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The Impact of Artificial Intelligence in Society Through the Lens of Luhmann's Social Systems Theory – A Systematic Review

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In this developmental paper, a systematic review of Niklas Luhmann's Social Systems Theory is conducted, oriented to understand the impact of Artificial Intelligence in Society. Luhmann was an inspiring scholar of complexity in the contemporary sociology with an interdisciplinary approach, oriented to explain the functionalism of social structures through an autopoietic concept and his own theory of communication. Applying an abduction approach and qualitative methods, the review explores the proposed theory as the best lens to understand the impact of AI technology in postmodern societies, involving the synthesis of fourteen academic publications from seven databases, and the codification of three categories. Surprising facts have been highlighted as the relevance of expert systems between Artificial intelligence and society, and the role of trust and ethics in social systems.

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MacKenzie and Wajman (1999) argue the classic definition of society as *"a structure that already exists, where interactions take place"* has been challenged by ethnomethodology, sociology of science, and sociology of technology. According to their performative approach, society is constructed by the interaction of social actors, including the social scientists who define what society is. In other words, *"what is described performs the description"* (Luhmann, 1997, p. 1). The role of technology in post-industrial society has increased since the 1960s, favouring interdisciplinary studies focused on understanding the impact of specific Information and Communication Technologies (ICTs), such as computers, in most aspects of our lives (Dutton, 1999; Cutcliffe, 2000). At the end of the 20th century, information has gained much attention, been described as "the most valuable commodity in business" (Roszak, 1988, p. 33) and *"a defining feature of the modern world"* (Webster, 1997, p. 1), when scholars started to talk about *information age* and *information society* (Trend, 2001). Castells (2004) argued is the combination of capitalist restructuring and technological innovation the main reason of societal impact. More recently, the voices highlighting the negative impact of ICTs in society indicated the control, inequality, and the exhausting acceleration of life as some of the downsides (Hughes, 2016; Dauvergne, 2020; Kitchin and Fraser, 2020).

Artificial intelligence has many definitions and perspectives, mostly differentiating the views regarding the concept of intelligence and the feasibility of human intelligence reproduction (Dreyfus et al, 1986; Wilson, 2011; Heikkinen, 2019; Sarmah, 2019). For the purpose of this paper, a more academic view will be taken into consideration, defining AI as

> *A computer science discipline that designs machines and algorithms capable of performing tasks that require human intelligence.* (Easterby-Smith, p. 389)

AI, as a digital technology with the capability to accelerate tasks and processes, is shaping the nature of organisations and the way we do things. Because of its transformative nature, it is a competitive advantage for firms, with the potential to change dramatically the way companies operate and deliver value. For example, in the retail sector, AI gave Amazon the possibility to create a data-centric platform to escalate its eCommerce, connecting thousands of sellers and personalising the customer experience. Nevertheless, most AI projects fail to deliver their goals since AI is different from any other IT project, as it can provoke devastating consequences. (Iansiti and Lakhani, 2020; Pelz-Sharpe and Kompella, 2019).

Systems theory, despite been criticised as over functionalist (Habermas, 1989; Mingers, 2002), offered explanation of pattern and order within society, a processor transforming inputs into outputs. Furthermore, the second order cybernetics, an interdisciplinary branch of systems theory, introduced the autopoiesis concept from biological field, claiming autopoiesis social systems transform itself in itself. The consequences of this fundamental premise made this theory more attractive to sociologists, maintaining its interdisciplinarity (Mingers, 2002). Niklas Luhmann is considered one of the most pre-eminent sociologists of postmodern time but also an inspiring ambassador of system theory, neo-functionalism and radical constructivism for much of contemporary sociology (Šubrt, 2019; Roth, 2013). His professional journey started in the public sector in Germany after Second World War and since a period of investigation in Harvard at the beginning of the 60s, his attention has been oriented to social systems, inspired by Husserl's phenomenology (Morgner, 2014) and following and contrasting the work of Talcott Person (Albert, 2016). In 1969, his new role in the Department of Sociology of the University of Bielefeld has consolidated his purposes. In his own words,

