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Redefining relevance in information systems curriculum: insights for IS educators from a systematic literature review

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ABSTRACT

Curriculum relevance is the applicability of an education program to the needs of the program stakeholders. Previous studies have identified a gap in the relevance of Information Systems (IS) curricula. This paper explores the concept of relevance in the IS field by asking 'relevant to whom?', 'relevant to what?', 'relevant how?', and 'relevant when?' through a systematic literature review. The review yielded 45 peer-reviewed journal articles and conference proceedings from seven databases. The review indicates that a relevant IS curriculum aligns with the needs of both industry and students, focusing on professional interests. It also considers contextual factors and the balance between current and future relevance. The findings highlight that stakeholder perspectives, involvement, context, university resources, and technological advancements influence curriculum relevance. The findings provide curriculum developers and decision-makers with insight into the various aspects of relevance and how they relate equipping them with knowledge to improve curriculum relevance.

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1. Introduction

In the field of Information Systems (IS) the concept of curriculum relevance is a topic of continuous discussion. Several studies on IS curricula have revealed an expectation gap between IS curricula and IS stakeholders, particularly industry (Burns et al., 2018; Ngo-Ye & Choi, 2021; Woolridge & Parks, 2016). Maintaining relevance in IS curricula is a challenge because of the constant advancement in technology which also necessitates a constant change in the skills of graduates (Topi, 2019). Ng Tye et al. (1995) explain that in the 1990s the desired skillset for graduates shifted from a predominantly technical skillset to one that incorporated business and interpersonal skills. For example, in the early 1990s there was a greater demand for application programmers than any other IS-related role. However, by the mid-1990s system analysts were becoming much more sought-after (Ng Tye et al., 1995). In the late 1990s and early 2000s roles such as Information Technology (IT) architect, project manager and database analyst began to appear (Topi et al., 2010). Fast forward to the 2020s and IS graduate job titles now include IT auditor, IT consultant, software developer and information security analyst (Leidig et al., 2020). These challenges impact IS curricula by forcing IS model curriculum guidelines to evolve. Changes in technology are cited as one of the reasons why model curriculum guidelines need updating (Topi et al., 2010). For example, in the late early 2010s, the IS2010 curriculum guideline was published. In their justification for why an update was needed from the previous model curricula version, the authors referenced several technological and practice-related changes which impacted the discipline (Topi et al., 2010). These included the introduction of Information Technology (IT) management and governance frameworks such as ITIL and COBIT, the growth in mobile computing, the increasingly global nature of teams in the workplace, the importance of web technologies and the greater demand for Enterprise Resource Planning

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(ERP) implementation and configuration (Topi et al., 2010). When IS2020 was published the authors for IS2020 argued that there were new trends that were relevant to the discipline including blockchain, internet of things and cloud computing (Leidig et al., 2020). Equipping students for an uncertain future is also an important consideration in IS curricula. Technologies and society are constantly evolving and it is important to equip students with the necessary abilities and attitudes to successfully navigate such an environment (Saulnier et al., 2019). Therefore, catering for future reference is something that IS curriculum developers constantly need to grapple with.

1.1. IS curricula comparison

IS curricula are implemented in different ways not only globally but even within the same countries. One of the indicators of the lack of standardization is the variety of names used to refer to IS programs. IS can also be referred to as informatics, computing, information technology and information management (Hirschheim & Klein, 2012; Leidig et al., 2020). There have been efforts in the past to standardize IS curricula. However, more recently, some in the IS field have argued that it is better to embrace the lack of standardization and allow IS educators to tailor their offerings by their contextual realities (Coady & Berg, 2016). This lack of standardization does make it challenging, however, to compare and contrast IS curricula globally. One way to alleviate this challenge is to use model curricula as a framework to evaluate curricula against. In doing so this allows for a common standard to evaluate curricula against. This approach has been used by several authors across different countries.

