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Strategic Decisions in Defense Enterprises: a bibliometric review

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Abstract

The analysis of scientometric, bibliographic indicators in the direction of studying the development of strategic decision support systems in the defense industry is carried out. The results of the study show a weak representation of strategic management in the defense industry, moreover, it is not a popular direction in applied application at defense enterprises. In general, there is a dynamic growth of publications on management for 30 years. The most significant research areas are Business economics, engineering and computer science. The main organizations publishing research are the state military structures of the United States of America, as well as a number of universities. The results of this work will be useful for researchers whose interests lie in the development of the military-industrial complex, the machine-building industry, as well as those who study modern trends in the development of strategic decision support systems.

Keywords: Strategic management, Defense industry, Strategic decisions, Systematic review

1 Introduction

Defense Enterprises are very important for national security as an industry of high technology. A particularly important influence in the activities of Defense Enterprises is the procedure for making strategic decisions. The topic of strategic decision making in the enterprises of the military industrial complex is being actively studied by scientists all over the world, but there are no full-fledged literary reviews on this topic.

Now widely accepted that the state is a funda- mental player in national innovation systems (Mowery, Rosenberg, 1990; Edquist, 2004), such involvement was often criticized based on the idea that the state misunderstands and consequently mismanages its industrial inter- ests. This criticism does not seem to be supported by the experience of governments around the world. Several nations have successfully implemented policies that proved essential to their industrial development and specializa- tion. Paradoxically, however, the role of public procurement and its impacts on the defence industry have been little studied (Edler, Georghuiou, 2007; Rolfstam, 2012). This is particularly surprising when we consider how well known is the influence of customer demand in innovation development (Von Hippel, 1976; Barbaroux, Dos Santos, 2013).

Dunne (1995) defines a Defence Technological and Industrial Base (DTIB) as the group of companies that supply the military with a range of products needed for their operations. This includes not just weapons but any other type of goods or services necessary for the maintenance of these armies. Defence companies are very heterogeneous. They may range from primary contractors specialized in the production of defence equipment to small businesses that occasionally supply other defence agents, states or companies (Blom et al., 2014).

Because governments are at the same time the main customers, regula- tors and financers of the defence industry, they are in a position to directly influence its structure, activity and performance (Belin, Guille, 2008). We assume as a premise, therefore, that States play a crucial role in the strategic choices of defence companies confronted with budgetary restrictions and technological changes (Bellais, 2005; Avadikyan, Cohendet, 2009). These strategic choices have revolved around four main areas: a) the nature of their activities (military, civilian or dual, Depeyre, Dumez, 2010); b) their openness to new partners (national or international, horizontal or vertical cooperation, Hoeffler, 2008); c) their market extension strategies (exports, diversification into civilian products or other defence activities) and d) their financial needs. These decisions have a strong influence on the overall industry structure and innovation dynamics.

The Internet of Things (IoT) is undeniably transforming the way that organizations communicate and organize everyday businesses and industrial procedures. Its adoption has proven well suited for sectors that manage a large number of assets and coordinate complex and distributed processes.

This article aims to make a systematic review of the available scientific publications in the world on the topic of strategic decision making in the military-industrial complex and deliver an objective overview of the state-of-the-art strategic decisions on today's Military Industrial Complex (MIC) research.

The main goal is to search for academic literature that explains how organizations can incorporate real-time data of physically operating objects into their decision making.

Better understanding of the IoT's analytical capabilities stimulates future SCM research to customize information systems by proactively acting on the dynamic and stochastic nature of supply chains.

Therefore, we have to map which type of IoT devices and analytical models are prescribed by scientists to improve supply chain performances.

Therefore, the content of this paper is structured as follows. First, we explain how our SLR will extend the current body of knowledge by elaborating on the theoretical background related to strategic decisions, and defense industrial complex in Section 2. In Section 3, we introduce the research methodology applied, including a description of the search strategy, selection criteria, and data extraction forms. In Section 4, we summarize the SLR results and discuss the observations made, compare our SLR results with other relevant publications, summarize our findings and give some pointers to future Strategic Decision MIC research. We end with our conclusions and recommendations in Section 6.