> *I was asked what research projects I had running. My project was and ever since has been, the Theory of Society; term: thirty years; costs: none.* (Luhmann, 2012, p. XI)

Luhmann's ambition has been shaped by his hard-writing work, which contributed to hundreds of books and academic articles. Most of his work has been written originally in German and most of those contributions have not been translated into English; however, his work has been increasing in popularity, gained special attention in Scandinavian and Latin American countries (Roth, 2013; Morgner, 2014). He intended to offer to sociology discipline a unified theory, split at the time into two concepts, *"empirically verifiable hypotheses about relations among data"* and *"conceptual efforts in a broad, somewhat indeterminate sense"* (Luhmann, 1995, p. XLV). He was inspired by several disciplines in different scientific fields, such as thermodynamics, cybernetics, and biology, building his social systems theory in the assumption of self-reference and functional differentiation (Morgner, 2014; Šubrt, 2019). Moreover, Luhmann considered sociology a theory of communication; differing from Shannon-Weaver Model of Communication (Al-Fedaghi, 2012) or from the idea of communication as a transmission or a consensus oriented process, Luhmann argued *"the act of communication, the unity of a communicative event, or a communicative operation ends in understanding"* (Luhmann, 2013, p. 223). Anything onward this understanding point he considered a bifurcation leading to a further act of communication.

Following the systems theory exploration proposed by Simoes, Radosavljevic, and Johnston (2021) in analysing the impact of artificial intelligence in society, the Social Systems Theory of Luhmann has been identified as a potential *"sociological approach to understand the complexity of human-oriented AI"* (p. 3), considering modern societies are functional differentiated by media of communication coding (Morgner, 2014). This developmental paper intends to keep exploring the relevance of Luhmann's Social Systems Theory in understanding the complex impact of AI in society through a systematic review. Looking to evaluate and summarise research evidence with reduced bias (Booth, Clowes and Martyn-St James, 2022), this paper is going to conduct a step-by-step capture of the most relevant publications involving Luhmann's work, artificial intelligence, and society. A rigorous approach to reduce bias and increase quality will be applied, including preliminary search, inclusion and exclusion criteria, and quality assessment. Finally, a preliminary grounded analysis will explore patterns between the full reading selection to provide insights and further research questions.

Methods

In the first step of this systematic review, scoping searches have been undertaken to define the search terms and offer a broad idea of the literature to refine the review question. These preliminary searches were equivalently important to understand the estimated number of studies related to the topic to determine the methodology of the review (Booth *et al*, 2021). In Table 1 is possible to see the exploratory terms used in the first scoping searches and Table 2 the combined terms that generated three options of search strategy, followed by each respective rationale.

POSSIBLE TERMS
"Social Systems"
"Social Systems" AND "Luhmann"
"Social System" AND "artificial intelligence"
"Social System" AND "ethics"
"Social System" AND "artificial intelligence" AND "ethics"
"Social System" AND "modern societ*"
"Artificial Intelligence"
"artificial intelligence" + "Luhmann"
"artificial intelligence" AND "ethics"
"artificial intelligence" AND "ethics"
"Niklas Luhmann" AND "feminis*"
"Social System" AND "creativ*"

Table 1: Possible Terms (Developed by Researcher)

FINAL TERMS	RATIONALE
(("Social system*" AND ("artificial intelligence" OR "AI")) OR (("artificial intelligence*"OR "AI") AND "Niklas Luhmann") OR ("Niklas Luhmann" AND "ethic*") OR ("Niklas Luhmann*" AND "modern societ*"))	Comprehensive coverage, exploring main topics of interest, and all research related with Niklas Luhmann, not only Luhmann's work in Social Systems Theory.
(("artificial intelligence*" OR "AI") AND "Niklas Luhmann" AND "Social System*") OR ("Niklas Luhmann" AND "Social System*" AND "ethic*") OR ("Niklas Luhmann*" AND "Social System*" AND "modern societ*")	Comprehensive coverage, exploring main topics of interest, but only including research related to Niklas Luhmann and Social Systems Theory.
("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " societ*")	Limited coverage, only exploring main terms of research question together.