Hwang et al. (2015) conducted a study of 394 undergraduate IS programs in the USA. The study used the Information Systems 2020 (IS2010) curriculum guidelines to compare the curricula against. IS2010 has several subject areas that it recommends IS curricula cover. Seven of these are considered core courses, while the rest are elective courses. Hwang et al. (2015) analysed the websites of the IS programs to determine what percentage of IS programs covered what courses. They found that Enterprise architecture had the lowest coverage, 13.5%, amongst US programs, while data and information management had the highest coverage, appearing in 87% of IS programs (Hwang et al., 2015). The study also compared programs across different types of universities. They classified universities according to whether they were accredited, whether they were public or private, and their level of research focus, i.e. whether they offered PHD programs. They found no significant difference in coverage based on university characteristics. Therefore, the type of university does not appear to significantly influence what is taught in an undergraduate IS program in the USA (Hwang et al., 2015).

Steen and Pierce (2019) conducted a comparative study of IS curricula between Sweden, Australia and the USA. The authors reviewed IS curricula in Sweden and then used similar studies in Australia and the USA to conduct their comparative analysis. The comparison was based on the subject areas in the IS2010 curriculum guidelines. Steen and Pierce (2019) compared the coverage percentages from each country and made several findings. There were several subjects in which the coverage variation was less than 20% between countries, indicating alignment in the level of importance of those subjects (Steen & Pierce, 2019). Data and information management, systems analysis and design and foundations of IS had an average coverage of 80%. In addition, the differences between the coverage between each country were not greater than 20%. This indicates that these courses are commonly taught across all 3 countries and are considered a core component of IS programs in their respective countries. IS strategy, management and acquisition also had coverage variation of less than 20%, but the average coverage was 27%. This indicates a common view across all 3 countries that IS strategy, management and acquisition are not considered core subjects in IS (Steen & Pierce, 2019).

Large differences were observed in coverage with regard to IT Infrastructure and IS project management. IT infrastructure had the most coverage in the USA with an average coverage of 68%. This was followed by Australia on 45% and Sweden on 26.3%, respectively. IS project management coverage was highest in Australia and Sweden, with coverage of 69% and 68%, respectively, while the USA had coverage of close to 33% (Steen & Pierce, 2019).

Application development appears to be a required subject in Sweden, with 100% coverage. The USA had high coverage for application development of 84%, while interestingly, in Australia, the coverage was only 18.2%. This suggests that in Australia, programming is taught in other computing disciplines

(Steen & Pierce, 2019). In 9 of the 14 subject areas, Swedish universities had the highest coverage, indicating stronger adherence to model curriculum guidelines in Sweden compared to Australia and the USA. In Australia and USA, there were three subjects where the coverage was below 20%. These were enterprise systems, enterprise architecture and IT security management. This suggests that these subjects in Australia and the USA are of low importance. Subjects with coverage of less than 20% across all 3 countries include IS innovation and new technologies and IT Audit and controls (Steen & Pierce, 2019).

Hol et al. (2024) examined 227 computing degree offerings from 40 institutions in Australia using the Computing Curricula 2020 (CC2020) guidelines. Their findings showed that there has been a decrease in the number of degrees that offer IS as the primary major. In addition, the number of IS major offerings is small in comparison to CS and IT (Hol et al., 2024). The study also noted the following subspecialties in the IS offerings: web and mobile development, cloud computing, gaming, mathematics, data science, cybersecurity, entrepreneurship, user experience and network security. Interestingly, there were no IS majors that offered Artificial Intelligence (AI) as a sub major. AI was found primarily in CS and IT (Hol et al., 2024). The absence of AI in IS programs at the undergraduate level was also noted by Lyytinen et al. (2021) in their review of 14 IS programs in the USA. The authors did not find any undergraduate core courses that focused on AI. There were a small number of programs that had electives in AI-related courses. However, at the graduate level, Lyytinen et al. (2021) did observe core courses in AI. This suggests that in the USA, IS courses that focus on AI are more prevalent at the postgraduate level (Lyytinen et al., 2021).