2 Theoretical background

The Internet of Things (IoT) is a distributed system for creating value out of data. It enables heterogeneous physical objects to share information and coordinate decisions. The impact of IoT in the commercial sector results in significant improvements in efficiency, productivity, profitability, decision-making and effectiveness. IoT is transforming how products and services are developed and distributed, and how infrastructures are managed and maintained. It is also redefining the interaction between people and machines. From energy monitoring on a factory (Nutt, 1984)to tracking supply chains (Lai, et al., 2015), IoT optimizes the performance of the equipment and enhances the safety of workers. Until today, it has allowed for more effective monitoring and coordination of manufacturing, supply chains, transportation systems, healthcare, infrastructure, security, operations, and industrial automation, among other sectors and processes.

Defense and Public Safety (PS) organizations play a critical societal role ensuring national security and responding to emergency events and catastrophic disasters.

Nowadays, the challenge of crisis management is in reducing the impact and injury to individuals and assets. This task demands a set of capabilities previously indicated by European TETRA (TETRA Association, 2010), TCCA (TETRA Critical Communications Association (TCCA), 2013), and ETSI (European Telecommunications Standards Institute (ETSI), 2010) standardization bodies and American APCO Project-25 (Telecommunications Industry Association (TIA), 2013), which includes resource and supply chain management, access to a wider range of information and secure communications. Military and first responders should be able to exchange information in a timely manner to coordinate the relief efforts and to develop situational awareness. FY 2016 SAFECOM Guidance (Office of Emergency Communications, 2016) provides an overview of emergency communications systems and technical standards. Communication capabilities need to be provided in very challenging environments where critical infrastructures are often degraded or destroyed. Furthermore, catastrophes, natural disasters or other emergencies are usually unplanned events, causing panic conditions in the civilian population and affecting existing resources. In large-scale natural disasters, many different PS organizations (military organizations, volunteer groups, non-government organizations and other local and national organizations) may be involved. At the same time, commercial communication infrastructure and resources must also be functional in order to alert and communicate with the civilian population. In addition, specific security requirements including communication and information protection can also exacerbate the lack of interoperability. Sharing various types of data is needed in order to establish and maintain a Common Operational Picture (COP) between agencies and between field and central command staff.

Strategic Decisions (Strategic Management). Strategic decisions are the decisions that are concerned with whole environment in which the firm operates, the entire resources and the people who form the company and the interface between the two

Defense Enterprises. The term “Defense Enterprise” means the organizations, infrastructure, and measures, including policies, processes, procedures, and products of The Department of Defense.

Strategic Management in Defense Enterprises.

One of the theoreticalapproaches in the methodology for strategicmanagement of enterprises is the resource-based approach, the foundations of which were laid in the works of foreign researcherssuch as Schumpeter (Schumpeter, 2008), Penrose (Penrose, 1960), Wernerfelt (Wernerfelt, 1984). This approach as a way ofmanaging enterprises was considered in theworks of Kat’kalo (Kat’kalo, 2008), Efremov and Khanykov (Efremov and Khanykov, 2003) and others.However, specific features of strategicmanagement at the military-industrialcomplex enterprises have a pronouncedeffect on the use of the resource-basedapproach in their management andactualize further research in this direction.

3 Methods and Materials

Data on the list of articles with their bibliometric data was obtained from the Web of Science database (Clarivate Analytics, 2022). The period was chosen from 1900 to 2021. However, works on the chosen topic have been indexed in the database only since 1990.

Building a query to obtain a list of works on a selected research topic:

1. We took the "defense" branch in different spellings in British and American (Defense, Defense, Military).
2. Then included in the query the words "enterprises", "organization", "industry", "complex".
3. Then included in it "strategic decisions", "strategic management";

After that, we excluded words like "medicine", "health", because there were many irrelevant articles, specifically medical, not related to the sphere of strategic decision-making.