Table 2: Final Terms (Developed by Researcher)

By doing this exercise, became clear the academic work of Niklas Luhmann, in addition to his fruitful production, involved other theories beyond social systems theory and areas less relevant for the scope of this research, as Radical Constructivism. In consequence, it has been decided to select the third search strategy option, including only the linked results of the main topics of the research question, as follows: *Niklas Luhmann*, *Artificial Intelligence,* and *Societ*y.

In the next step, the A-Z databases (UWS, 2021) have been taken as a reference of a vast multidisciplinary list of databases. A total of thirty databases has been explored so far, being most of them responding with empty search results or inconsistent co-relations. After the inclusion and exclusion criteria has been applied, seven databases have been able to offer eligible sources, including Scopus and ProQuest, totalising seventy-six sources. The inclusion/exclusion criteria included language, Luhmann's reference, and period of publication (see Table 3). The search execution has taken place between 3rd and 4th October 2021 and it has not been reviewed since then (see Appendix A).

COMPONENT	STARTING PRINCIPLES
Sampling	Academic articles/papers; Textbook chapters;
Source	30 initial databases executed, 7 extracted: Scopus; Web of Science; ACM Digital Library; BMJ Journals; ProQuest; Business Source Ultimate; CORE; / 76 sources explored, 15 analysed.

Structured Question	Could Luhmann's Social Systems Theory be an appropriate lens to understand the complex impact of artificial intelligence in society?
Search procedures	("Niklas Luhmann" AND "artificial intelligence" AND " societ*")
Search strategies and filters	From January 2012 to January 2022; English/Spanish/Portuguese/Italian languages;
Supplementary quality strategies	Referencing Niklas Luhmann at least once; Exploration of reference list and Connect Papers tool for further search.
Standard	PRISMA

Table 3: 7S Qualitative Searching (Developed by Researcher based on Booth et al, 2021)

During the data extraction, a quality assessment has taken place, by controlling titles, keywords, abstracts, and references of sources. Typology of source and duplicities have been checked (Boland, Cherry and Dickson, 2017). Other limitations have constrained the number of studies, as the lack of trust in search filters and other technical issues. After the extraction, a further manual search exploring reference lists and the use of Connect Paper tool to identify additional relevant sources took place, resulting in a total of fourteen papers to be fully reviewed (Appendices B & C).

Considering the final number and the typology of the studies, the methodology chosen to analyse the full-text papers is qualitative methods, through the grounded analysis method. The grounded analysis is an open approach aimed to understand the fragments of data in their specific context, by teasing patterns, categories, and themes, exploring links between concepts, and emerging hypotheses. The qualitative methods will be conducted by abduction approach since pure deduction or induction approach is unlikely to occur in the real world. The abduction is the most appropriate approach to observe surprising facts and identify the best explanation - or plausible theory – possible (Saunders, Lewis and Thornhill, 2019; Easterby-Smith et al, 2021).

Findings

The findings summarised in the Appendix D indicate a varied exploration of Luhmann's social systems, being highly related with the impact of AI in society from different angles. Furthermore, a few good contributions have be extracted, mostly regarding the role of experts in interfering in the relationship between AI and society. For example, PAPERS 2 and 8 called for entities who should regulate the relation AI-User, being named *Socialtechnical Organisations* and *Officer for Public-Lobbying* respectively. Complementarily, PAPER 7 adverts about the *digital parasitism* of hackers, which creates noise in communications. PAPER 6 proposes art as a policy-maker through its *aesthetic expertise*. Similarly, PAPER 13 highlights religion as an expert in providing *reassuring to human destination*. Finally, PAPER 14 directly addresses the relevance of experts in constructing a *trustful relationship* between internet and social systems. Trust is also present in several papers; for example, in PAPER 5, it is defined as a functional mechanism to reduce complexity. PAPER 1, differently, reflects about the paradoxical functions of AI as machine and communicator, being expected to execute a precise task and at the same time surprise the interlocutor.

