Constructing Digital Architectures under Society 5.0: An Enterprise Architecture Perspective

Jean Paul Sebastian Piest[1[0000-0002-0995-6813]], Yoshimasa Masuda[2, 3[0000-0001-6186-3158]] and Maria Eugenia Iacob[1[0000-0002-4004-0117]]

[1] University of Twente, Drienerlolaan 5, 7522 NB, the Netherlands
[2] Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA 15213, United States
[3] Tokyo University of Science, 1 Chome-3 Kagurazaka, Shinjuku City, Tokyo 162-8601Japan
j.p.s.piest@utwente.nl

Abstract. As Japan's vision regarding Society 5.0 is unfolding, several digital architectures are (being) constructed. Although Society 5.0 is extensively researched and its application is illustrated in several domains, little research is conducted regarding the construction of digital architectures under Society 5.0. The aim of this paper is to analyze digital architectures that are (being) constructed under Society 5.0 from an enterprise architecture perspective. Extending the results of related studies, a systematic literature review is conducted to find out which enterprise architecture frameworks and principles are utilized to construct digital architectures under Society 5.0. The initial search in three scientific databases resulted in a sample of 857 documents. After removing duplicates and screening based on abstracts, 116 documents have been analyzed. This revealed a variety of 37 digital architectures in different domains. The main finding is that the analyzed digital architectures mainly use conceptual representations, make little use of established enterprise architecture frameworks, and are not based on explicit principles. This study is limited to scientific databases and selected published articles. Empirical research is required to validate the findings. This paper presents an enterprise architecture perspective on Society 5.0 and is considered of value for scholars and enterprise architects that are interested in constructing digital architectures under Society 5.0. As the interest in Society 5.0 is increasing, it is recommended to develop a reference architecture and guiding principles to support digital transformation processes. Future research can contribute to develop prescriptive design knowledge and supporting methods for constructing digital architecture under Society 5.0.

Keywords: Society 5.0, Digital Architecture, Enterprise Architecture, Frameworks, Principles, Systematic Literature Review.

1 Introduction

Since its introduction in the 5th Science and Technology Basic Plan 2016-2021, the topic Society 5.0 (hereafter S5.0) attracted the interest of scholarly and policy makers around the globe. S5.0 is defined as "A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space." [1] Originally developed in Japan, S5.0 is being adopted in many other countries and closely related to Industry 4.0 (hereafter I4.0) and the Sustainable Development Goals (SDGs) [2,3,4]. I4.0 refers to four distinct industrial revolutions and the national strategic initiative in Germany that focuses on realizing the smart factory based on Cyber-Physical Systems (CPS), Internet of Things (IoT), and Artificial Intelligence (AI) [3]. The SDGs are part of the United Nations Member States's 2030 agenda for sustainable development and provides a shared blueprint for peace and prosperity for people and the planet, for now and towards the future [5]. The S5.0 vision and related development programs in Japan are compared, amongst other countries, to I4.0 in Europe, advanced manufacturing in the US, and Made in China 2025, and more recently linked to the emergence of I5.0 [3].

With the completion of the 5th Science and Technology Basic Plan various digital architectures are (being) constructed under S5.0. However, S5.0 attracted fairly limited attention in the Enterprise Architecture (EA) discipline. In order to guide the large-scale implementation of I4.0, reference architectures and standards have been developed, including the Reference Architecture Model for Industry 4.0 (RAMI4.0). On the contrary, a reference architecture for S5.0 seems not to exist.

The main aim of this paper is to identify and analyze digital architectures that are (being) constructed under S5.0. The following research questions are formulated:

- Which digital architectures are developed under S5.0?
- Which enterprise architecture frameworks and/or principles are used to construct S5.0 applications?
- Is there a reference architecture for S5.0? If not, is there a need for developing a reference architecture?

Extending the scope of earlier conducted Systematic Literature Reviews (SLR), an updated SLR is conducted using the PRISMA 2020 guidelines (https://prisma-statement.org/). The envisioned contribution of this research is to provide a common ground to start developing a EA perspectives regarding S5.0. and digital transformation processes. More specifically, this paper provides scholars and enterprise architects an overview of digital architectures (being) constructed under S5.0. in relation to EA frameworks and principles.