Final Query for Web of Science database is following:
(TS=(Defense) **OR** TS=(Defence) **OR** TS=(Military)
AND(TS=(Enterprise) **OR** TS=(Organization) **OR** TS=(Industry) **OR** TS=(Complex))
AND(TS=(Strategic Management) **OR** TS=(Strategic Decision))
NOT(TS=(medicine) OR TS=(health))
Link to this saved query in Web of Science website: https://www.webofscience.com/wos/woscc/summary/21e1a282-98ab-400e-ac14-379d479b62cc-4c52e8b0/relevance/1
Original source data table is holding on the following link: https://docs.google.com/document/d/17sg33UEVFIfG2_byvDtz-DtigqoNK_Rd?rtpof=true&usp=drive_fs
A similar query for the Scopus database looks like this:
(TITLE-ABS-KEY(defence) **OR** TITLE-ABS-KEY(defense) **OR** TITLE-ABS-KEY(military)) **AND** (TITLE-ABS-KEY(organization) **OR** TITLE-ABS-KEY(complex) **OR** TITLE-ABS-KEY(enterprise) **OR** TITLE-ABS-KEY(industry)) **AND** (TITLE-ABS-KEY(Strategic Decision) **OR** TITLE-ABS-KEY(Strategic Management)) **AND NOT** (TITLE-ABS-KEY(health) TITLE-ABS-KEY(medicine))
As of May 7, 2022 the distribution of articles was as follows (Table 1):

Table 1. Count of records in databases

Step #	Words in Query Part	Record Count in WoS	Record Count in Scopus
1	"Defense" + "Defence" + "Military"	293 750	679 486
2	include "Enterprise" + "Organization" + "Industry" + "Complex"	1 500	103 000
3	include "Strategic Management" + "Strategic Decision"	545	1 642
4	exclude -"medicine", "health"	500	1 579

Source: Own calculations

Web of Science was chosen because it is the highest quality database of scientific articles thus, 500 articles from the WoS database were selected for the study

This review is particularly based on the systematic review methodology proposed by

Denyer and Tranfield (Denyer and Tranfield, 2009).

Data visualization was carried out using VosViewer, a software tool for constructing, analyzing, and visualizing bibliometric networks (Jan van Eck et al., 2009) and WoS Dashboards web service. After steps occured in Table 1 we export keywords of all bibliometric lists to the RIS file. Then, we visualize the co-occurences of top keywords for discovored disciplines in VOS Viewer by constructing a bibliometric network including most frequently used keywords used in exported articles.

4 Results and Discussion

Despite the fact that the sampling period was from 1900, the first papers on the chosen topic began to appear in 1990 (Fig. 1). A significant increase occurred in 2019 - up to 58 works per year. The figures have been declining for the past two years, but interest in the topic may rise due to increased attention to military budgets in countries due to the geopolitical situation in 2022.