The above articles indicate that IS educators have continued to build their curricula around core subject areas, although to varying degrees. However, to ensure that their curricula remain current, IS educators have integrated new technologies and trends into existing recommended subjects. For example, in the IS2020 curriculum guidelines, AI is included under the business and data analytics competency (Chen, 2022). This approach has also been applied to blockchain and cryptocurrency, which is another current topic of interest. Han and Larson (2022) is a case study which describes an analytics course at an American university where students are exposed to blockchain and cryptocurrency (Han & Larson, 2022). The same strategy can be seen in teaching cloud computing. Hwang et al. (2016) cite an example of a software development course where students are required to use cloud platforms to develop their products (Hwang et al., 2016).

1.2. Defining curriculum relevance

Within the education field, there are various definitions of the term relevance. Adil et al. (2022) define relevance as 'an individual's perception of how an experience was useful in meeting their needs and desires, such as how an activity evoked a sense of satisfaction, which further facilitated a student's learning' (Adil et al., 2022, p. 2). Brøgger and Madsen (2022) define relevance 'as an adaptation of programs to societal developments, as well as to current and future labour market needs and demands' (Brøgger & Madsen, 2022, p. 17). According to Cahapay (2021) relevance as 'the applicability of a curriculum to the needs, interests, desires, and prospects of students and the community as a whole' (Cahapay, 2021). What these definitions reveal is a lack of consensus regarding what relevance means and a variety of stakeholders whose needs should be considered when it comes to relevance.

This leads to debates regarding what relevance means or even if it is necessary (Albrecht & Karabenick, 2018). We argue it is important to understand relevance as it can be linked to important issues such as student motivation, sustainable development, the value of higher education and skills challenges, particularly in the computing fields (Alexander, 2018; Ali et al., 2018; Stuckey et al., 2013; Tomlinson, 2022). However, we are not aware of any paper that unpacks what relevance means in IS and what factors impact it. In this paper, we conduct a systematic literature review to address this gap. Based on the definitions cited above, we define relevance as the applicability of an education program to the needs of the program stakeholders.

1.3. Research questions

This study aims to answer the following research questions:

1. 'What does curriculum relevance mean within the field of Information Systems?'
2. 'What factors impact curriculum relevance in the field of Information Systems?'

This paper provides a research basis for efforts to improve curriculum relevance. Firstly, the study determines what curriculum relevance means in IS. Relevance is a multi-faceted and contested term. Being unable to agree on what it means can make it challenging to gain a consensus on how a curriculum can be changed or improved. The findings will address this challenge. Secondly, by identifying the factors that affect relevance and how they relate this research helps decision-makers determine what steps can be taken to improve curriculum relevance and the limits of such steps. This will in turn help decision makers to communicate to their stakeholders, particularly industry, what they can or cannot change regarding the relevance of curriculum and why. The goal is to spur candid conversations amongst all stakeholders about the role of universities in curriculum relevance and how curriculum relevance overall can be improved within IS.

The remainder of the paper is organized as follows: Section 2 discusses the theoretical background, Section 3 outlines the methodology, Section 4 presents the results, Section 5 provides the discussion, Section 6 concludes the study, and Section 7 addresses limitations and future research.

2. Theoretical background

To answer the research questions, we need to determine what relevance means in IS literature and what factors influence relevance. To determine this meaning, we need to make use of concepts which help us to form mental representations of the components of relevance. One of the ways researchers conceptualise relevance is to pose questions which capture different dimensions of the term. Albrecht and Karabenick (2018) and Doherty (2015) suggest 4 questions that relate to curriculum relevance: 'relevant to whom?', 'relevant to what?', 'relevant how' and 'relevant when?'. These questions are reflected in how relevance is referred to or used in research.

2.1. Relevant to whom

The concept of relevance is subjective and therefore needs to be considered from the perspectives of curriculum stakeholders (Adil et al., 2022). This is why several of the definitions of relevance in literature contain some reference to stakeholders. For example, in their study of the relevance of software engineering education Liebenberg et al. (2015) answered the question of '*relevant to whom?*' by defining curriculum relevance 'as the applicability of what is taught in respect of the needs and interests of students and society' (Liebenberg et al., 2015, pp242). Looney et al. (2014) identified the following stakeholders for the IS discipline: industry, students, government, regulatory bodies, IS faculty, journals, funding sources and university colleagues.

