Strategic Intelligence in Complex Environments for Complexity to Accuracy in Strategic Decision-Making

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Abstract: There is a growing need to use strategic intelligence (SI) to navigate from an environment that is volatile, uncertain, complex, and ambiguous, to an environment with strategic vision, understanding, clarity, and accuracy. The ability to clarify complex environments, enables organisations to reach accurate decision-making quicker and avoid elements of surprise. Artificial Intelligence (AI) can be part of the problem and the solution to decision-making fatigue. For example, AI agents can liberate time-poor analysts to focus on tasks where human value-add lies in human sense of reality, applying their expertise and tacit knowledge. The research objective is to identify SI clusters relevant to strategic decision-making in complex business environments. The research question is: what relevance does SI have in complex environments for accuracy in strategic decision-making? The PRISMA method for systematic literature reviews was utilised for this research paper, combined with Vosviewer co-occurrence mapping, which produced five clusters linked to SI to navigate complex environments. This paper describes a systematic review of secondary data to investigate SI in complex environments and presents the findings of SI clusters with its relevance to accurate interpretation of data and information for strategic decision-making. The paper highlights the role of SI coupled with the rapid development of tools such as generative AI (GenAI) and agentic AI used in complex environments for accurate interpretation. This research used Boolean search strings to gain access to relevant articles, 115 articles were retrieved with only ten articles meeting the criteria for analysis after the use of the PRISMA method and the application of eligibility criteria. The recommendation is that in complex environments strategic decision makers must combine their human analytical strengths with the strengths of artificial intelligence (AI) to accelerate the processing of large volumes of data, information, and knowledge. By combining SI and agentic AI, strategic decision makers turn complexity into opportunities for innovation and sustainable growth. In the agentic era, accurate decision-making requires a human in the loop.

Keywords: Strategic Intelligence; Artificial Intelligence; Human Intelligence, Agentic AI, Complex Environments.

1. Introduction and Problem Statement

The most basic definition of Strategic Intelligence (SI) is relevant actionable information in the hands of the right people at the right time to make the right decisions for the future success of an organisation. SI is required for mapping out the future of management science in the age of agentic artificial intelligence (AI). Agentic AI involves the autonomous actions of AI agents backed by a system of AI tools that perform tasks with minimal human intervention. Human Intelligence (HI) is the mental quality of human reasoning, problem-solving, decision-making, and augmented learning through experience to adapt to new situations, understand, process abstract concepts, and engage in complex cognitive acts through appreciative inquiry. HI is required to produce SI. The rationale of the study is the growing need to use SI to navigate from the “as is” volatile, uncertain, complex, and ambiguous (VUCA) environment to an environment with strategic vision, understanding, clarity, and accuracy, referred to as the “to be” VUCA environment. In the “as is” VUCA environment, strategic decision makers are faced by the challenge of insurmountable data and information in vast repositories in structured and unstructured format in complex environments (De Koker, 2025). The focus of this paper is the combination of HI and AI to navigate complex environments. The research objective is to identify SI clusters that have relevance to strategic decision-making in complex business environments.

The problem is that decision makers are suffering from decision-making fatigue and depletion linked to the rapid technological advances, which is not a new problem but a problem that has accelerated exponentially since the rise of AI and the quest for accurate interpretation of large language model outputs (Devanny, Dylan and Grossfeld, 2023; Manyika, Chui, Bughin, Dobbs, Bisson and Marrs, 2013).

2. Research Objectives

This paper covers one segment of a larger study which had three objectives: to conceptualise how GenAI is used in complex environments for strategic decision-making; identify SI principles and tools that apply in complex environments linked to AI ethics; and describe the SI approach to innovation commercialisation in complex

environments. For this paper, the objective is to identify SI clusters relevant to strategic decision-making in complex business environments. The research question is: what relevance does SI have in complex environments for accuracy in strategic decision-making?

3. Research Methodology

The research methodology to answer the research question combined the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) protocol and VOSviewer co-occurrence mapping. VOSviewer is a qualitative data analysis tool for the Visualisation of Similarities (VOS) to produce descriptive analysis and patterns based on the data downloaded from Scopus database. According to Azzam and Beckman (2024: 7), VOSviewer identifies the "number of clusters with similar research themes. The higher the number of clusters, the bigger the group of words that will appear collectively together. Within these clusters, researchers can determine the significant research themes."

