

An Overview of AI Adoption in Business & Management

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Presentation Outline



Background

600K academic papers in the area of AI (Shoham et al. 2019)



Increased number of systematic literature reviews (SLRs) on AI in different domains



No attempts to review the results of these SLRs in a systematic way



No SLRs that bring together different business disciplines and application areas



Important to understand drivers/and barriers for the AI adoption in Bus. & Mgmt.



£630bn by 2035 - estimated value of AI for UK economy (Hall and Pesenti, 2017;

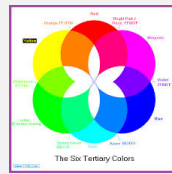
The aim

To produce a tertiary study that will provide an overview of results from the existing systematic literature reviews on AI adoption across different business sectors, B&M functions and to outline a roadmap for further research in this area.

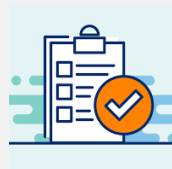
Methodology



Systematic literature review (SLR) is a type of a literature review that follows a specific review protocol and quality procedures to select relevant (primary) studies, extract and analyse the relevant information from the studies to answer specific research questions.



A tertiary study compiles the evidence from other SLRs, using them as primary studies for further analysis. This type of review is also known as 'umbrella study', 'overview of systematic reviews', 'systematic review of systematic reviews' and 'meta- review'.



This study is based on the guidelines from Kitchenham and Charters (2004), Budgens et al (2015) and other examples of tertiary studies such as Kitchenham et al. (2010), and Hoda et al. (2017).

Research Questions

RQ1

How many SLRs on AI in B&M were published since the re-birth of AI (2000) to date (2019) and what is their quality?

RQ2

Which research areas are being addressed in AI for B&M?

RQ3

What are the driver and the barriers for AI adoption in B&M?

RQ4

What importance is placed on human and social factors relevant to the AI application in B&M?

RQ5

What recommendations are made for further research on AI in B&M?

RQ6

What progress has been achieved with respect to prior recommendations for AI in B&M

Search string 1:

("systematic review" OR "systematic literature review" OR "systematic map" OR "systematic mapping" OR "mapping study" OR "scoping review" OR "meta-analysis") AND

("AI" OR "artificial intelligence" OR "machine learning" OR "neural network" OR "robot" OR "intelligent agent" OR "deep learning")

Search string 2:

<Search string 1> AND

("business" OR "management" OR "finance" OR "financial services" OR "high tech" OR "information technology" or "IT" OR "tourism" OR "hospitality" OR "travel" OR "transportation" OR "logistics" OR "energy" or "resources" or "healthcare" OR "education" OR "retail" OR "media" OR "entertainment" OR "automotive" OR "assembly" OR "smart cars" OR "smart cities" OR "consumer goods" OR "building" OR "accounting" OR "insurance")