Following the abductive approach and codes-of-theory model, three theories have been noted, *ethics theory, trust theory* and *expert system*. Surprisingly, normative ethics is one of them, despite Luhmann's interest in differentiating ethics from his study of moral communications (Luhammn, 1996). Trust is a relevant part of Luhmann's overall contributions, which is understood as a basic fact of life, a reason to arising every morning (Luhmann, 2018), while Expert System could be correlated with *medium of communication* from Luhmann's social systems perspective, a system able to formulising and conditioning the process of selection, hence, capable to reduce complexity (Morgner, 2014). Systematic Review is a broad and time demanding methodology, however, a useful step-by-step methodology to find textual information with reduced risk of bias while exploring complex and interdisciplinary theories and facilitating links between patterns (Campbell et al, 2014). Further research is advised to explore more publications, correlations of theories and applicability to AI, society, and business. Ultimately, it would be recommendable a further exploration of the work of Jurgen Habermas and Niklas Luhmann in regading their theory of communication.

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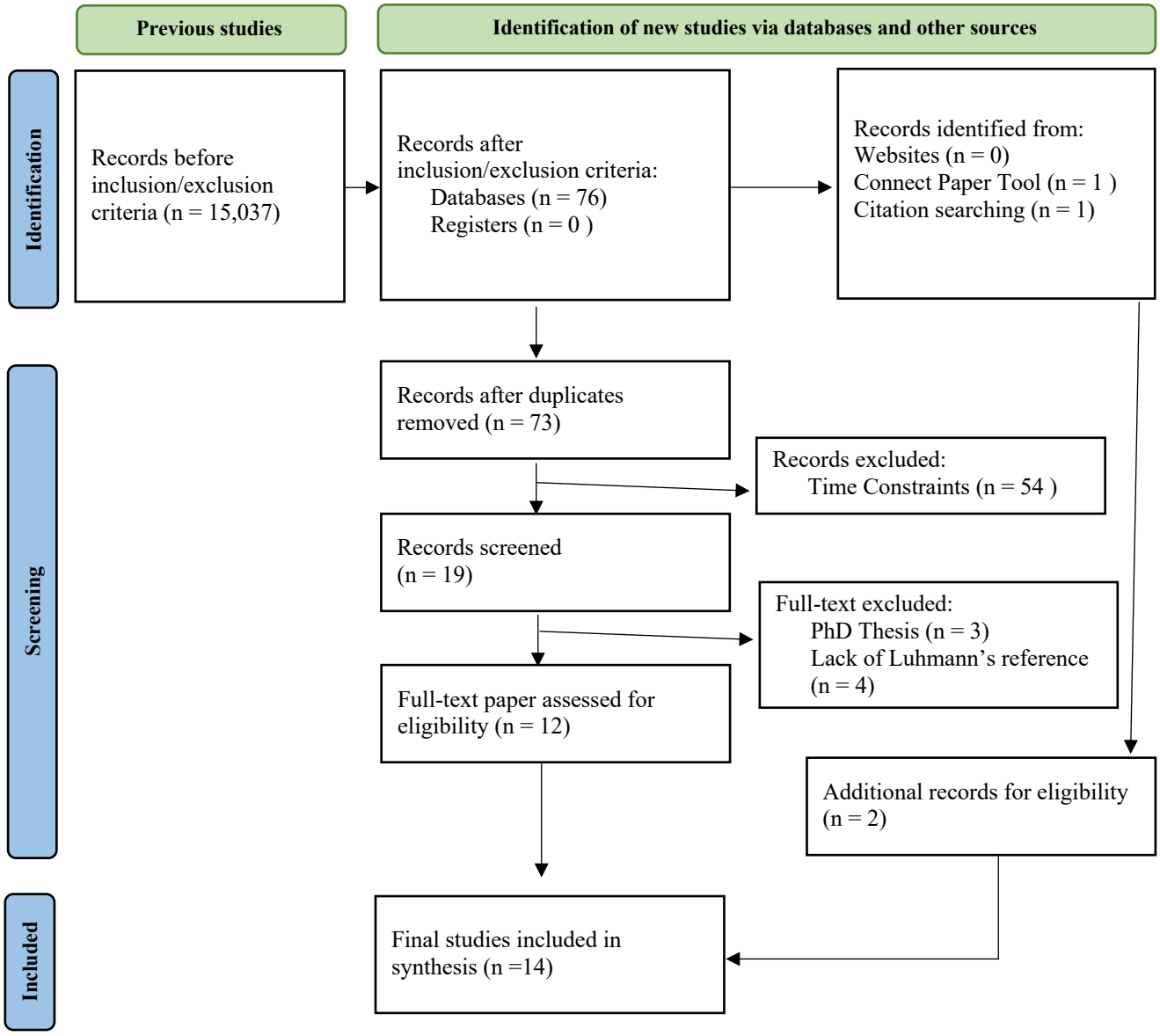
Appendices

