organization; thus, one must try to make the balance of taking advantage of them.
Strategic Directions for AI: The role of CIOs and Boards of Directors	(Li et al., 2021)	They showed the risk, the complexity of AI, and the need to ensure AI orientation, link with overall strategic directions and goals to guide the investment, adoption, practices of AI technologies. Based on upper echelons theory, their empirical results indicated that CIO presence impacted AI orientation, which could also be positively moderated through board characteristics (educational diversity; R&D experience; AI-related experience)
Data governance: Organizing data for trustworthy Artificial Intelligence	(Janssen et al., 2020)	Highlighted "data governance capability", setting data governance as organizations' personal usage of data into accountability, the life-circle view across enterprises. They also offer 13 principles for the data governance



Title	Authors	Comments
Special Issue Editorial: Artificial Intelligence in Organizations: Implications for Information Systems Research	(Benbya et al., 2021)	This article explored opportunities of AI in terms of four business capabilities: automation; engagement; insight/decision making, and innovation. They raised great questions, for example, automation vs augmentation; automation of work or process; internal and external engagement; accountability issues. They also offered three typologies for AI based on intelligence, technology, function, respectively.
Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance	(Mikalef & Gupta, 2021)	Based on RBV they offer the first conceptualized AI capability, and use empirical case to investigate the link between organizational creativity and performance(the results indicates a positive impact)
The role of Artificial Intelligence and Data Network Effects for Creating User Value	(Gregory et al., 2021)	They introduced a model of Data Network Effects(more value that users could obtain if more of the data they used are collected by the platform they used) as the extent of network effect theory, in which they defined platform AI capability: "the ability of a platform to learn from data to continuously improve its products and services for each user."
AI on Drugs: can Artificial Intelligence accelerate drug development? Evidence from a large-scale examination of Bio-Pharama firms	(Lou & Wu, 2021)	They proposed "AI innovation capability" (AIIC): the ability to develop, use, and manage AI resources in combination or copresent with other resources and capabilities to effectively conduct scientific discovery and R&D. Also highlighted the combination view of AI skills and domain knowledge, listed some pros and cons in implementing of AI.
How AI capabilities enable business model innovation: Scaling AI through co-evolutionary processes and feedback loops	(Sjödín et al., 2021)	They focus on the manufacturing industry to display the AI capabilities: data pipeline, algorithm development, and AI democratization, then they introduced a co-evolutionary framework
Artificial intelligence in operations management and supply chain management: an exploratory case study	(Helo & Hao, 2021)	Three barriers: 1. without a strategy and top managers' support, could lead to the failure of AI; 2. Need a robust technological infrastructure and supported data; 3. Huge costs related to AI technics and talents. Also listed are great AI real-world examples, linked AI methods with the SCM
Artificial intelligence and rationalized unaccountability: Ideology of the elites?	(Vesa & Tienari, 2020)	The author proposed "rationalized unaccountability" to claim the ideology behind the AI technologies("black box" effects), using AI as an undoubtful approach to justify the decision can be a problematic future of humanity, as we should notice that the current AI is still subjective to data and its designers, which consists bias and ideologies. The analyses are on the core qualities of intelligent agent programs: autonomy, adaptability, and sociality

Title	Authors	Comments
Managing Artificial Intelligence	(Berente et al., 2021)	This article proposed a new perspective to understand what AI is: as a frontier of computational advancement to solve ever more complex decision-making problems, it also displayed three interrelated facets: autonomy, learning and, inscrutability. Besides, it offered a good overview of the challenge and risks within AI debates.
Robo-Apocalypse canceled? Reframing the automation and future of work debate	(Willcocks, 2020)	The author claimed three main technologies within existing AI technologies: physical robots, robotic process automation (RPA), and cognitive automation (CA). He also pointed out a "hype-fear" storyline for the current AI situation; hype: massive benefits, a panacea, and fastly adoption, fear: replacement, net job loss. He suggested moving the focus of AI's impacts on process and work rather than jobs(occupations)
Robots and Organization Studies: Why Robots Might Not Want to Steal Your Job	(Fleming, 2019)	The author proposed "bounded automation", highlighted social considerations (the price labor, the power relationship within organization, and the nature of the task) over technologies; He claimed that the economic views from firms to replace manual power and related cost for in AI equipment need taking into consideration. He forecasted that there would be more low-skilled and low-paid jobs in the future.
When machines think for us: the consequences for work and place	(Clifton et al., 2020)	A historical review of the definition of AI and its trend, applications; Claimed consultancies are not neutral observers but driving demand of AI adoption in the workplace; Issues related, including homogeneous of AI impact on the State level, amplify the bias; AI policy(nothing preordained for AI deployment).
Demystifying AI: What Digital Transformation Leaders Can Teach You about Realistic Artificial Intelligence	(Brock & von Wangenheim, 2019)	Through a comparable survey, this article indicated 8 success factors to implement AI successfully: 1. organizational agility; 2. engagement of skilled staff; 3. leadership; 4. support from technology partners; 5. investment; 6. culture; 7. alignment of new digital technologies with existing IT; 8. learning from failed projects. It also introduced its DIGITAL survey framework; it highlighted AI is deployed based on the existing BUs. Besides, it also shows the challenges, issues related.
Artificial Intelligence in Service	(Huang & Rust, 2018)	They formalized the "job replacement theory", which consists of 4 ordinal and parallel intelligence: Mechanical; Analytical; Intuitive, Empathetic(specialized in service). Besides, they also highlighted the replacement occur in task level rather than job level
Beyond design and use: How scholars should study intelligent technologies	(Bailey & Barley, 2020)	This research highlighted applying a unified approach to investigate intelligence technologies through variation, power, ideology, and institutions. Variation: indicates that technologies can be applied differently into different domains and could be subject to the location, organizations, ranges of factors; Power: link with the adoption of the technologies and the interests; Ideology: considering the ideas of the AI designers and its promoters; Institutions: considering the unintended