2.2. Relevant to what

In education literature, this refers to contextual realities. Chaka et al. (2017) in their paper on decolonizing English Studies speak of the importance of literature being relevant to the African context. Wittuhn and Le Roux (2017) discussed internationalization of Master's in Public Health programmes in SA. In discussing the challenges posed by having a diverse student body the authors mentioned that such diversity made it difficult to develop content relevant to specific contexts and cultures (Witthuhn & Le Roux, 2017). Contextual realities can include demographics, political environments, geography, and socioeconomic conditions (Leidig et al., 2020; Oppong, 2017).

2.3. Relevant how

This attempts to capture the different aspects of what stakeholders need. For example, employers are most often concerned with obtaining graduates with the relevant skills. Other stakeholders, particularly students, have several dimensions to their needs. In literature student needs are categorised under the

term's personal relevance, professional relevance, and societal relevance (Benvenuti et al., 2014; Cahapay, 2021). Personal relevance refers to whether what is taught is meaningful to the individual and can be related to their life experiences (Yager, 1989). Professional relevance relates to students' perception that what they are learning will be relevant in their future careers (Liebenberg et al., 2015). Societal relevance relates to the ability of education to assist in resolving societal challenges (Liebenberg et al., 2015).

2.4. Relevant when

This question can be interpreted as addressing the applicability of what is being taught to a specific point in time. Corritore and Love (2020) described the redesign of an introductory computer programming course. The authors explained that during the redesign a decision was made to use an approach that led to the development of lifelong skills in students rather than just programming skills (Corritore & Love, 2020). Bosnić et al. (2019) surveyed software engineering alumni of the University of Zagreb in Croatia who were at different career stages. One of the objectives of the survey was to determine how a distributed software development course was relevant to an alumnus's first job compared to their current job (Bosnić et al., 2019). This again illustrates an awareness in the literature that curricula, particularly computing curricula, has a temporal aspect which should continuously be catered for in curricula processes.

3. Methodology

We used the work of Okoli (2015) as a guide for conducting the systematic literature review. Our process consisted of 6 steps which are described below.

3.1. Purpose of study

The purpose of this literature review is to examine the literature on curriculum relevance in IS to determine what this term means within the discipline and what factors impact relevance.

3.2. Data sources and search strings

For the data sources we chose Web of Science (WOS), Scopus and EBSCO as these sources were used in previous computing literature reviews and provided coverage of high-quality IS sources (Iden & Eikebrokk, 2013; Lowry et al., 2013; Salazar-Reyna et al., 2022). To add geographic diversity, we included the Electronic Journal of Information Systems in Developing Countries (EJISDC) and the African Journal of Information Systems (AJIS). Given that this is an IS paper, the Association of Information Systems Electronic Library (AISeL) was included. Within the AISeL we used the AIS Journals & AIS Affiliated Journals and ICIS Proceedings repositories. We also used Science Direct as the authors had prior experience with the data source and felt it could provide relevant sources.

Our search strings were derived from an iterative process of trial and error. Our starting point was the research questions of the literature review, which could be broken down into several elements:

1. Information Systems
2. Curriculum
3. Relevance

There were two aspects we had to grapple with: 1) Deriving the appropriate keywords and 2) Determining an appropriate combination of keywords. We started with a search string that contained all of our terms: ('information systems curriculum relevance'). This search string did not return any results in some of our databases such as Science Direct and EBSCO. We therefore quickly realized that we needed to create a search string that broke up the elements we were looking for into different phrases. We

then started experimenting with search strings that were made of several phrases that we gradually combined.