Appendix A: Search Execution

Database	Search Syntax	Search Results	Results after inclusion/exclusion	Data Extraction
ACM Digital Library	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	3 (executed on 3rd Oct 2021)	2	YES
ACZ Publication	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
APA PshycArticles	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
APA PshycBooks	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
arXiv.org	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
ASM Digital Collection	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
BAILII	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	1 (executed on 3rd Oct 2021)	0	NO RESULTS
Barbour	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
BATES	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	NA	0	SEARCH ERROR
Bioline International	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
BMC	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
BMJ Journals	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	1 (executed on 3rd Oct 2021)	1	YES
BOLDE	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
British Journal of Mental Health Nursing	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
British Library Sounds	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
ProQuest (found from British Periodicals)	("Niklas Luhmann" AND ("artificial intelligence") AND " society")	6964 (executed on 3rd Oct 2021)	64	YES
BSOL Standards Online	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 3rd Oct 2021)	0	NO RESULTS
Business Source Ultimate	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	10 (executed on 3rd Oct 2021)	5	YES
Cambridge Core	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	80633 (executed on 3rd Oct)	0	NO DISTINCTION BETWEEN AND/OR
Cambridge Digital Library	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 4th Oct 2021)	0	NO RESULTS
Cardiff Index to Legal Abbreviations	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 4th Oct 2021)	0	NO RESULTS
ChemSpider	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 4th Oct 2021)	0	NO RESULTS
CINAHL Complete	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 4th Oct 2021)	0	NO RESULTS
Click View	NA	NA	0	VIDEO PLATFORM
Cochrane Library	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	0 (executed on 4th Oct 2021)	0	DOUBLE RESULTS
Conference Proceedings Citation Index – Science (CPCI-S) – 1990-present	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	NA	0	NO RESULTS
Construction Information Service	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	1 (executed on 4th Oct 2021)	0	CRITERIA CUT
CORE	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " society")	2 (executed on 4th Oct 2021)	2	YES
Scopus	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " societ*")	1 (executed on 3rd Oct 2021)	1	YES
Web of Science	("Niklas Luhmann" AND ("artificial intelligence" OR "AI") AND " societ*")	1 (executed on 3rd Oct 2021)	1	YES

(Source: Developed by Researcher adapted from Boland, Cherry and Dickson, 2017)

Appendix B: PRISMA Diagram



(Source: Developed by Researcher adapted from PRIMA, 2020)