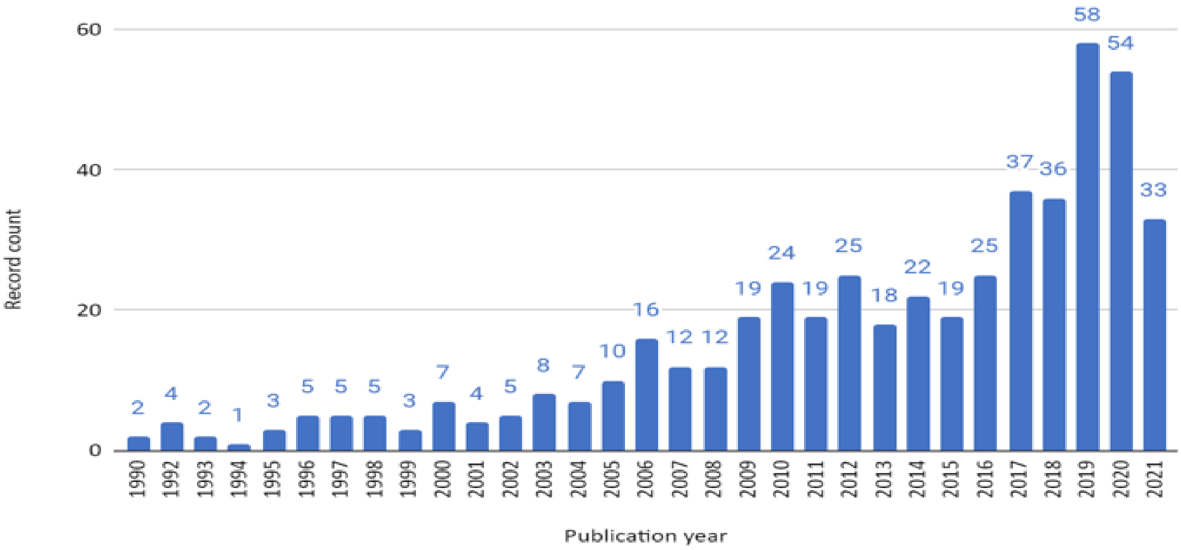

Fig. 1. Count of Publications by Year

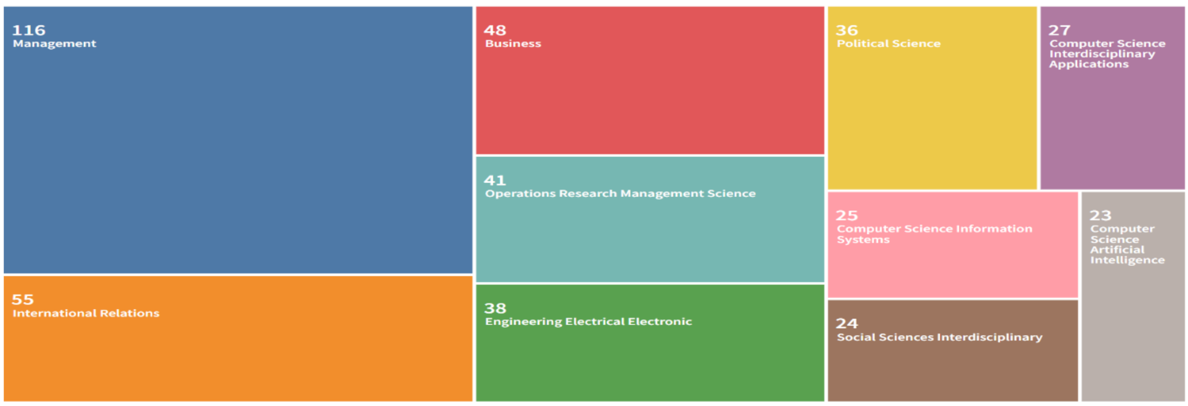

Fig. 2. Top-10 Categories in TreeMap visualization

After analyzing the data, it is possible to describe their frequency statistics for important bibliometric attributes. Thus, the most popular category (Table 2, Fig.2) is Management, which significantly breaks away (more than 2 times) from other categories in this list.

Table 2. Top-10 popular categories in topic's distribution

Categories (Top-10)	Record count	% of 500
Management	116	23.2
International Relations	55	11.0
Business	48	9.6
Operations Research Management Science	41	8.2
Engineering Electrical Electronic	38	7.6
Political Science	36	7.2
Computer Science Interdisciplinary Applications	27	5.4
Computer Science Information Systems	25	5.0
Social Sciences Interdisciplinary	24	4.8
Computer Science Artificial Intelligence	23	4.6

Source: Web of Science database (1990-2021)

At the same time, the analysis by Research Areas showed that the most popular areas in the selected works are Business Economics, Engineering and Computer Science (Fig.3, 4).