This paper is structured as follows. **Section 2** lays down the theoretical foundation by summarizing related work regarding S5.0 and EA frameworks. **Section 3** is concerned with the methodological approach of the SLR. **Section 4** presents the results and findings of the SLR regarding digital architectures (being) constructed under S5.0, emphasizing the use of EA frameworks and principles. **Section 5** discusses the SLR outcomes. **Section 6** concludes and positions opportunities for future research.

2 Related work

This section summarizes relevant related work regarding S5.0 and EA frameworks. **Section 2.1** discusses the topic S5.0. and related SLRs. **Section 2.2** highlights established EA frameworks and principles. **Section 2.3** presents related work concerning the design of S5.0 solutions.

2.1 S5.0

The Hitachi-UTokyo Laboratory published a book regarding S5.0 encompassing the people centric, super smart society [4]. The authors contextualized the five societies in terms of productive approach, material, transport, settlement form, and ideals. S5.0 is categorized as the super smart society in which cyberspace and the physical space are merged, that is built with smart materials, provides transport based on autonomous driving, and is organized in autonomous decentralized cities. The city ideal is humanity. This is emphasized in the statement that S5.0 is leveraging technology to balance economic development with the resolution of social problems, taking into account the demographic developments, and bring wealth, comfort, and quality of life to people. S5.0 leverages technology to establish a knowledge-intensive and data-driven society. Here, digital platforms play an important role. Various examples are presented to illustrate the S5.0 vision, including personal health robots, autonomous transport, smart energy consumption, and data-driven governmental services. Establishing smart cities requires a massive transformation to integrate IT and sensors into urban planning, public infrastructure, energy systems, and individual households. This raises the important question and/or concern how to balance the needs of society and individuals. The habitat innovation framework presents a set of Key Performance Indicators (KPIs) and formulas to balance structural transformation with technological innovation and quality of life. The KPIs support measuring residents quality of life, evaluating social issues, and predicting drivers for social issues. From an EA perspective, the so-called urban datarization will raise challenges regarding integrating data and systems. The trends and development of smart cities are compared by the authors in Japan, the US, and the EU. The book provides an extensive overview of S5.0. Additionally to the book, some related review studies and SLRs are identified regarding S5.0.

Shahidan et al. [2] conducted a SLR regarding S5.0 to map the emergence of S5.0 and its core concepts. Their SLR is based on the PRISMA guidelines (version not reported), included 142 documents from the Scopus database (initial sample not reported), and bibliometric analysis using VOSviewer version 1.6.16. Their SLR shows that S5.0 is a relatively young research field and is predominantly studied in engineering disciplines, but has interdisciplinary traits. The research indicates a strong link between S5.0 and I4.0. and its related technologies to build smart cities. Furthermore, the study shows that S5.0 is studied in 41 countries. The authors conclude that S5.0 is an under researched topic that requires further research. More specifically, the authors recommend that additional databases (e.g., Web of Science) should be included and research can be done based on analysis of co-citations and bibliographic couplings.

Roblek et al. [3] conducted a similar SLR regarding S5.0 and the relation to I4.0 and I5.0. Their SLR is based on a three-step approach, included 37 documents from an initial sample of 916 documents from the Web of Science database, and bibliometric analysis using VOSviewer version 1.6.16. The authors examined S5.0 from a historical economical and technological perspective. Furthermore, the author emphasize the transformation challenges to transition from S4.0 to S5.0. The authors recommend to develop a set of good practices to foster implementation (in other countries) and pay more attention to the risks related to the digital society.

2.2 EA: frameworks and principles

In the past decades, the discipline of EA evolved to a well-known practice of business and IT alignment. A review illustrates how the discipline first focused on understanding and modelling EA, and switching focus to managing EA [6].