Our first attempt at this was the search string 'information systems curriculum'). For the term 'curriculum', we noticed that it would return what we viewed as a low number of results. For example, in the EBSCO, the search string ('information systems curriculum') for full text, peer-reviewed journal articles between 2013 and 2024 returned less than 30 results after duplicates were removed. Our experience in researching IS education and IS curricula made us feel as though that number was low for such a topical issue. We then changed to using 'information systems' and 'curriculum'; however this combination returned many irrelevant results. For example, this combination would return papers that had the phrase 'information systems' only in the references list as part of an article's title or the publication not in the main body of the article. In such cases the articles were not focused on the IS discipline in relation to curriculum but simply mentioned 'information systems' and 'curriculum' at separate and unrelated points in the paper. We then revisited the use of the word curriculum to see if we could find alternative or additional words that we could use to capture more of the literature we were looking for. We settled on the word 'education' as curriculum is considered part of education (Mulenga, 2018). We then used the search terms ('information systems curriculum' OR 'information systems education') in our databases and scanned some of the results that were returned. We felt that these results were more relevant than what we were getting from using ('information systems' AND 'curriculum') or ('information systems curriculum'). We then added keywords related to relevance to the search strings we had derived. Based on previous articles that we had read on curriculum relevance, we observed that the word 'relevant' would also be used in some of these articles in relation to the topic we were interested in. Therefore, our search strings were expanded to include ('relevance' OR 'relevant'). At this point, our search strings were:

('information systems curriculum' OR 'information systems education') AND ('relevance' OR 'relevant').

We then realised we had made an oversight with regards to the choice of 'information systems' as a keyword. The IS discipline gets referred to using various names. We looked in the IS education literature to identify some of these other names that were accepted alternatives in the IS literature and we found informatics, computing, information technology and information management (Hirschheim & Klein, 2012; Leidig et al., 2020). Therefore, we included these terms in our keywords, and this produced the following search string:

('information systems curriculum' OR 'informatics curriculum' OR 'information management curriculum' OR 'information technology curriculum' OR 'computing curriculum' OR 'information systems education' OR 'informatics education' OR 'information management education' OR 'information technology education' OR 'computing education') AND ('relevance' OR 'relevant').

3.3. Inclusion and exclusion criteria

To be included in this study papers needed to be written in English, published in peer-reviewed publications to ensure quality, be published in the period 2013-2024, focus on tertiary level curricula and focus on Information Systems and related subjects such as business analysis. Articles relating to other disciplines such as accounting, nursing, health informatics, computer science and software engineering were not considered. We made an exception for business-related disciplines given the close relationship between business schools and IS, particularly in North America (Topi et al., 2010). Table 1 describes the inclusion and exclusion criteria. There is some overlap between the two types of criteria. That is because in our experience reading the abstract, which is typically when the inclusion criteria are applied, may not be sufficient to determine a paper's suitability. Therefore, we ensure that the exclusion criteria, which is applied in the full paper scan, include elements of the inclusion criteria.

3.4. Conduct the review

The literature search was conducted in April 2024. The inclusion criteria were initially applied through the search filters and reading of the abstracts. The initial searches returned a total of 2790 results. The

Table 1. Description of inclusion and exclusion criteria.

Criteria Type	Criteria
Inclusion	1. Published between 2013 and 2024.
	2. Peer-reviewed journal articles and conference papers
	3. Focus on IS related curricula only
	4. Focus on higher education only
	5. Written in English
	6. Published in journals or conferences
	7. Open Access (only what our university has access to)
Exclusion	1. Does not focus on IS-related curricula only
	2. Does not focus purely on higher education
	3. Is not written in English
	4. Does not use the term 'relevant' or 'relevance' in relation to curricula