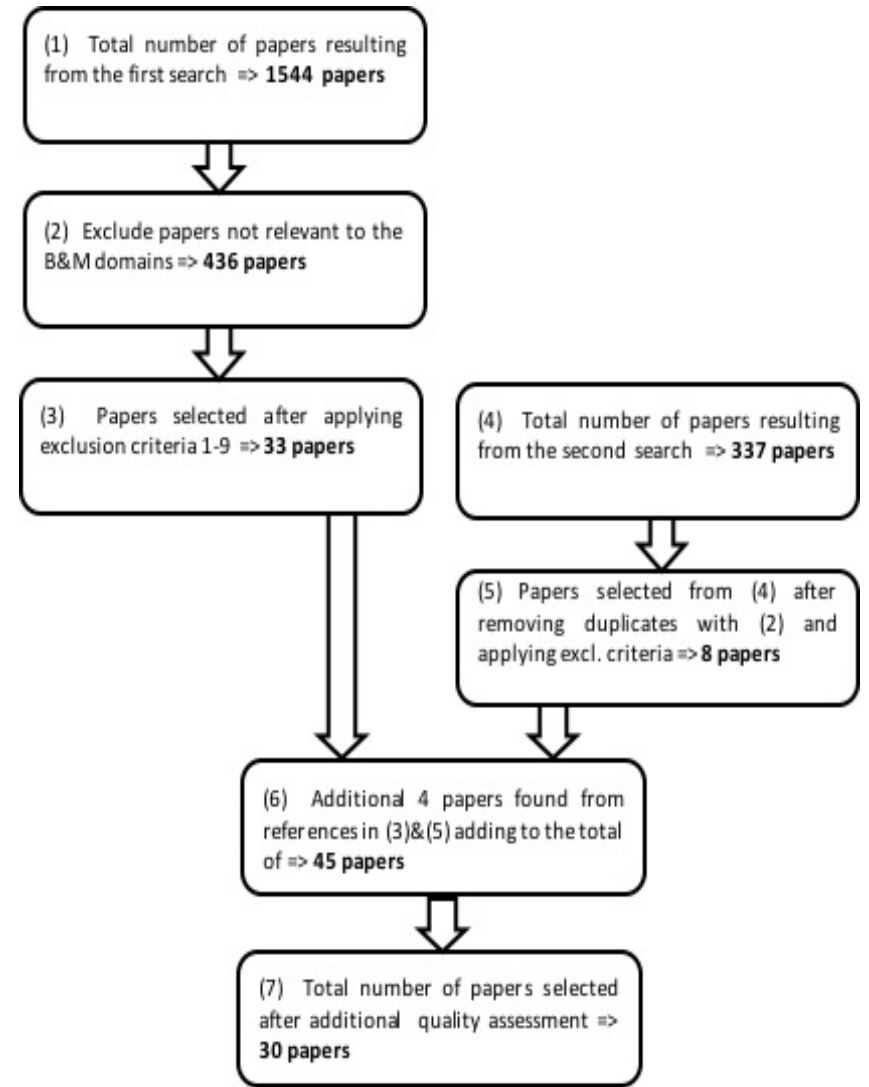
The search process

Two searches were performed on the 18th of July 2019 using the University of Hertfordshire Online Library (UHOL) search facilities.

The UHOL performs a search over 278 different library databases, including Scopus which has the widest coverage of peer-reviewed journals.

The study selection process

- ✓ Published after 01/01/2000.
- ✓ Journal/ conference peer-reviewed papers
- ✓ English
- ✓ Snowballing
- ✓ AI in Bus, Mgmt, Dec support
- ✓ Technology acceptance
- ✗ False positives
- ✗ Only abstract available
- ✗ Non-systematic literature reviews

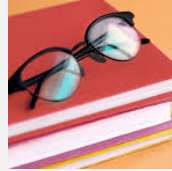


Quality ranking criteria	Yes (1.0 score)	Partial (0.5 score)	No (0 score)
Publisher's reputation	Top publishers	Others	-
The role of AI	Primary	One of the two main techniques	One of many
Type of SLR	SLR	Mapping or scoping study	Other
Number of studies	Reported	Could be derived	Not reported
Number databases	3 or more	2 or less or top journals/conf.	Not reported
Years covered	Reported	Could be derived	Not reported
Specific SLR guidelines	Reported	Based on other reviews	Not reported
Search string	Reported	Yes (1-2 terms)	Not reported
Data analysis	Reported	Could be derived	Not reported
Research questions	Reported	Only objectives	Not reported

Quality assessment

Data extraction

Thematic analysis was performed on qualitative data such as abstracts, findings, recommendations etc



Bibliographic information such as: 1)citation, 2) title, 3) abstract, 4)publication year, 5)publication type, 6)publication title, 7)publisher, and 8)keywords.