Data collection was guided by category sheets with subject of category (SOC) keyword parameters and Boolean search identifiers: (GenAI in SI), (PTE in SI), (IC in SI), described in Table 1.

Table 1: Systematic review category sheets (own source developed for this study)

Boolean Search (GenAI in SI)	
Topic:	The use of GenAI in complex environments for strategic decision-making in strategic intelligence (SI).
Definition of underlying variable:	SI is a systematic and continuous process of producing needed intelligence of strategic value in an actionable form to facilitate long-term decision-making. Waghmare (2019), explains that SI in its most basic definition is about having relevant information in the hands of right people at the right time to make the right decisions for the future success of an organisation.
Subject of category:	• Strategic intelligence • Artificial intelligence • Generative AI (GenAI) • Large language model (LLM) • Decision-making • Complexity • The Cynefin framework • Human intelligence
Research question:	How is GenAI used in complex environments for strategic decision-making in SI?
Search string:	TITLE-ABS-KEY-AUTH ("strategic intelligence" AND ("artificial intelligence" OR AI OR "generative AI" OR "large language model*" OR LLM OR "human intelligence" OR "decision-making" OR complex* OR Cynefin OR "sense making"))
Sources:	SCOPUS: Access to registers, records, and reports is granted through the university institutional user licenses and articles published in these databases are from trusted sources. Grey literature will not be included.
Eligibility criteria:	• Full text articles • Final publication • English
Boolean Search (PTE in SI)	
Topic:	SI principles and tools in complex environments
Definition of underlying variable:	SI is defined as evidence-based meta-analyses dealing with information volume and complexity. SI is the accurate interpretation of data, information, and knowledge from a number of analyses of the same subject. SI is the convergence of intelligence reports from information management (IM), knowledge management (KM), business intelligence (BI), competitive intelligence (CI), open-source intelligence (OSINT), social media intelligence (SOCINT), and other ethically sourced intelligence. SI is strategically significant actionable information from the internal and external environments. Actionable information is immediately available, bottom-line, up-front first and fast consumable information to support strategic decision-making, implement, and execute business strategy in complex environments (Xu and Kaye, 2010). SI is crucial in volatile, uncertain, complex, and ambiguous environments, defined as the VUCA phenomenon (Azzam and Beckmann, 2024).
Subject of category:	• Strategic information management principles • Complexity

	• Design thinking • Knowledge systems • Systems thinking • Intelligent systems • Artificial intelligence (AI) • AI ethics
Research question:	What SI principles and tools apply in complex environments linked to AI ethics?
Search string:	TITLE-ABS-KEY-AUTH("strategic intelligence" AND (principle* OR tool* OR "design thinking" OR "knowledge system*" OR "intelligent system*" OR "artificial intelligence" OR AI OR "AI ethics")
Sources:	SCOPUS: Access to registers, records, and reports is granted through the university institutional user licenses and articles published in these databases are from trusted sources. Grey literature will not be included.
Eligibility criteria:	• Articles full text • Final publication • English language
Boolean Search, (IC in SI)	
Topic:	SI approach to commercialisation of innovation
Definition of underlying variable:	According to Popa, Preda and Boldea (2010), innovation is the capability to determine new ways of doing things, new perspectives and to combine existing concepts, to create new products. On the other hand, Arnaut, 2019, Rooke, 2017, and Bansi, 2016, define innovation as the creation of improved processes and procedures to add value to an organisation. Commercialisation can be defined as the process of presenting a product or service to the market to gain profit (Alsani, Eftekhari, Hamidi and Nabavi, 2015: 132). Commercialisation can be referred to as the activities and procedures that are needed to introduce new innovative ideas into the market (Datta, Reed and Jessup, 2013: 149). SI is the process of collecting, analysing, and applying strategic insights to business decisions. It uses internal and external data to formulate, inform, execute, and evaluate strategic decisions and their implementation. SI is the process of gathering data, analysing it, and disseminating relevant data for strategic decision-making.
Subject of category:	• Strategic information management principles • Complexity • Innovation • Commercialisation • Entrepreneurial institutions • Entrepreneurial education
Research question:	How do SI approaches apply in complex environments of commercialisable innovation?
Search string:	("strategic intelligence" AND (innovat* OR commerc* OR "commercialisation dynamics" OR "commercialization dynamics" OR "information entrepreneurship" OR "entrepreneurial education" OR "entrepreneurial institution*"))
Sources:	SCOPUS: Access to registers, records, and reports is granted through the university institutional user licenses and articles published in these databases are from trusted sources. Grey literature will not be included.
Eligibility criteria:	• Articles full text • Final publication • English language