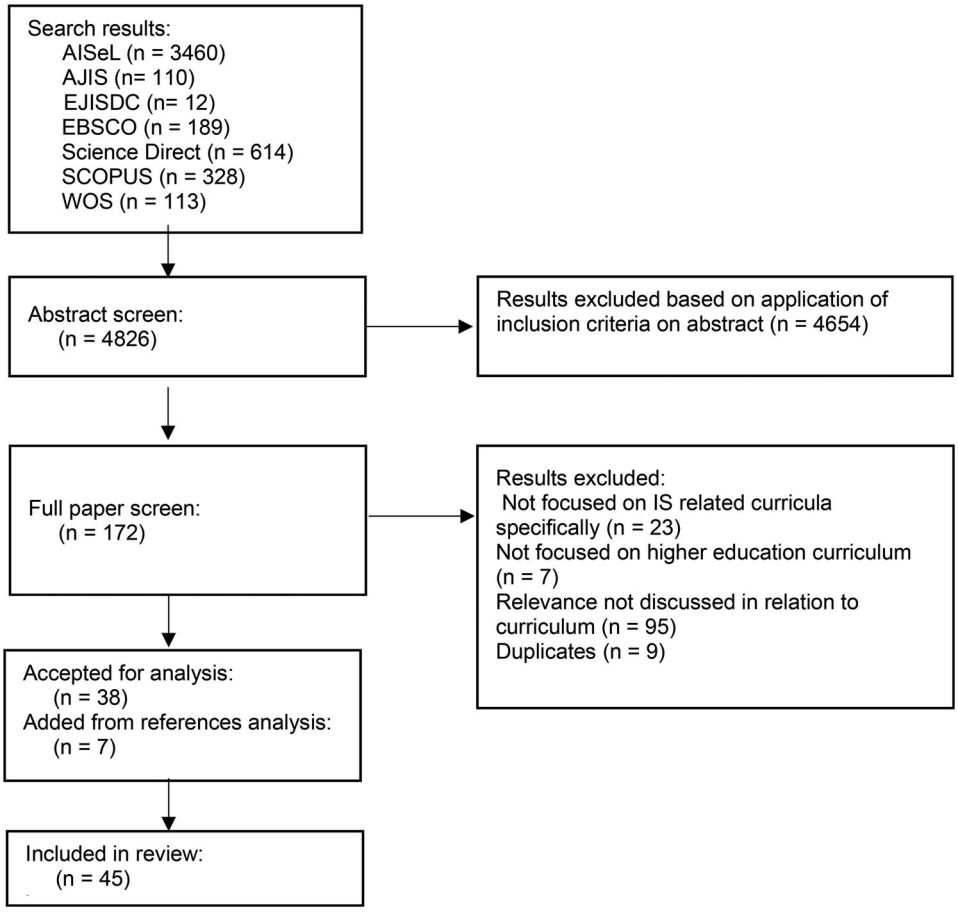

Figure 1. PRISMA diagram of the literature search process (Hart & Rodgers, 2024).

final number of articles that were analysed was 42. Figure 1 is a PRISMA diagram that shows the process that was followed and the numbers that were associated with each step.

3.5. Bias and quality

Data sources such as AISeL were chosen because of their perceived quality. However, Lowry et al. (2013), argue that the perception of quality of IS publication sources is dominated by North American perspectives of what quality is. This can lead to the omission of other useful data sources. To mitigate this data source selection bias, we added the EJISDC and AJIS to include sources from developing countries. The selection period was 10 years, which also helped to minimise selection bias. To ensure quality, we focused on peer-reviewed articles that were published in journals and conference proceedings.

3.6. Methodological limitations

The methodology employed has several limitations. Firstly, focusing on peer-reviewed articles however, leads to the exclusion of literature that could be of interest, such as postgraduate theses. Secondly, the study only considers English-language publications. While this is an obvious and unavoidable limitation, it is important to consider the implications. For a continent such as Africa, this can result in fewer results from regions where English is not the language of instruction, leading to a regional selection bias. A third limitation is that this review is based on publications that the researchers had access to. There were instances where the source database would return a result but did not have the full text available. Efforts to locate the article in the journal that the database was referencing would sometimes prove unsuccessful due to lack of access. Thus, potentially relevant articles could have been excluded. Lastly, because our search strings looked specifically for the words 'relevant' or 'relevance' in relation to curricula, our searches excluded papers which addressed curriculum relevance without using the specific words we were looking for. For example, articles which discuss the skills needs of employers with respect to IS education but do not use the keywords 'relevant' or 'relevance' were excluded.