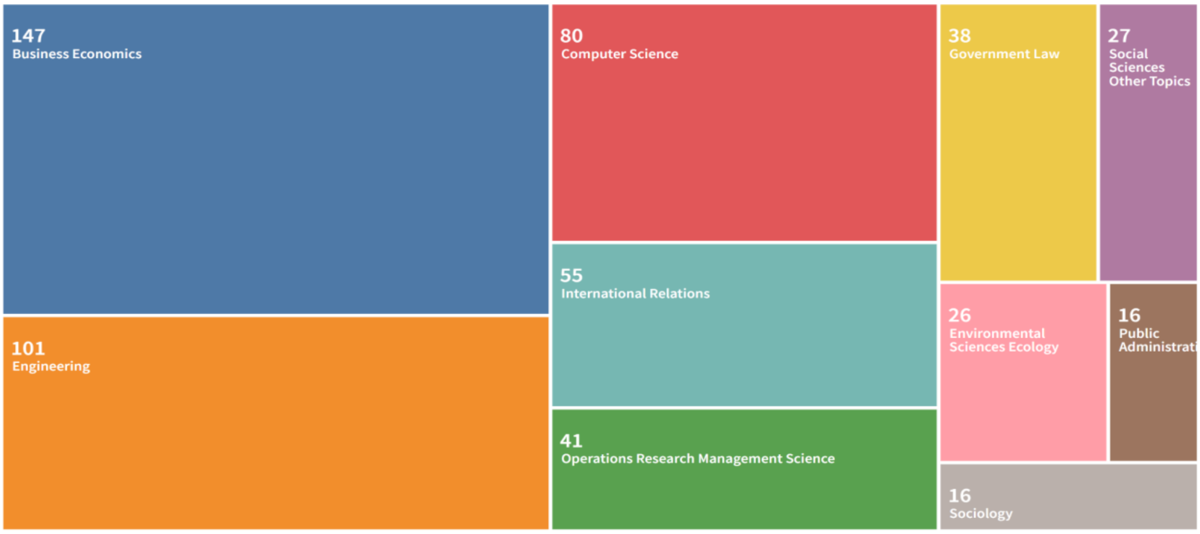

Fig. 3. Top-10 research areas on TreeMap diagram

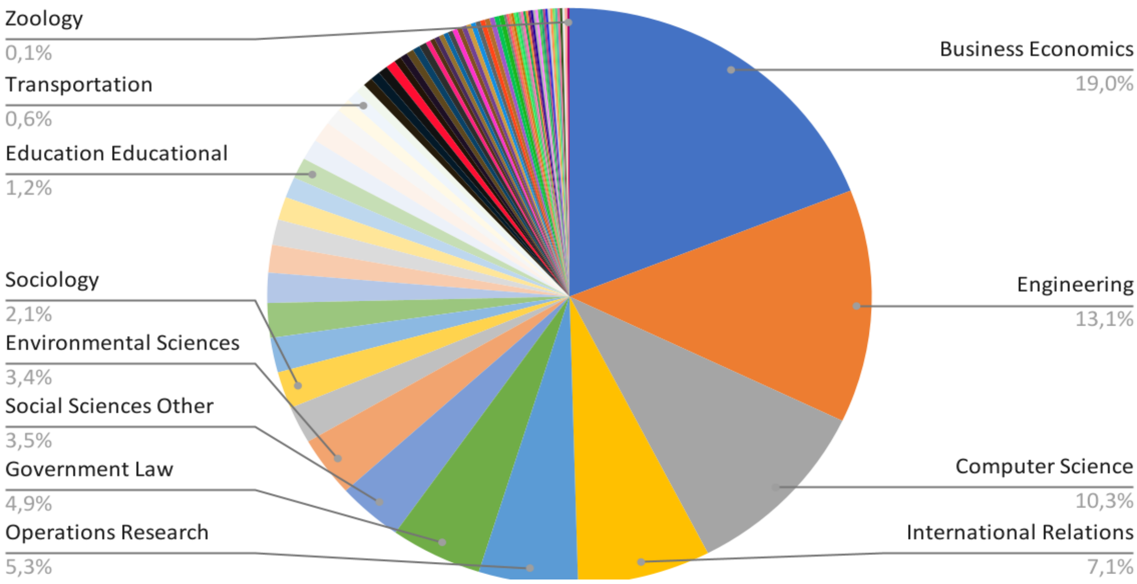

Fig. 4. Distribution of publications by research areas

If we look at organizations with which scientific work on the topic is affiliated, then we can single out a clear leader - the United States Department of Defense (Fig.5). In addition, most of the scientific papers were published from the USA (Fig.6), the rest of the countries are European countries, Australia, China and Russia.