EA frameworks have various approaches, levels of granularity, and abstraction. A comparison study [7] identified several established EA frameworks, varying from generic EA frameworks to specific EA frameworks. Generic EA frameworks include the Zachman framework for EA and The Open Group Architectural Framework (TOGAF). Domain specific EA frameworks include the Department of Defense Architecture Framework (DoDAF) and Federal Enterprise Architecture Framework (FEAF). A similar review study complements previous studies with more recent EA Frameworks, including, amongst others, the Adaptive Integrated Digital Architecture Framework (AIDAF)[8]. AIDAF is based on modern development paradigms and emphasizes the need to support digital transformation processes. Furthermore, another review study identified the main EA implementation methodologies which are concerned with the practices to model, develop, and maintain EA [9]. Reference architectures contribute to effective implementation of EA. A review revealed a variety of 162 reference architectures, including RAMI4.0 and smart cities [10]. However, to the best of our knowledge, a reference architecture for S5.0 seems not to exist.

Principles are important elements of EA frameworks. However, a review regarding design principles indicated the lack of a general accepted definition and conceptual framework for enterprise architecture principles [11]. The author illustrates that principles exist on different levels (e.g., business, IT, data) and architectures essentially can be seen as networks of interrelated principles. The author presents a conceptual foundation for enterprise architecture principles in which principles are described as fundamental propositions related to the design, guiding both the construction and evaluation, and/or the representation, describing and modelling, of architectures. Furthermore, the author differentiates generic and enterprise-specific principles.

2.3 Designing S5.0 solutions

Bartoloni et al. [12] present a design approach for S5.0 solutions based on design thinking and the quadruple helix innovation framework. The proposed conceptual model is constructed around circular, multilateral S5.0 logic and applied to design and implement the SMARTAGE platform based on action design research in a single case study. The authors acknowledge the presence of design principles for I4.0, but emphasize that S5.0 solutions require a holistic approach and design principles for S5.0 are lacking. Furthermore, the authors stress that S5.0 is lacking empirical studies that provide understanding in the design and development processes and interactions between stakeholders to realize solutions that leverage I4.0 technologies to solve societal problems to benefit the entire society. The authors argue that the application of S5.0 logic is based on human-centric design, goes beyond the political-ideological concept, and should be based on an interdisciplinary approach to ensure that stakeholder needs are incorporated in the design and implementation of S5.0 solutions.

3 Methodology

Extending related studies [2], the methodological approach is based on a SLR using the PRISMA 2020 guidelines [13]. **Section 3.1** highlights the use of the PRISMA 2020 guidelines. **Section 3.2** describes the topic identification process and scope of the SLR. **Section 3.3** summarizes the screening process as part of the SLR. **Section 3.4** describes the in- and exclusion process as part of the SLR.

3.1 Overview

The PRISMA 2020 guidelines are utilized to identify the topic and scope of the SLR, screen scientific databases for literature, and create a sample by extracting documents based on in- and exclusion criteria, as shown in Figure 1. The PRISMA 2020 checklist is used to assess 27 items. Next, the use of PRISMA 2020 is visualized and described based on the guidelines and checklist.