Title	Authors	Comments
		institutional ramifications.

### Appendix D. General information for 65 selected articles

Title & Authors	Unit of analysis	Theory involved	Domain/Industry	*Detail	Method	*Detail	R
Artificial Intelligence in Service (Huang & Rust, 2018)	N/A	job replacement theory	N/A	Service	N/A	simulation	4
Robots and Organization Studies: Why Robots Might Not Want to Steal Your Job (Fleming, 2019)	N/A	N/A	N/A	Business, economy, society	N/A	Debates	5
The Future of Management in a World of Electronic Brains (Ferràs-Hernández, 2018)	N/A	N/A	N/A	Organizational context	N/A	N/A	2
An integrated artificial intelligence framework for public management (Wirtz & Müller, 2019)	Article	N/A	Public Management	N/A	LR	conceptual, framework building	2
Artificial Intelligence in Human Resources Management: Challenges and a Path Forward (Tambe, Cappelli, et al., 2019)	N/A	N/A	Human Resource Management	N/A	N/A	conceptual	2
Demystifying AI: What Digital Transformation Leaders Can Teach You about Realistic Artificial Intelligence (Brock & von Wangenheim, 2019)	N/A	Mixed(Innovation diffusion, RBV, etc)	N/A	Implementing AI	mixed	Survey	5
Frontiers: Machines vs. Humans: The Impact of Artificial Intelligence Chatbot Disclosure on Customer Purchases (Luo et al., 2019)	N/A	N/A	Marketing	Call, chatbot	Quantitative	A/B test	2
Regulating Autonomy: An Assessment of Policy Language for Highly Automated Vehicles (Schuelke- Leech et al., 2019)	N/A	N/A	N/A	Law, Automated Vehicles	N/A	Data mining	1
Resistance to Medical Artificial Intelligence (Longoni et al., 2019)	N/A	N/A	Healthcare	customer preference	Quantitative	Survey	1
Rethinking country effects: robotics, AI and work futures in Norway and the UK (Lloyd & Payne, 2019)	N/A	N/A	Policy	country effects	Qualitative	interviews	1

Title & Authors	Unit of analysis	Theory involved	Domain/Industry	*Detail	Method	*Detail	R
The role of internet-related technologies in shaping the work of accountants: New directions for accounting research (Moll & Yigitbasioglu, 2019)	N/A	N/A	Accounting	N/A	LR	Quantitative & Qualitative	1
Artificial intelligence and rationalized unaccountability: Ideology of the elites? (Vesa & Tienari, 2020)	N/A	N/A	N/A	Ideology	N/A	N/A	5
Beyond design and use: How scholars should study intelligent technologies (Bailey & Barley, 2020)	N/A	N/A	N/A	Research agenda	N/A	N/A	5
Call me maybe: Methods and practical implementation of artificial intelligence in call center arrivals' forecasting (Albrecht et al., 2021)	N/A	N/A	Customer relationship Management	Call center	N/A	simulation	1
Data governance: Organizing data for trustworthy Artificial Intelligence (Janssen et al., 2020)	N/A	N/A	N/A	Data governance	N/A	conceptual, principle	4
Editors' Comments: The Future of Organizational Theory (Baum & Haveman, 2020)	N/A	N/A	N/A	Organizational context	N/A	comments	2.5
Human Trust in Artificial Intelligence: Review of Empirical Research (Glikson & Woolley, 2020)	N/A	N/A	N/A	Trust in AI	LR	Thematic, conceptual	2
Human-Centered Artificial Intelligence: Reliable, Safe & Trustworthy (Shneiderman, 2020)	N/A	N/A	N/A	Human-Centered Artificial Intelligence (HCAI)	N/A	conceptual, framework building	3
Innovation and Design in the Age of Artificial Intelligence (Verganti et al., 2020)	case(Firm)	N/A	N/A	Design and innovation management	Qualitative	case studies	3
Intelligent purchasing: How artificial intelligence can redefine the purchasing function (Allal-Chérif et al., 2021)	case(Firm)	N/A	Supply Chain Management	Purchasing	Qualitative	case studies	1
Machine learning and AI in marketing – Connecting computing power to human insights (Ma & Sun, 2020)	Article	N/A	Marketing	Research agenda	LR	conceptual, framework building	1
The Ethical Implications of Using Artificial Intelligence in Auditing (Munoko et al., 2020)	N/A	N/A	Auditing	ethical	N/A	N/A	1