Data analysis was divided in two steps; firstly, apply the PRISMA protocol for meta-analyses for systematic review. Secondly, VOSviewer co-occurrence mapping and data visualisation of text into clusters. The steps of the analysis were: 1) Choose type of data – create a map based on text data, 2) Choose data source – read data from bibliographic database files, 3) Choose type of analysis and counting method – type of analysis, co-occurrence; 4) Choose fields from which terms will be extracted – title, abstract, keywords, 5) Choose counting method – full counting with default threshold of minimum four occurrences of a term, selecting 60% of the most relevant terms. With these parameters set, Figure 1 illustrates the VOSviewer network visualisation settings for this study.

Figure 1: The Vosviewer network visualisation settings (own source developed for this study)

The university's code of practice and ethics policy guided the process of identifying SI clusters. The approach was abductive, drawing on the theoretical overview of SI and decision-making

4. Theoretical Overview

Strategic intelligence is an established concept for describing and investigating characteristics such as strategic thinking, future-oriented analyses, technology-based organisation, strategic decision-making, and accurate interpretation (Watkins, 2024; Pellissier and Kruger, 2011; Cagnin, Keenan, Johnston, Scapolo and Barre, 2008). Recent studies report various tasks AI can perform for SI analysts, such as information management (IM), knowledge management (KM), business intelligence (BI), competitive intelligence (CI), open-source intelligence (OSINT), social media intelligence (SOCINT), and territorial intelligence, (Azzam and Beckmann, 2024; Devanny *et al*., 2023; Fournie, 2023; Dou, Clerc and Juillet, 2020). For example, Devanny *et al*., (2023: 20), describe the "prudent approach is for intelligence assessment organisations to use AI to empower human analysts by creating more time and space for them to employ their indispensable tacit knowledge and 'sense of reality'". Business leaders describe one of SI's functions as conducting research through a combination of human intelligence, sense-making, and technology to produce catalytic strategic thinking, (Watkins, 2024; Pellissier and Kruger, 2011; Johnston, 2003), for example:

- Human intelligence: applying the mental quality humans have, attributing to the ability to learn from experiences, adapt to new situations, understand, and handle abstract concepts, and engage in complex cognitive acts. It can also be defined as a general mental ability for reasoning, problem-solving, decision-making, and learning, (Sternberg, 2023; Klug, 2022).
- Sense-making: applying the Cynefin framework, that was developed to help business leaders understand their challenges and to make decisions in context. The Cynefin framework distinguishes different domains such as the clear, chaotic, complicated, and complex subsystems in which we operate, to help business leaders cultivate an awareness of what is really complex and what is not and respond accordingly so that energy is not wasted in strategic analysis, (The Cynefin Company and The Cynefin Centre, 2024).
- GenAI: applying AI to produce various types of content, including text, imagery, audio, and synthetic data, for example, ChatGPT, Gemini, Perplexity, (TechTarget, 2024).
- Large language models: applying AI algorithms that use deep learning techniques and massively large data sets to understand, summarise, generate, and predict new content (TechTarget, 2024).
- Agentic intelligence: applying AI systems that perform tasks and make decisions without much need for human input. Agentic AI selects sophisticated tools and applies advanced autonomous reasoning to solve complex tasks by initiating, implementing, and executing multiple steps through iterative planning, with little to no human intervention (Visvanathan, 2025; Purdy, 2024).

SI is the accurate interpretation of data, information, and knowledge from a number of analyses of the same subject. SI is actionable information that is immediately available, bottom-line, up-front first and fast consumable information to support strategic decision-making, implement, and execute business strategy in complex environments (Leeb, 2017; Xu and Kaye, 2010). SI is crucial in volatile, uncertain, complex, and ambiguous environments, defined as the VUCA phenomenon (Azzam & Beckmann, 2024).