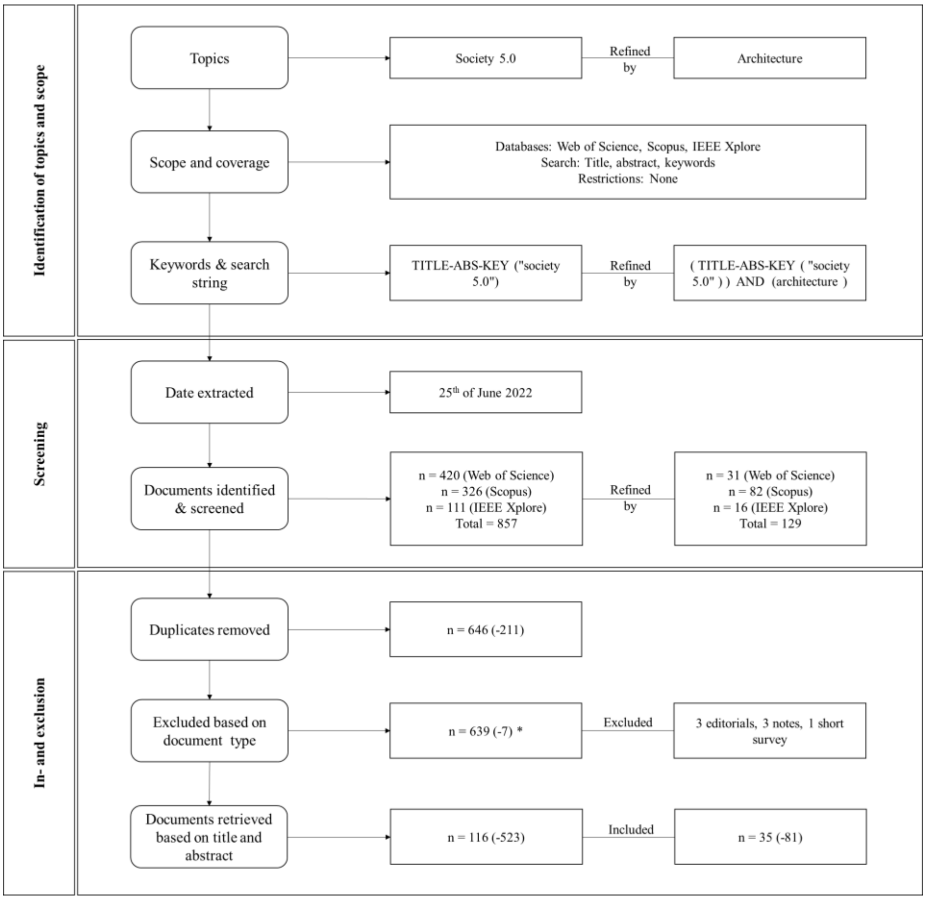

Fig. 1. Overview of the SLR regarding digital architectures under S5.0 (adapted based on [13]).

This study is identified as SLR. The abstract is checked using the checklist. The rationale of the SLR is described in the introduction together with the objective and research questions. In- and exclusion criteria are specified. The information sources and date of search are specified, including the search strategy and filters. The selection and data processing process are conducted independently by the first author without the use of automation tools. The study selection process and individual selected studies are described. The data items are listed and defined in this paper. The synthesis methods are described, visualized, and tabulated. The second author assessed the results and methodology. The risks of bias in studies are assessed for each individual study. The results of the syntheses are assessed to identify biases are reported. Specific attention is given to the certainty of evidence. The bias and certainty assessment are reported. The third author assessed the risks of bias. The research is conducted independently and received no funding or financial support. The authors declare no conflict of interest. All details are published in this paper and were subject to peer-review by multiple anonymous reviewers. The review is not registered.

3.2 Identification of topic and scope

The main topic of the SLR is S5.0 in relation to architecture to extend related studies [2,3,6] and book regarding S5.0 [4]. Three scientific databases were selected: Web of Science (https://www.webofscience.com/), Scopus (https://www.scopus.com/), and IEEE Xplore (https://ieeexplore.ieee.org/). No restrictions were set given the fact that S5.0 is a relatively new topic. The TITLE-ABS-KEY ("society 5.0") was used to query the databases for an initial search and TITLE-ABS-KEY ("society 5.0" AND "architecture") was incorporated to refine the results for the purpose of this study.

3.3 Screening

The three databases are queried on the 25th of June 2022 and resulted in a sample of 857 documents. The refined search yielded a sample of 129 documents (15% of the sample). Due to the relatively limited sample size, all 857 documents were screened.

3.4 In- and exclusion

First, 211 duplicates were removed from the sample. Next, 7 documents were excluded based on document type. This concerned 3 editorials, 3 notes, and 1 short survey. Then, 523 documents were excluded based on analysis of the title and abstract. Here, the main criteria were the relatedness to the main topic S5.0. and presence of a system or application. Documents that did not contain a clear relation to S.5.0 or lack a system or application in the title or abstract were excluded. This reduced the sample to 116 documents, which were obtained and analyzed in detail for the presence of either a digital and/or an enterprise architecture. Documents that lacked content regarding digital and/or enterprise architectures were excluded. Based on the analysis of the 116 documents, a total of 35 documents are included in this SLR.