Title & Authors	Unit of analysis	Theory involved	Domain/Industry	*Detail	Method	*Detail	R
The Rise of Corporate Science in AI: Data as a Strategic Resource (Hartmann & Henkel, 2020)	N/A	N/A	R&D	Organizational context, digital transformation	mixed	Quantitative & Qualitative	5
Transforming business using digital innovations: the application of AI, blockchain, cloud and data analytics (Akter et al., 2020)	N/A	N/A	N/A	Organizational context, digital transformation	LR	N/A	4
A Survey on Applications of Artificial Intelligence in Fighting Against COVID-19 (Chen et al., 2022)	N/A	N/A	Healthcare	anti-covid	N/A	Survey, application of AI	1
AI in marketing, consumer research and psychology: A systematic literature review and research agenda (Mariani et al., 2021)	Article	N/A	Marketing	consumer, psychology	SLR	Quantitative & Qualitative	1
AI on Drugs: can Artificial Intelligence accelerate drug development? Evidence from a large-scale examination of Biopharma firms (Lou & Wu, 2021)	Patent, job pasting	Resource Based View	Pharmaceutical	Drug discovery	Mixed	Quantitative & Qualitative	4
Algorithmic decision-making? The user interface and its role for human involvement in decisions supported by artificial intelligence (Bader & Kaiser, 2019)	Individual & Firm	N/A	Telecommunication	Call center	Qualitative	interviews & single case study	3
Artificial Intelligence and Management: The Automation-Augmentation Paradox (Raisch & Krakowski, 2021)	Books	N/A	N/A	Organizational context	N/A	N/A	4
Artificial intelligence applications in supply chain management (Pournader et al., 2021)	Article	N/A	Supply Chain Management	N/A	SLR	Quantitative & Qualitative	2
Artificial intelligence as an enabler of B2B marketing: A dynamic capabilities micro-foundations approach (Mikalef et al., 2021)	Individual & Firm	Dynamic Capabilities Views	Marketing	B2B marketing	Qualitative	interviews & case studies	2
Artificial intelligence as Augmenting Automation : Implications for employment (Tschang & Almirall, 2021)	case	N/A	N/A	Business, economy, society	N/A	N/A	3
Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance (Mikalef & Gupta, 2021)	N/A	Resource based view	N/A	Organizational context	mixed	Expert Panel, Survey (Empirical analysis)	4
Artificial intelligence in operations management and supply chain management: an exploratory case study (Helo & Hao, 2021)	case (Firm)	N/A	Supply Chain Management	N/A	Qualitative	exploratory interviews	4

Title & Authors	Unit of analysis	Theory involved	Domain/Industry	*Detail	Method	*Detail	R
Artificial intelligence in supply chain management: A systematic literature review (Toorajipour et al., 2021)	Article	N/A	supply Chain Management	N/A	SLR	Quantitative & Qualitative	2
Changing the means of managerial work: effects of automated decision support systems on personnel selection tasks (Langer et al., 2021)	N/A	N/A	N/A	Human-machine interaction	Quantitative	A/B test	2
Consumers and Artificial Intelligence: An Experiential Perspective (Puntoni et al., 2021)	N/A	N/A	N/A	consumer experience, research agenda	N/A	N/A	1
Data science in organizations: Conceptualizing its breakthroughs and blind spots (Cybulski & Scheepers, 2021)	N/A	N/A	N/A	Data governance	N/A	conceptual	3
Disruptive technologies in agricultural operations: a systematic review of AI-driven AgriTech research (Spanaki et al., 2022)	Article	N/A	Agriculture	N/A	SLR	Quantitative & Qualitative	1
Electronic personhood for artificial intelligence in the workplace (Nowik, 2021)	N/A	N/A	N/A	Law, right, Ethical	N/A	N/A	1
How AI capabilities enable business model innovation: Scaling AI through co-evolutionary processes and feedback loops (Sjödén et al., 2021)	Individual & Firm	N/A	Manufacturing	N/A	Qualitative	interviews & case studies	4
How does artificial intelligence enable and enhance value co-creation in industrial markets? An exploratory case study in the healthcare ecosystem (Leone et al., 2021)	Individual & Firm	N/A	Healthcare	B2B, value co-creation	Qualitative	interviews & case studies	3
Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda (Zuiderwijk et al., 2021)	Article	N/A	Public management	N/A	SLR	Quantitative & Qualitative	1
Influence of artificial intelligence on public employment and its impact on politics: a systematic literature review (Reis et al., 2021)	Article	N/A	Public employment	N/A	SLR	Quantitative & Qualitative	1
Man Versus Machine: Complex Estimates and Auditor Reliance on Artificial Intelligence (Commerford et al., 2020)	individual	N/A	Auditing	N/A	Quantitative	Control experiments & Survey	2
Managing Artificial Intelligence (Berente et al., 2021)	N/A	N/A	N/A	IS research	N/A	conceptual, framework building	5