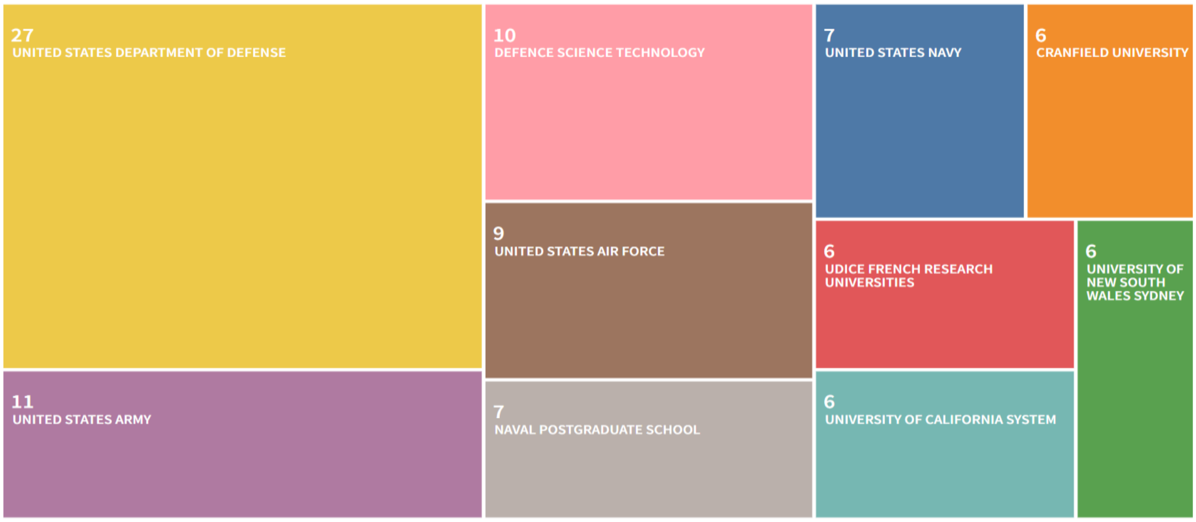

Fig. 5. Top-10 affiliations

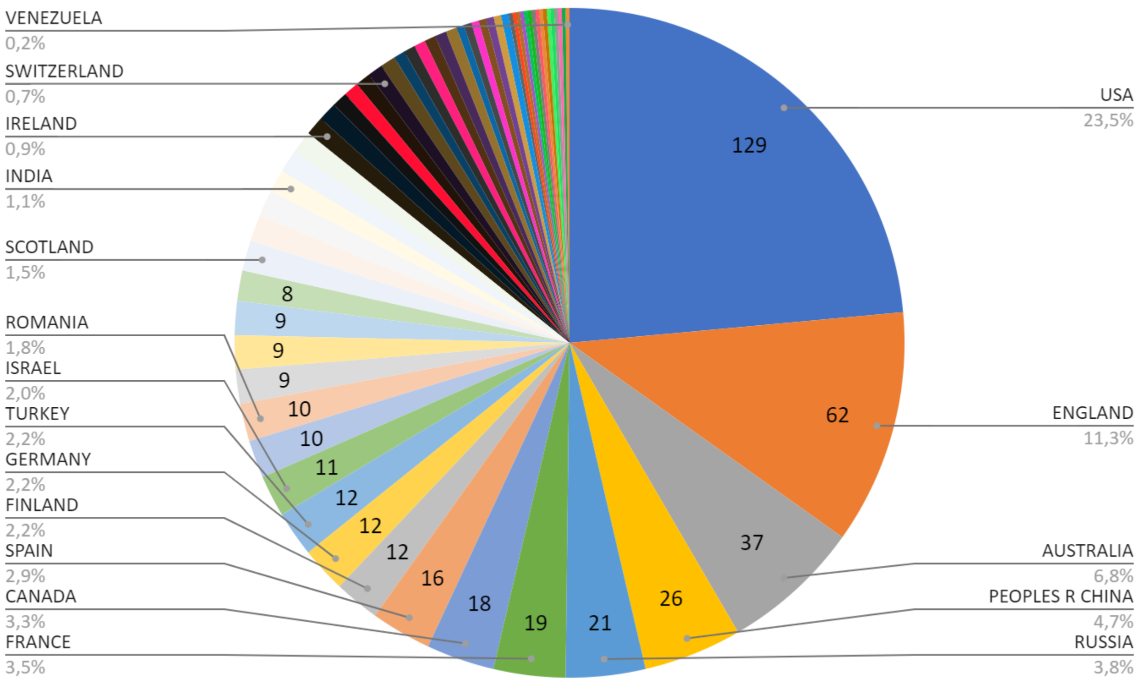

Fig. 6. Distribution of Papers by Countries

Among the sources, the distribution looks even, but there are three journals that have published the largest number of articles (7):

1. Armed Forces Society;
2. Internqtion lAffairs;
3. Knowledge Based Org in Int Conference.
4. Among the publishers are all well-known publishers of a wide profile, but among them in the top 10 there was a specialized conference organizer Acad conferences Ltd.