4 Results and findings

In this section, we present the results and findings of the SLR and answer the research questions. **Section 4.1** summarizes the results of the bibliometric analysis of the research topic S5.0. **Section 4.2** lists and describes the identified digital architecture under S5.0. **Section 4.3** analyzes the identified digital architectures under S5.0 in relation to EA frameworks and principles.

4.1 Bibliometric analysis

VOSviewer (https://www.vosviewer.com/) version 1.6.18 is used to visualize, explore, and analyze bibliometric networks. The bibliometric database files from Web of Science and Scopus can be imported in VOSviewer. VOSviewer does not support the import of multiple databases. Therefore, the database with the most documents is used first. Based on 420 documents from the Web of Science database, a keyword co-occurrence analysis is conducted to determine the relatedness of items based on the number of documents in which they occur. The sample includes 1857 keywords. Based on the minimum occurrence of 5, a total of 49 keywords meets the threshold. VOSviewer calculates the strength of the co-occurrence link with other keywords for each of the 49 keywords. The keywords that have the greatest link strength will be selected. The following keywords are manually removed “0”, “Society 5”, “Industry 4”, and “Industry 5” to remove noise. Figure 2 shows the visualization of keyword co-occurrence based on the bibliometric data. The scale is set to 2.0 to emphasize links.

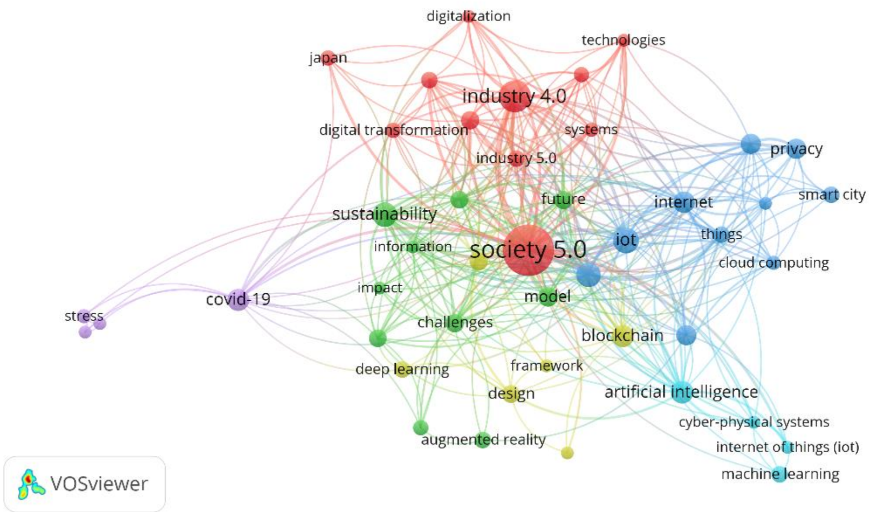

Fig. 2. Keyword co-occurrence >5 regarding S5.0 in Web of Science (image from VOSviewer).

A similar bibliometric analysis is conducted based on the 327 documents from the Scopus database, which revealed significant differences in terms of keywords (2328) and keyword co-occurrence of >5 (58 keywords), as shown in Figure 2.