5. Findings

The findings from the flowchart application of the PRISMA protocol identified 115 records for inclusion from the Scopus database. The screening of records reduced the number of eligible reports to 45 data sources. Five reports were excluded based on the eligibility criteria listed in Table 1. Figure 2 illustrates this study's application of the updated PRISMA guidelines, as outlined by Page *et al*., (2021).

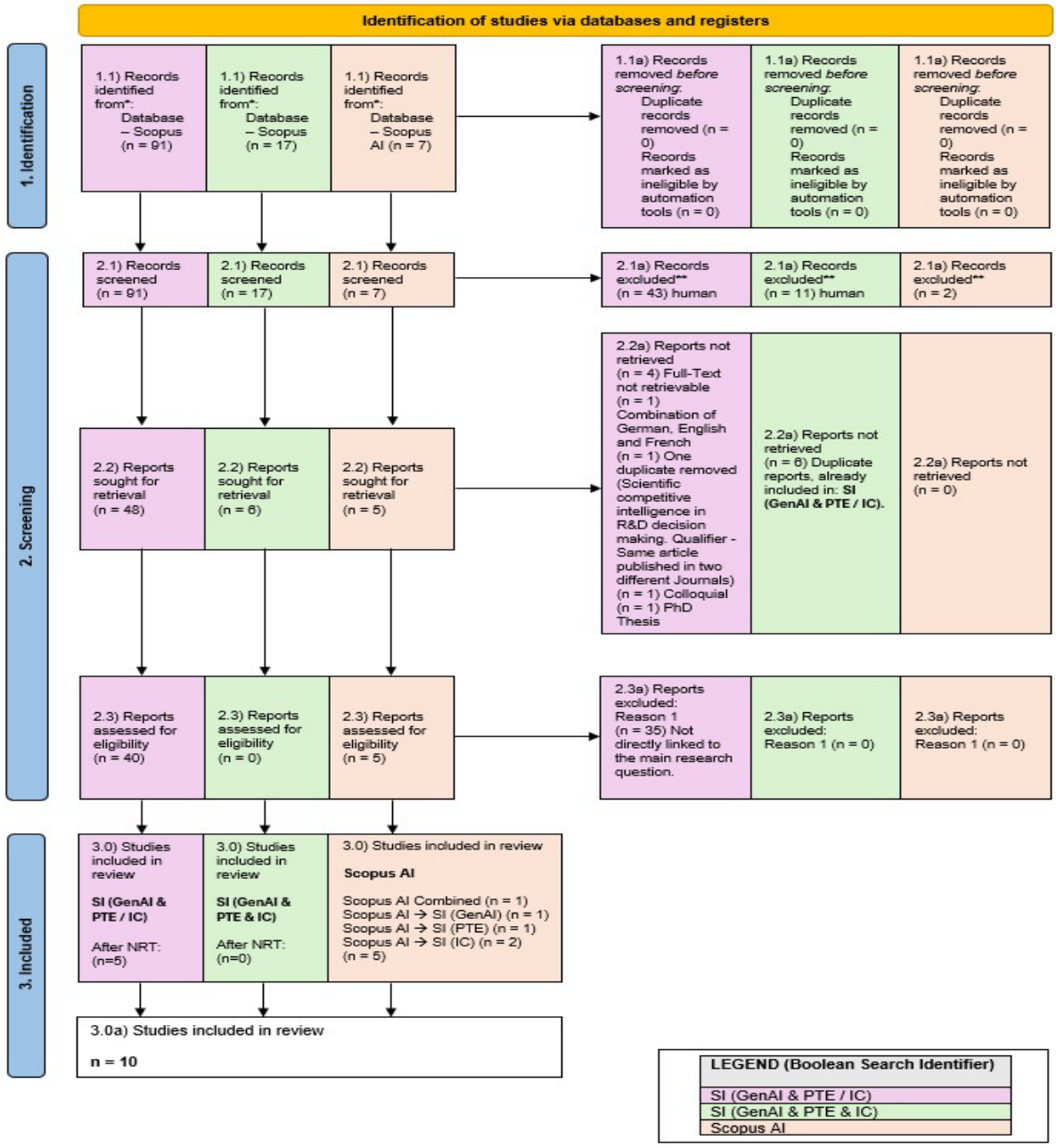

Figure 2: Prisma flowchart (own source developed for this study)

Forty studies were included in the VOSviewer co-occurrence mapping and data visualisation of text into clusters. Five SI clusters were identified: Cluster 1: artificial intelligence; Cluster 2: behavioural research; Cluster 3: decision-making; Cluster 4: business intelligence; and Cluster 5: territorial development, illustrated in Figure 3.