Fig. 7. Top-10 sources

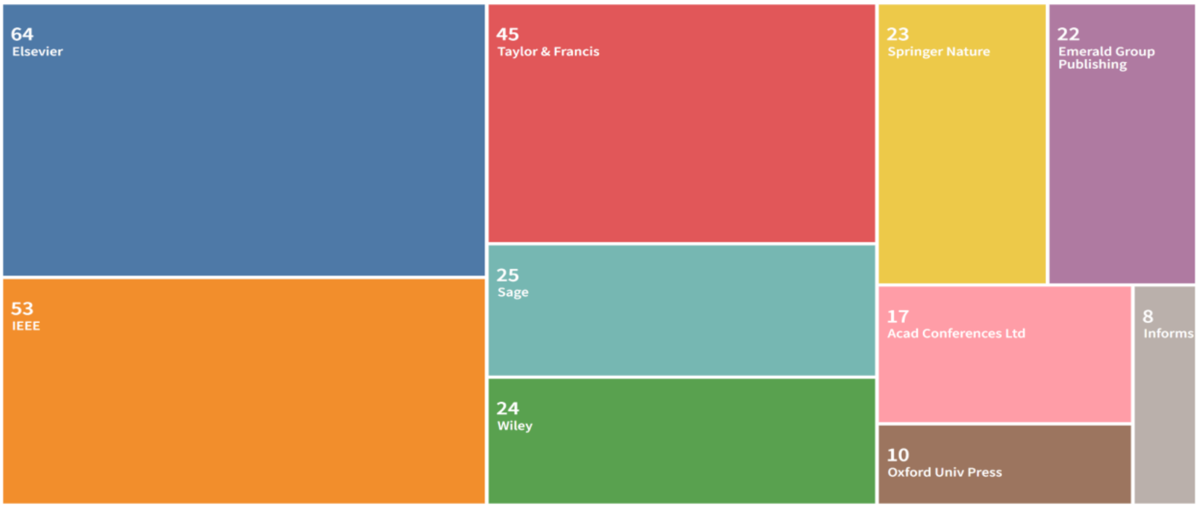

Fig. 8. Top-10 publishers

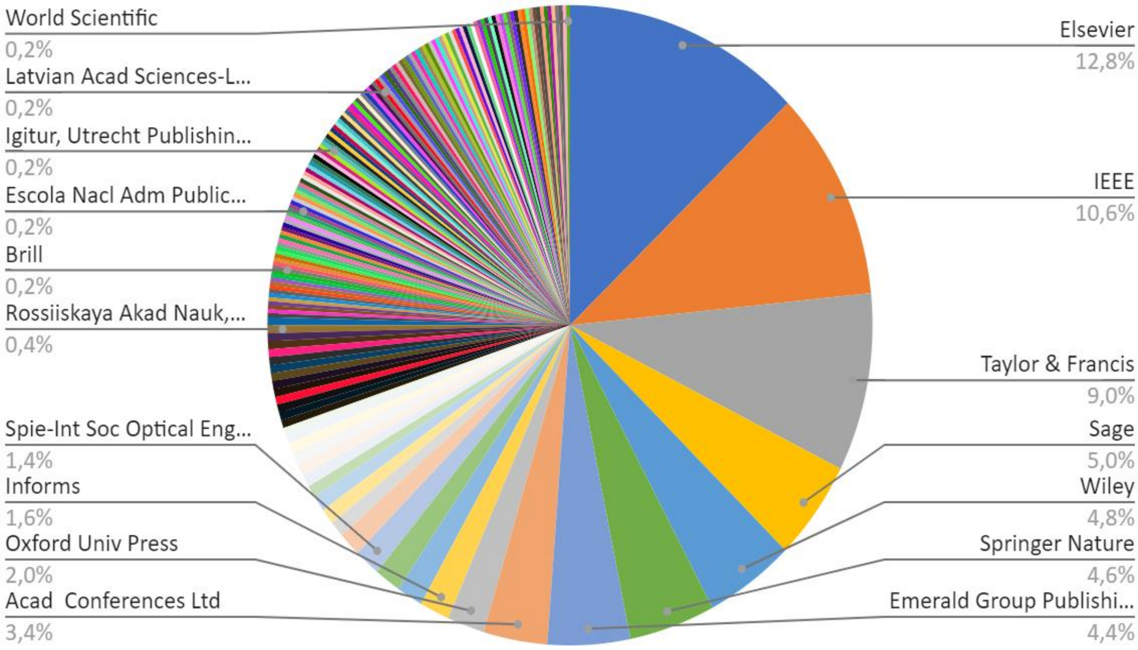

Fig. 9. Distribution by Publishers

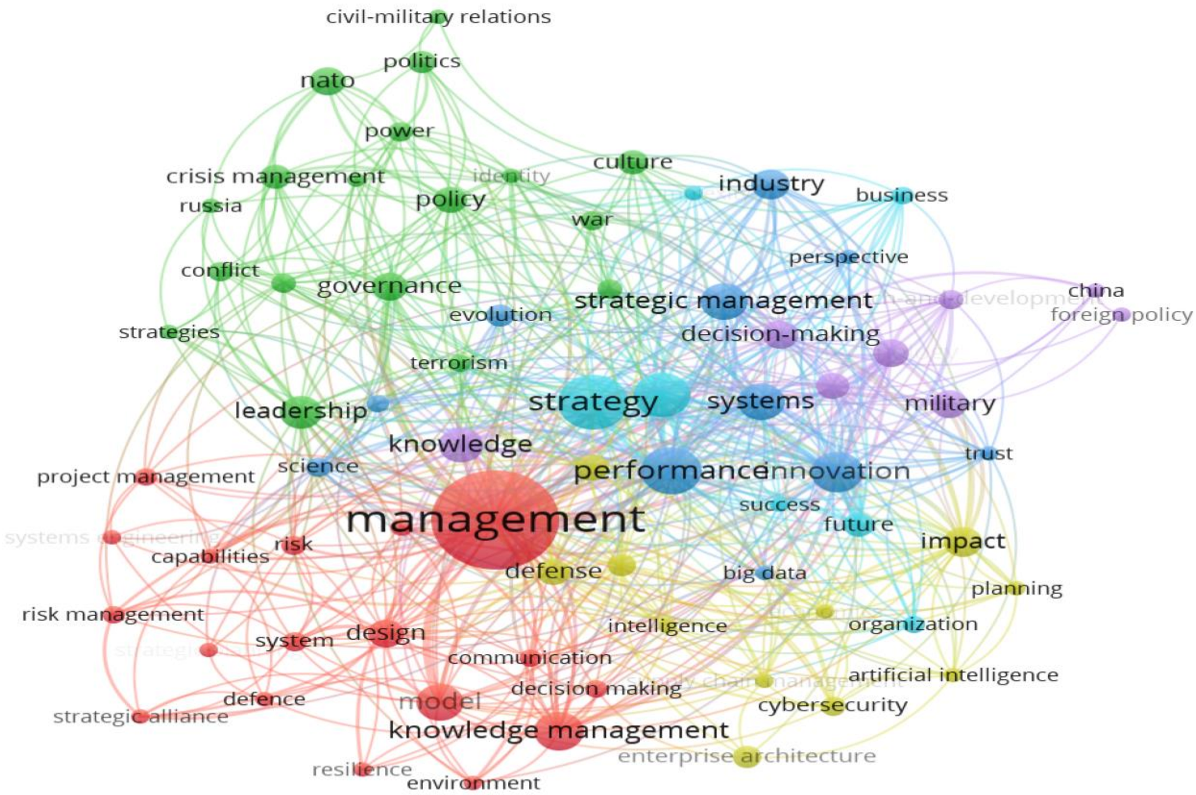

Fig. 10. Bibliometric network diagram by keywords

Content analysis was made by keywords from 500 papers and visualized with a network diagram on Figure 10. The most popular keyword is management, around which they choose as keywords - countries (China, Russia), political organizations and country unions (NATO), the name of technologies (big data, artificial intelligence,), managerial categories (risk-man, project-man, knowledge-man, decision-making), events and situations (war, crisis, terrorism).

5 Acknowledgement

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6 Conclusion

This article examined how the defense industry can use the opportunities created by the transformation of the Internet of Things. The main topics related to the application of the concepts of the Internet of Things in the military and security sphere were explained. The added value and the risk of using Internet of Things technologies in selected scenarios were also assessed. Based on operational requirements, we have proposed an architecture, technologies and protocols that take into account the most significant capabilities.

Organic transitions, such as supply chain management and logistics, will naturally move into mission-critical environments. Beyond the earliest military innovations of the Internet of Things, complex battlefields will require additional advances in research to meet specific needs. In addition to solving various technical problems, this work has identified vital areas for further research in 2022-2030. Moreover, the areas of combat that closely integrate human cognitive processes will require new or expanded existing information theories that scale in deterministic situations.

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