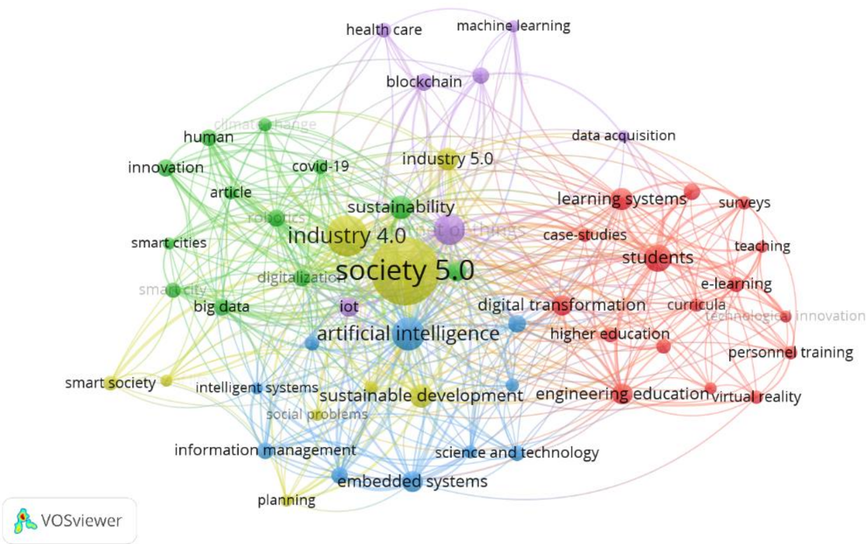

Fig. 3. Keyword co-occurrence >5 regarding S5.0 in Scopus (image from VOSviewer).

Comparing both figures shows that using a single database introduces a risk of bias. The difference is also reflected in the limited number of duplicates (-211). Therefore, the results must be cross-validated by (manually) merging both databases.

4.2 Digital architectures under S5.0

Based on the SLR and the selected 116 documents, a total of 37 digital architectures are identified. Table 2 lists the digital architectures and their source(s).

Table 1. Identified digital architectures under S5.0.

ID	Digital architecture	Domain	Year	Source(s)
1	Group management system design	Generic	2017	[14]
2	Future energy system	Energy	2017	[15]
3	Cone-X-ion system	Retail	2018	[16]
4	Gurarda Framework for Smart Cities	Smart cities	2018	[17]
5	Civil registration and population data system	Government	2018	[18]
6	Visual Analytics Framework for Condition Monitoring in Cyber-Physical Systems	Manufacturing	2019	[19]
7	Digital Healthcare Platform	Healthcare	2020	[20, 21]
8	Cyber-physical system setup for predicting tool wear in machining	Manufacturing	2020	[22]
9	Facemask and Physical Distancing Detection with Alarm Systems	Security	2020	[23]
10	Enhanced living environments with with ambient	Living	2020	[24]

	assisted living			
11	Societal security concept for society 5.0	Generic	2020	[25]
12	Human-machine system for finishing mill process	Manufacturing	2020	[26]
13	Learning health system	Healthcare	2020	[26]
14	Marketplace of services	Generic	2020	[27]
15	Human-centred management system for scheduling in operations and maintenance	Manufacturing	2020	[28]
16	Smart state net scheme	Smart cities	2020	[29]
17	Teleoperation system	Generic	2021	[30]
18	Secure hash algorithm (SHA)-256 accelerator	Generic	2021	[31]
19	AI-based Communication-as-a-Service	Generic	2021	[32]
20	AI-Based Heart Monitoring System	Healthcare	2021	[33]
21	Intelligent Health Service	Healthcare	2021	[34]
22	AIoT based picking algorithm	eCommerce	2021	[35]
23	Robotics and Digital Platform (IoT)	Healthcare	2021	[21]
24	Reference architecture for framework for MNCRP	Generic	2021	[36]
25	530-mW Multicore Blockchain Accelerator	Generic	2021	[37]
26	Anticipatory smart energy system	Energy	2021	[38]
27	Architecture for a flexible and modular manufacturing system	Manufacturing	2021	[39]
28	Digital twin for smart cities	Smart cities	2021	[40]
29	A Generalized Framework for Tactile Internet	Generic	2021	[41]
30	Shiojiri Environmental Data Compilation Platform and IoT network	Generic	2021	[42]
31	SMARTAGE platform	Healthcare	2022	[12]
32	Delay-tolerant public blockchain network in healthcare systems	Healthcare	2022	[43]
33	Cipher policy-attribute-based encryption for smart healthcare systems	Healthcare	2022	[44]
34	Dialog and recommender system	Retail	2022	[45]
35	A Platform for Integrated and Connected Government	Government	2022	[46]
36	Long-range real-time monitoring for precision irrigation and rural farming	Smart cities	2022	[47]
37	Cyber-physical network architecture for data stream provisioning in complex ecosystems	Smart cities	2022	[48]

The list is numbered and sorted by year of publication, but is limited to published articles in the selected databases and the sample based on the in- and excluding criteria. Therefore, the list is non-exhaustive and should be seen as a starting point to identify digital architectures that are constructed under S5.0. However the sample presents digital architectures from various domains, not all domains are represented (e.g., education, transportation, finance). Moreover, the certainty that the identified architectures are constructed under S5.0 cannot properly and solely be assessed based a SLR.