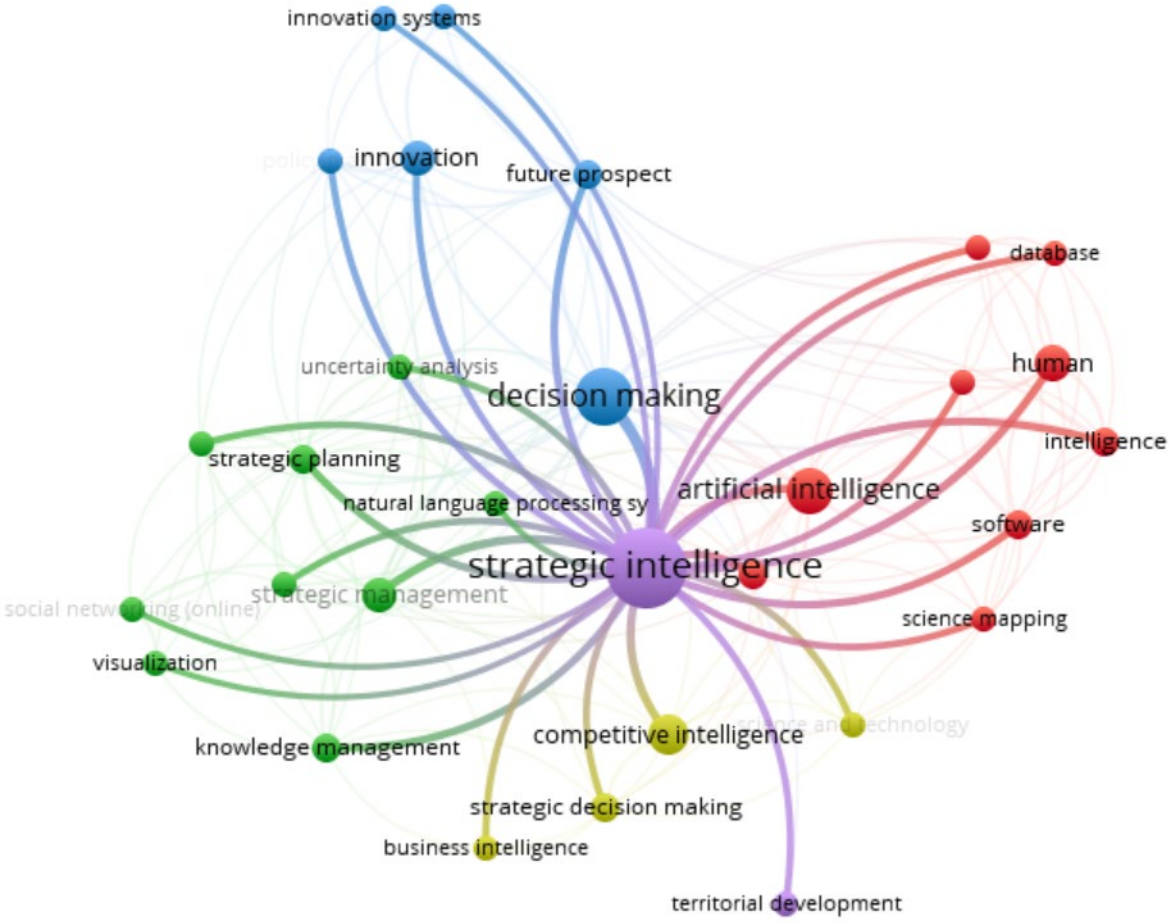

Figure 3: Strategic Intelligence clusters (own source developed for this study)

The five SI clusters are:

- Cluster 1: artificial intelligence linked to clinical decision-making, data mining, database, human, intelligence, network analysis, science mapping, software.
- Cluster 2: behavioural research linked to knowledge management, management science, social networking (online), strategic management, strategic planning, uncertainty analysis, visualisation.
- Cluster 3: decision-making linked to future prospect, innovation, innovation systems, policy making, technological forecasting.
- Cluster 4: business intelligence linked to competitive intelligence, science and technology, strategic decision-making.
- Cluster 5: territorial development.