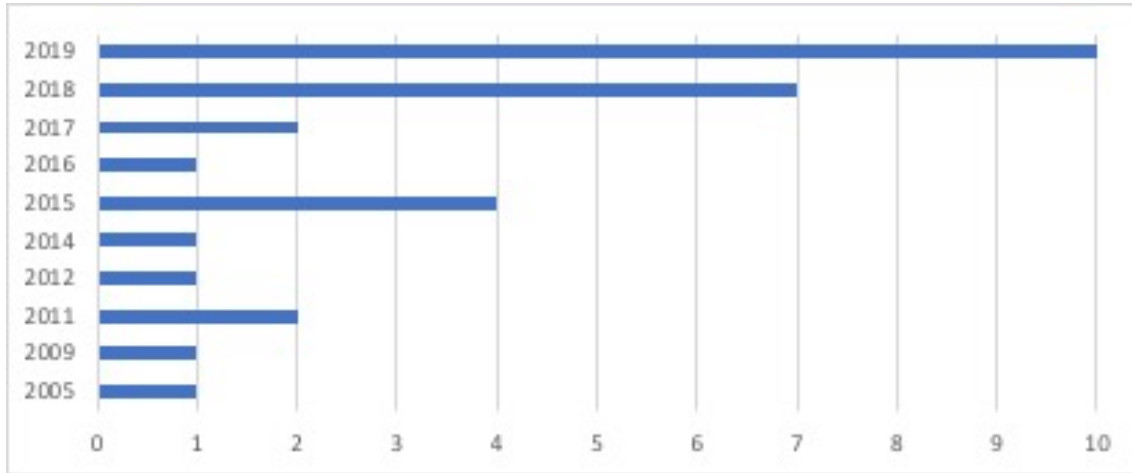
SLR quality related information: 1)type of review, 2)number of primary studies, 3)online databases, 4)years covered, 5)SLR guidelines, 6)search string (only AI related portion), 7)data analysis method, 8)business sector/ or business function, 9)AI role, 10) research questions.



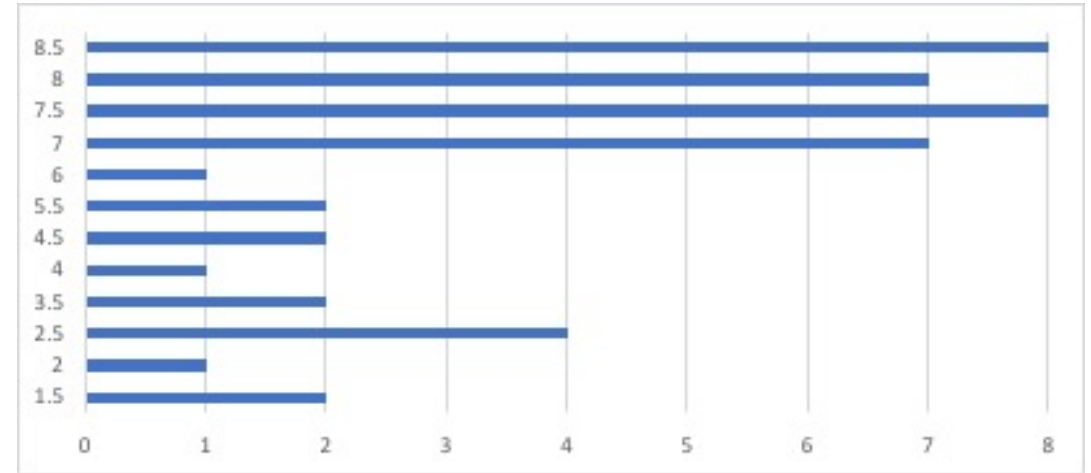
Research questions related information: 1)main findings, 2)bias, 3)ethics,4) other human and social consideration such as such as trust, privacy, 5)barriers for AI adoption, 6)drivers for AI adoption, and 7)recommendations.

Findings





Number of SLRs per year



Distribution of the quality scores of the SLRs

RQ₁: Thirty SLRs on the use of AI in B&M domains were found to match the selection criteria with a quality score between 7 and 8.5 out of 10 ($m=7.77$, $sd=0.57$). These SLRs were published between 2005 and 2019.