4.3 EA frameworks and principles

The identified digital architectures are analyzed using an EA perspective. Table 3 presents an additional overview of the representation(s) of the digital architectures under S5.0 and the use of EA framework(s) and principle(s).

Table 2. Representation(s), use of EA framework(s), and principle(s) in digital architectures.

ID	Representation(s)	EA framework(s)	Principle(s)
1	System;	Not stated;	Not explicit;
2	Conceptual; Layered; System; Reference;	Smart Grid Architecture Model;	Not explicit;
3	Conceptual;	ZEF framework;	Not explicit;
4	Conceptual; Framework; Living Lab;	ASEAN Smart Cities Network; Garuda Smart City Framework (own contribution);	Living lab; Scientific method;
5	System;	Not stated;	Not explicit;
6	Framework; Conceptual; System; Lab;	CPS framework (own contribution);	Not explicit;
7	Conceptual; Framework; System;	AIDAF; RAMI4.0;	AIDAF; Agile; Design Thinking; GDPR;
8	Conceptual; Prototype;	Not stated;	Not explicit;
9	Algorithm;	Not stated;	Not explicit;
10	Conceptual; Framework; Domain;	Not stated;	ELE-Industry 4.0; Human habitat innovation;
11	Conceptual;	Not stated;	Crowd;
12	System; Functional;	Not stated;	Not explicit;
13	Conceptual;	Not stated;	Not explicit;
14	Layered;	Not stated;	Not explicit;
15	Conceptual; System; Functional;	Not stated;	Not explicit;
16	Conceptual;	Not stated;	Society 5.0;
17	Conceptual; Network; Infrastructure; Prototype;	Not stated;	Not explicit;
18	System; Component; Data flow;	Not stated;	Not explicit;
19	Layered; Conceptual; Network;	Not stated;	Not explicit;
20	System; Algorithm;	Not stated;	Not explicit;

21	Conceptual; Layered;	Not stated;	Not explicit;
22	System; Information flow; Data; Algorithm;	Not stated;	AIoT;
23	-	AIDAF; RAMI4.0;	AIDAF;
24	Conceptual; Layered; Reference;	ArchiMate; Unified Architecture Framework;	Modeling by Angelov; General architecture;
25	Conceptual; System; Component; Data flow;	Not stated;	Not explicit;
26	Conceptual; Layered; System; Data;	Not stated;	Society 5.0;
27	System;	Not stated;	Digital Twin;
28	System;	Not stated;	Gemini; Circular;
29	Conceptual; System; Network; Reference;	International mobile telecommunications framework; Tactile internet framework (own contribution);	Not explicit;
30	System;	Not stated;	SDG;
31	-	Quintuple helix framework;	Human-centric design; Design thinking; Quintuple helix;
32	Conceptual; Layered; Information flow;	Not stated;	Not explicit;
33	Conceptual; Layered; Data flow;	Not stated;	Not explicit;
34	System; Interaction;	Not stated;	Not explicit;
35	Framework;	TOGAF; Indonesian EA framework (own contribution);	IEA Development Method;
36	Conceptual; System;	Absolute innovation management framework;	Principles of workplace; Design principles I4.0; Industry 5.0;
37	Conceptual; Layered; System; Network; Algorithm;	iFog framework (own contribution);	Clustering spatial-temporal data system;

The synthesis is based on the analysis of selected published articles. There is a risk that the article does not (fully) report the use of EA frameworks, principles, and digital transformation processes. Therefore, the certainty can not be assessed properly and solely based on the SLR. Empirical research is required to validate the findings.