Each cluster is linked to SI and co-occurs with strategic decision-making at varying weight levels as illustrated in Figure 1, top right corner. Nodes in the network map can be expanded to illustrate the existing connections linked to hidden co-occurrences, for example, Cluster 1: artificial intelligence is linked to strategic management, illustrated in Figure 4.

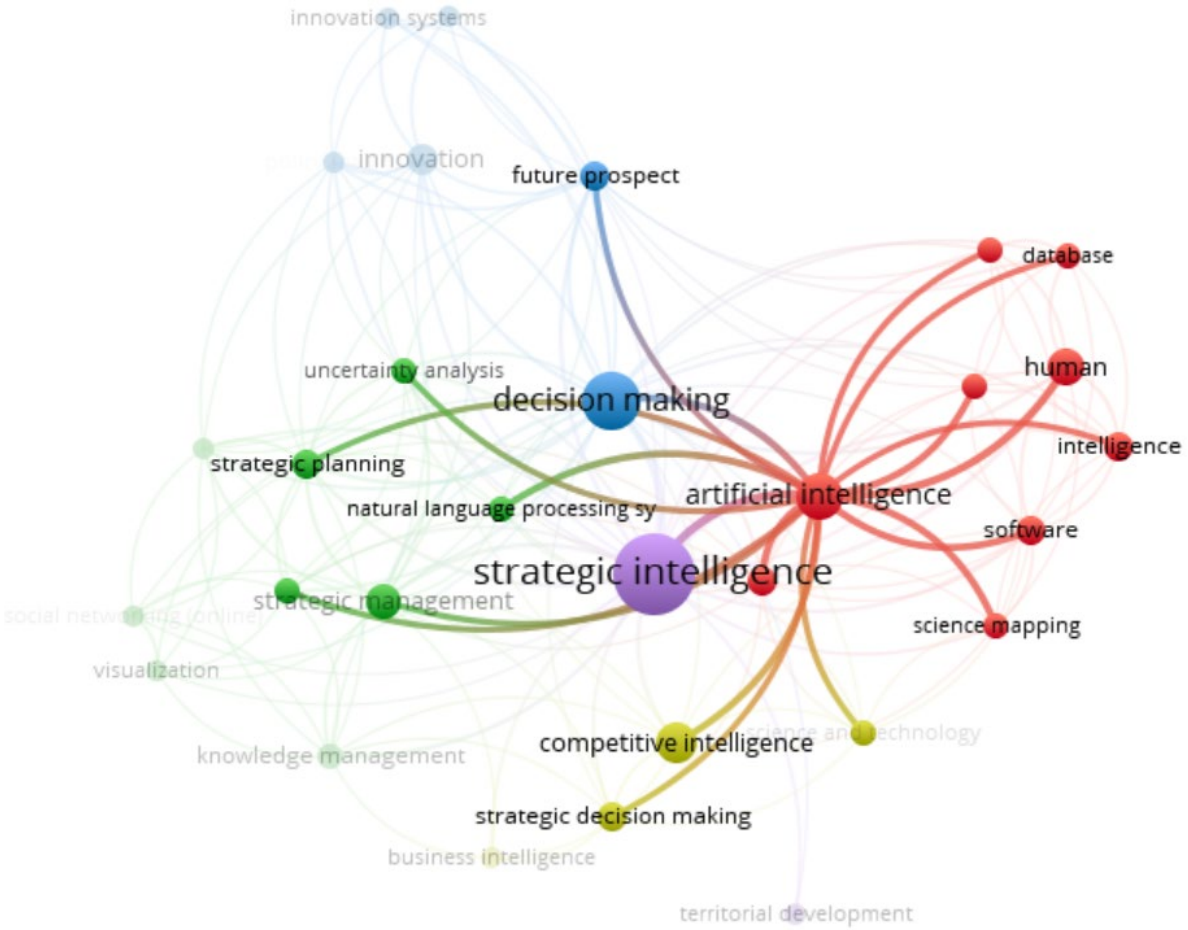

Figure 4: Cluster 1 Artificial Intelligence (own source developed for this study)
A discussion follows on how these concepts intersect and their relevance to strategic decision-making.