RQ2: Business sectors, business functions and research areas covered in the SLRs

<i>Bus. sector</i>	<i>AI type</i>	<i>Bus. Fun./res. area</i>	<i>Review topic</i>
Healthcare	Robots	HSM	The role of SARs in elderly wellbeing
	Robots	HSM	SAR in elderly care
	Robots	HSM	Robotics in nursing
	CA	HSM	Conversational agents in healthcare
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	Robots	Tech. acceptance	Acceptance of healthcare robots for the older population
	Robots	Teamwork	Comms and dec. making in robot-assisted surgical teams
	ML	HRM	ML for assessing physician competences
	ML	DSS	Applications of ANN in healthcare org. decision-making
Various	Robots	Customer service	AI and robots in value co-creation
	Robots	Health & Safety	Safety certification practices in robots s/w development
	Robots	Tech. acceptance	Social acceptance of robots in different occupational fields
	AI	DSS	Application of AI in decision support systems
	AI	SCM	AI potential and use in ("self-thinking") supply chain
	ML	DSS	Application of ML in decision support systems
	ML	SCM	Use of AI in supply chain risk management
	ML	BPI	Process mining through ANN and SVM
	IT	ML	SW Project Mgmt.
ML		SW Project Mgmt.	ML techniques for software fault prediction
ML		SW Project Mgmt.	ML for software optimization of parallel comp. systems
ML		SW Project Mgmt.	ML-based sw development effort estimation models
GP		SW Project Mgmt.	Effectiveness of GP for quality/cost predictions/estimations
Energy	ML	Systems Mgmt.	ML models in energy systems
	ML	Systems Mgmt.	Electrical load forecasting models
Agriculture	AI	DSS	AI in precision agriculture for grain crops
Apparel ind.	AI	DSS	Applications of AI in the apparel industry
Engineering	ML	Systems Mgmt.	Application of DL in mech. systems' health management
Smart cities	ML	Smart cities	ML techniques for supporting smart cities
Tourism	ML	Customer service	Online reviews on sustainability of hotels
Transport	ML	Systems Mgmt.	Intelligent intersection management systems with AV

RQ3: The drivers and the barriers for AI adoption

Drivers

- **Economic:** innovation, productivity, efficiency, cost, customer satisfaction, accuracy, decision making, and predictions.
- **Social:** sustainability, well-being.

Barriers

- **Technical:** cost, data, model re-use, problem selection, support infrastructure.
- **Social:** dependence on non-humans, jobs, lack of knowledge, s/h perspectives, safety, trust.

RQ4: Importance of human and social factors in AI applications

Many SLRs (N=19, 63.3%) do not consider **bias** in the primary studies.

- *"none of the articles has directly attempted to evaluate the proposed models. This is in particular remarkable since it is well understood that decisions are biased by psychological and social factors" (Merkert et al. 2017; DSS)*

Even less studies (N=6, 20%) consider **ethics** as an important element in the AI design.

- *A robot needs to be ethical for trustworthiness which relies on modelling the robot as well as the environment, an issue in a dynamic environments... (Ingibergsson et al. 2015; AFR).*

Outside of healthcare **human/or social factors** or implications are rarely considered in the research objectives or recommendations

- *Reporting of the results in these studies is overly optimistic, while evaluation methods reveal a degree of immaturity (Ng)*

All studies from the **healthcare management** domain recommend increased focus on human and social factors, such as, stakeholders' (patients, nurses, doctors, family) perspectives.

- *there are currently no agreed methods to assess the long-term effects of this technology (AI) on human populations, including the "unintended consequences". (Laranjo et al. 2018)*

Recommendation categories	Count	%
Methodology improvements	17	30.36%
Focus on organisational and human aspects	16	28.57%
New application areas for AI	8	14.29%
More research (primary studies)	6	10.71%
AI technique improvements	6	10.71%
Quantification of the impact	3	5.36%
Total	56	100.00%

RQ5: Recommendations for future research

Limitations

The nature of tertiary studies

- overlap in primary studies related to the same topic
- quality of the original primary studies considered in the SLRs
- The research questions not addressed in the SLRs
- Lack of SLRs outside of the healthcare management and IT domains (e.g. financial service, retail etc)

The scope

- Some of the business and management aspects such as quality, time and cost of product/service etc, have been included in many publications that are outside of the B&M domain.
- The SLRs that considered technical improvements in a specific AI tool or technique (e.g. recommender systems) were not included.

And,

- Only one person (the author) has been involved in the selection and review process.
- Lack of other similar studies makes it difficult to assess the progress made in the field

Conclusions

Despite the limitation of the research, this study provides a timely identification and categorisation of some important findings from 30 SLRs (directly) and 2135 primary studies (indirectly), on the AI adoption in business and management field and it helps in raising awareness on human, organisational and wider societal implications of the AI adoption.

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