5 Discussion

Extending the scope of related SLRs, this research adds an EA perspective regarding S5.0 to the knowledge base by identifying 37 digital architectures. These digital architectures are analyzed based on their representation(s), use of EA framework(s), and principle(s). Most digital architectures are based on a conceptual representation. The majority of digital architectures is detailed using layered or system architectures. Some digital architectures focus on specific layers (e.g., network, process). EA frameworks (e.g., TOGAF, AIDAF) are used fairly limited and lack explicit principles. However an interesting design approach and some reference architectures are identified, no holistic S5.0 reference architecture is found based on the sample from the SLR. This can be explained by the fact that S5.0 is a relatively new research topic which extends the scope of individual enterprises and domains.

The SLR results regarding S5.0 indicate a strong link with I4.0 and related technologies. This is in line with related work. Contrary, the link to the SDGs is not clearly visible. However sustainability and sustainable development are among the keywords with a co-occurrence >5, none of the digital architectures specifically addresses SDGs in relation to goal realization. Moreover, the current SLR revealed a bias in bibliographic analysis using a single database (which may effect related SLRs).

Taken together, the SLR and related work show that the interest in S5.0 is increasing and tends to evolve to an interdisciplinary topic. This makes S5.0 a relevant topic for the EA discipline. However, given the increasing number of publications, it is remarkable that S5.0 attracted little attention in the EA discipline. The identified digital architectures serve as a starting point to develop EA perspectives, but S5.0 needs to be further examined using disciplinary knowledge, exceeding the current scope regarding EA frameworks and principles. Based on the assessment of risks of bias and certainty, empirical research is needed to validate the findings of the SLR.

6 Conclusion

The main aim of this paper was to identify and analyze digital architectures that are (being) constructed under S5.0. The SLR illustrated the increasing knowledge base regarding S5.0 and presence of a variety of digital architectures in different domains. More specifically, this study links S5.0 to the EA discipline and adds an EA perspective regarding S5.0 by identifying, listing, and analyzing 37 digital architectures in terms of representation(s), use of EA framework(s), and principle(s). The main finding is that the digital architectures are based on conceptual representations and make limited use of EA frameworks and principles. Although some reference architectures are present, a holistic reference architecture for S5.0 is not found in this study.

From an EA perspective, scholars and practitioners can leverage this study and available disciplinary knowledge, including existing EA frameworks, methods, and tools, to support the design, representation, implementation, and management of digital architectures under S5.0. EA frameworks can support the development of a holistic and systematic approach to support the lifecycle of digital architectures under S5.0. Existing principles can guide the design and representation, but specific principles are required to ensure incorporation of the core ideas of S5.0. Given the broad scope of S5.0, a holistic reference architecture may support the realization (in other countries).

Despite the systematic approach of this study, there are several limitations to address. The main limitation is that the current study is based on scientific literature in three selected databases in the English language. Extending the scope of related SLRs, this study focused on developing an EA perspective, but its scope is limited to EA frameworks and principles. The list of digital architectures provides an overview of digital architectures, but is a non-exhausting starting point to develop EA perspectives regarding S5.0. Empirical research is required to validate the results and findings. The bibliometric analysis of Web of Science and Scopus revealed a bias in (existing) single database studies. Therefore, the results must be cross-validated by (manually) merging multiple databases. For this reason, the identified future work based on bibliographic coupling and co-citation analysis are not included in this SLR.

Additional research is required to develop a theoretical foundation for EA research regarding S5.0. First, the results of this SLR should be cross-validated by (manually) merging multiple databases. Then, depending on the outcomes, further analysis can take place regarding bibliographic coupling and co-citation. Based on related work and this SLR, guiding principles and reference models can be developed to support digital transformation. For the broader adoption of S5.0 (in other countries), it is recommended to develop both general principles for S5.0 and specific principles (e.g., per country, domain and/or application). Furthermore, the development of a risk and security perspective is considered to be an interesting avenue for future research.

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