6. Discussion and Practical Implications on Strategic Decision-Making

The intersection of SI and Cluster 1: artificial intelligence linked to clinical decision-making, data mining, database, human, intelligence, network analysis, science mapping, and software, has relevance to strategic decision-making by analysing large datasets to provide evidence-based recommendations to strategic decision makers. For example, data mining techniques are applied to large healthcare databases to uncover patterns and insights to inform decisions of healthcare professionals. SI equips proactive medical practitioners to give personalised care to patients. Proactive medical practitioners using Agentic AI can search for relationships in information flows to accurately implement the most impactful treatments. The intersection of SI and Cluster 2: behavioural research linked to knowledge management, management science, social networking (online), strategic management, strategic planning, uncertainty analysis, and visualisation, has relevance to strategic decision-making by equipping managers with tools to mitigate cognitive biases. For example, virtual LLMs allow decision makers to access and utilise relevant company databases and collective insights trained on analytical methods to solve business problems.

The intersection of SI and Cluster 3: decision-making linked to future prospect, innovation, innovation systems, policy making, and technological forecasting has relevance to strategic decision-making by focussing the attention of organisations on anticipating change. SI helps organisations to prepare according to their need to embrace emerging technologies, sustain healthy competition among organisations, and foster innovation. For example, forecasting how agentic AI skills of a company's workforce will contribute to the successful implementation of renewable energy technologies contributes to the company's strategic thrust as the leaders in clean energy adoption. The intersection of SI and Cluster 4: business intelligence linked to competitive intelligence, and science and technology has relevance to strategic decision-making by combining internal

performance data with external market intelligence to make well-informed decisions. For example, an organisation can optimise their product portfolio with the use of agentic AI to simultaneously analyse sales data within the organisation's vertical LLM, comparing it with competitor pricing strategies, and monitoring potential impacts of emerging technologies, thereby enabling strategic decision makers to adjust their pricing models.

Lastly, Cluster 5 sheds light on how SI and territorial development intersect, and the relevance to strategic decision-making. For example, a specific city might use SI to identify key industries for investment, thereby fostering economic growth and job creation. Where territorial intelligence focuses on managing, and extrapolating the complexities of a specific geographic area, SI analysts will analyse political, environmental, social, technological, economic, and regulatory data to alert policymakers to course correct spending in alignment with local needs. By leveraging data on transportation patterns, economic trends, and population growth, strategic decision makers can develop plans that enhance the residents' quality of life. Also, SI can drive innovation in territories where small, medium and micro sized enterprises abound where strategic decision makers can focus the development of agentic AI skills to increase the sustainability of SMMEs.

7. Recommendation and Conclusion

The combination of SI and agentic AI has the potential to create a future where exploration into complexity brings forth opportunities for innovation and sustainable growth. The key to strategic decision making is accurate interpretation of SI. In the era of AI transformation, SI is a core human competency that is foundational to strategic decision-making, developing business solutions, and fostering commercialisation of innovation. To move from the "as is" VUCA environment to the "to be" VUCA environment, GenAI combined with SI principles, tools and ethics, combined with an understanding of the dynamics of innovation and commercialisation, will facilitate the rapid understanding of complexity. By leveraging AI, accurate strategic decision-making is made possible within the parameters of the "to be" VUCA environment. What this means is that the collaboration between Human Intelligence and AI paves the way for accurate interpretation of data and information in complex environments. The combination of SI and agentic AI has the potential to create a future where exploration into complexity brings forth opportunities for innovation and sustainable growth in territories previously underserved by SI analysts.

Ethics Declaration

This research required ethical clearance and was obtained through the University of Johannesburg's College of Business and Economics Research Ethics Committee (UJCBEREC).

AI Declaration

I declare that a portion of the data collected was a brained through Scopus AI search. Other than that, no AI tools were used for this research.

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