Title & Authors	Unit of analysis	Theory involved	Domain/Industry	*Detail	Method	*Detail	R
Occupational, industry, and geographic exposure to artificial intelligence: A novel dataset and its potential uses (Felten et al., 2021)	N/A	N/A	N/A	Exposure of AI	N/A	Measurement	2
Preference for human (vs. robotic) labor is stronger in symbolic consumption contexts (Granulo et al., 2021)	individual	N/A	N/A	customer preference	Quantitative	Control experiments	1
Rebooting employees: upskilling for artificial intelligence in multinational corporations (Jaiswal et al., 2021)	individual	Mixed(AI job replacement, etc)	IT sector	N/A	Qualitative	interviews	1
Rising with the machines: A sociotechnical framework for bringing artificial intelligence into the organization (Makarius et al., 2020)	N/A	Socio-Technical Systems (STS) theory	N/A	Organizational context	N/A	conceptual, framework building	1
Robo-Apocalypse canceled? Reframing the automation and future of work debate (Willcocks, 2020)	N/A	N/A	N/A	Business, economy, society	N/A	Debates	5
Setting B2B digital marketing in artificial intelligence-based CRMs: A review and directions for future research (Saura et al., 2021)	Article	N/A	Customer relationship Management	B2B	SLR	Quantitative&Qualitative	1
Sociotechnical Envelopment of Artificial Intelligence: An Approach to Organizational Deployment of Inscrutable Artificial Intelligence Systems (Asatiani et al., 2021)	individual	N/A	Information system	Organizational context	Qualitative	interviews & case study	3
Special Issue Editorial: Artificial Intelligence in Organizations: Implications for Information Systems Research (Benbya et al., 2021)	N/A	N/A	Information system	Research agenda	N/A	N/A	4
Strategic directions for AI: The role of CIOs and Boards of directors (Li et al., 2021)	Firm	N/A	N/A	Organizational context	Quantitative	Empirical analysis	4
Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms (Volberda et al., 2021)	N/A	N/A	N/A	Organizational context, digital transformation	N/A	conceptual, framework building	3
The evolving role of artificial intelligence in marketing: A review and research agenda (Vlačić et al., 2021)	Article	N/A	Marketing	N/A	SLR	Quantitative&Qualitative	1
The interpretive model of manufacturing: a theoretical framework and research agenda for machine learning in manufacturing (Sharma et al., 2021)	N/A	N/A	Manufacturing	N/A	SLR	Quantitative&Qualitative	1

Title & Authors	Unit of analysis	Theory involved	Domain/Industry	*Detail	Method	*Detail	R
The Janus face of artificial intelligence feedback: Deployment versus disclosure effects on employee performance (Tong et al., 2021)	individual	N/A	Human Resource Management	Performance measurement	Quantitative	Control experiments	1
The most human bot: Female gendering increases humanness perceptions of bots and acceptance of AI (Borau et al., 2021)	N/A	N/A	Customer relationship Management	Chatbot	Quantitative	Control experiments	1
The role of Artificial Intelligence and Data Network Effects for Creating User Value (Gregory et al., 2021)	N/A	Network Effects	N/A	Organizational context, digital transformation	N/A	conceptual, framework building	4
Theories in Flux: Reimagining theory building in the age of machine learning (Tremblay et al., 2021)	N/A	N/A	Information system	Research agenda	N/A	N/A	2
Value co-creation in industrial AI: The interactive role of B2B supplier, customer and technology provider (S. Li et al., 2021)	Individual & Firm	N/A	Marketing	B2B marketing	Qualitative	interviews	2
When machines think for us: the consequences for work and place (Clifton et al., 2020)	N/A	N/A	N/A	Business, economy, society	N/A	N/A	5
Decision support system for adaptive sourcing and inventory management in small- and medium-sized enterprises (Teerasoponpong & Sopadang, 2022)	N/A	N/A	Supply Chain Management	SMEs	Quantitative	simulation	1