Appendix C – Full-text papers included in synthesis

DATABASE	STUDY	REFERENCE
Scopus	PAPER 1	Esposito, E. (2017). Artificial communication? The production of contingency by algorithms. *Zeitschrift für Soziologie, 46*(4), pp.249-265.
ACM Digital Library	PAPER 2	Benthall, S. and Goldenfein, J. (2021) Artificial Intelligence and the Purpose of Social Systems. *In Proceedings of the 2021 AAAI/ACM Conference on AI, Ethics, and Society* (pp. 3-12).
	PAPER 3	Bishop, J.M. and Al-Rifaie, M.M. (2016) Autopoiesis in creativity and art. *In Proceedings of the 3rd International Symposium on Movement and Computing* (pp. 1-6).
BMJ Journals	PAPER 4	Graham, M. (2021) Data for sale: trust, confidence and sharing health data with commercial companies. *Journal of Medical Ethics*.
	PAPER 5	Christensen, M. (2013) *Trust, social work and care ethics an exploration of the Luhmannian concept of trust and social work with children at risk: Relating Luhmann's concept of trust to the ethics of care.* In Participation, Citizenship and Trust in Children's Lives (pp. 114-131). Palgrave Macmillan, London.
ProQuest	PAPER 6	Heinrichs, H. (2021) Aesthetic Expertise for Sustainable Development: Envisioning Artful Scientific Policy Advice. *World, 2*(1), pp.92-104.
	PAPER 7	Von Nordheim, G. and Kleinen-von Königslöw, K. (2021) Uninvited dinner guests: A theoretical perspective on the antagonists of journalism based on Serres' parasite. *Media and Communication, 9*(1), pp.88-98.
	PAPER 8	Saltelli, A. and Di Fiore, M. (2020) From sociology of quantification to ethics of quantification. *Humanities and Social Sciences Communications, 7*(1), pp.1-8.
	PAPER 9	Ribeiro, M.A.F. and Junior, R.D.T. (2020) Neopatrimonialismo, diferenciação funcional e a relação centro-periferia revisitada. *Política & Sociedade, 19*(46), pp.387-422.
	PAPER 10	Schluchter, W. (2020) Ação, ordem e cultura: fundamentos de um programa de pesquisa weberiano. *Política & Sociedade, 19*(45), pp.19-55.
	PAPER 11	Xue, Y. and Xiang, P. (2020) The social risk of high-speed rail projects in China: A Bayesian network analysis. *Sustainability, 12*(5), p.2087.
	PAPER 12	Botelho Moniz, J. (2020) Societalização como secularização? Correlação entre os índices de societalização e religiosidade na Europa. *Revista colombiana de sociología, 43*(1), pp.235-260.
	PAPER 13	Pace, E. (2017) Teoria dos sistemas e religião. *Civitas-Revista De Ciências Sociais, 17*(2), pp.345-359.
	PAPER 14	Antonijević, S. and Gurak, L. (2019) The internet: A brief history based on trust. *Sociologija, 61*(4), pp.464-477.

(Source: Developed by Researcher)

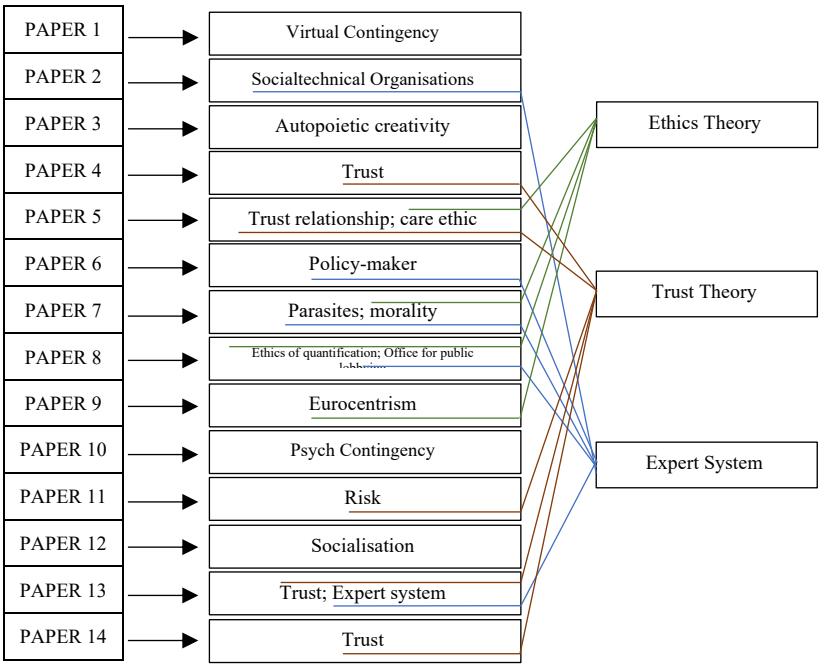
Appendix D – Findings

STUDY	REFERENCE
PAPER 1	Luhmann's theory is very present, while citing double contingency to analyse communication with algorithms: "Contingency is double not simply because there are two contingent participants, but because each of them decides what to do depending on what the other is doing, and both know this". Following this idea, the paper highlights the paradox of the AI as a machine and a communicator, who needs to surprise and function a precise task.
PAPER 2	Argues AI systems, with public individuals and private markets, are anti-liberalists and suggest the integration of intermediaries between AI-user to regulate the relation, named 'socialtechnical organisations". Luhmann's social systems theory is pointed as "a robust conceptualization of social form that is compatible with the now ubiquitous conditions of technical mediation we see today" and identifies a research gap stating "Second order cybernetics has been used in studies of software development and data modelling, but not yet to more modern machine learning applications."
PAPER 3	Autopoiesis and Luhmann's social systems theory are explored, defining social systems as the systems of communication. Also, spots the differentiation between unity and environment, being the environment defined as complex, and the inside system, as a place of reduced complexity, which preserves the identity of the unity, otherwise, it would be dissolved. The article uses an experiment using AI to illustrate the autopoietic artistic process.
PAPER 4	Addresses the issues of big health data sharing, arguing for confidence in data sharing systems. Luhmann's work is mentioned in regard to trust and confidence theory.
PAPER 5	Luhmann's view of trust is richly discussed in the PAPER 5, oriented to understand the role of the social worker in carrying on their work with children in risk positions. Trust and distrust are described as "functionally equivalent in the struggle to reduce complexity".
PAPER 6	A low connection between Luhmann's work and AI or technology has been noted. However, it provides an interesting view of Luhmann's idea of art as an autopoietic social system and the double role of art in reinforcing or protesting against power, proposing art as aesthetic expertise in the artful scientific policy-making process.
PAPER 7	Offers a meaningful discussion about digital parasitism, retaining a sub-system of antagonism or a dysfunctional actor that interferes as a noise in the communication of social systems (eg. hackers), forcing it to differentiate.
PAPER 8	Quantitative methods issues are highlighted, arguing that constant quantification is leading society to re-feudalisation. Luhmann is cited in regards to the code of social systems, explaining how science code is being corrupted by other systems' codes (eg. technology code of function). The paper concludes by suggesting the integration of intermediaries between AI-user to regulate the relation, named 'Office for Public Lobbying".
PAPER 9	Proposes Luhmann's functional differentiation and social systems theory as an alternative to neopatrimonialism to explain Brazilian modern political dilemmas. Nevertheless, Luhmann's social systems theory is retained eurocentrist, suggesting peripheric societies function differently.
PAPER 10	Contrasts Luhmann's and Habermas's work in regards to the theory of communication, standing while Luhmann minimizes the potential for rationality in communication, Habermas tends to maximize it. Also, explains the mutual relation of psych systems by Luhmann, made by at least two systems, ego and alter, considered the black boxes and the environment of each other.
PAPER 11	Explores Luhmann's view of the inevitability of risk taken and the impact of the increasing human activities in our natural and social worlds.
PAPER 12	Highly related to social theories, it is focused on exploring secularisation and societalisation. Luhmann is slightly cited as an authority of functional differentiation, as part of modernisation theory, which explains the change of system from traditional community to

	social-based. The paper concludes by defining twenty-two items to calculate a socialisation index, of which six are related to digital mass communication.
PAPER 13	Religion is explained through the lens of belief system theory, citing Luhmann and other social systems authorities. Religion is also proposed as an expert system, responsible to provide reassuring answers to the human final destination
PAPER 14	Links internet and social systems, including Luhmann's ideas of trust, being defined as "the broadest sense of confidence in one 's expectations", "the anticipation of the future", and "the blending of knowledge and ignorance". The role of experts is highlighted as relevant support for trust construction.

(Source: Developed by Researcher)

Appendix E – Codes-to-Theory Model



(Source: Developed by Researcher adapted from Easterby-Smith et al, 2021)