3.7. Data extraction and analysis

The data was coded using the NVIVO software tool. A combination of inductive and deductive methods was applied to code and analyse the data to answer each research question. For the first research question, 'What does curriculum relevance mean within the field of Information Systems?', several predefined themes were used as a starting point to guide data extraction (deductive approach). These were the questions regarding relevance that were discussed in our background section. These were relevant to whom? relevant how? relevant when? And relevant how?. However, within a category, we attempted to code the data in a manner that would reveal any subcategories that could provide further insight. These subcategories were not guided by any predefined codes and were derived inductively by grouping codes that appeared to be related from the perspective of the researchers.

For the second research question, 'What factors impact curriculum relevance in the field of Information Systems?', a combination of deductive and inductive approaches was used. The question-based framework that was used to answer the first research question provided initial codes to consider. For example, the question 'relevant to whom?' indicated that stakeholders were important. In our coding, we attempted to ascertain what aspect of stakeholders affected curriculum relevance. Our coding process led us to conclude that there are two factors related to stakeholders that affect curriculum relevance. For other factors that were not derived from the question-based framework, we derived them inductively.

Figure 1 illustrates the methodological steps undertaken in this literature review. The initial keyword search yielded over 1,000 sources. However, following a review of abstracts, 4,654 sources were excluded for failing to meet the predefined inclusion and exclusion criteria or being identified as duplicates. Consequently, a total of 45 articles were retained for the final review and analysis.

4. Results

In this section, we synthesise the literature using the question-based framework to answer the research questions.

4.1. The meaning of relevance in information systems

In the following subsection, we unpack the meaning of relevance in the literature in accordance with our question-based framework. To make our discussion coherent and avoid repetition of similar points we combined the questions 'relevant to whom?' and 'relevant how?'. Table 2 shows the results of the analysis.

Table 2. Literature analysis according to framework questions.

Source	Relevant to whom?	Relevant to what?	Relevant when? (current or future)	Relevant how?
(Adebayo & Mcgrath, 2013)			Current	
(Augustine & Kabanda, 2024)		Context	Current	
(Akbulut, 2015)	Students		Current	
(Alshare et al., 2015)	Students			Professional
(Annabi & Mcgann, 2019)	Industry, Students			
(Bell et al., 2013)	Industry			Professionally
(Bohler et al., 2020)		Practice		Practically
(Case et al., 2019)	Students		Current	
(Chan et al., 2014)	Students		Current	
(Coady & Berg, 2014)	Industry, Students	IS Curriculum		
(Cummings & Janicki, 2020)	Industry			
(Cummings et al., 2023)	Employers		Current	
(De Salas et al., 2013)	Students	Context, Practice		Professionally
(Eymann et al., 2014)	Industry			
(Föll & Thiesse, 2021)				Practically
(George & Marett, 2019)	Students			Personally
(Hadidi & Power, 2019)	Industry, Students			
(Hogan & Young, 2020)	Students			Practically, Professionally
(Jamil & Isiaq, 2019)	Students			Professionally
(Janicki & Cummings, 2022)	Employers		Current	
(Legier et al., 2013)	Alumni		Current	
(Leidig et al., 2019)	Students			Professionally
(Lending et al., 2019)	Students	Practice, IS curriculum		Personally
(Mahaney & Fisher, 2019)			Future	
(May & Lending, 2015)	Students	IS curriculum		
(Nagarajan & Edwards, 2015)	Alumni, Industry	Practice		Practically
(Ouh & Shim, 2021)	Industry, Students	Practice		
(Romanow et al., 2020)		Context		
(Rorrer et al., 2018)	Students			Culturally
(Saulnier et al., 2019)		Context		
(Schlimbach et al., 2023)		IS Curriculum, Practice		
(Shah et al., 2018)	Faculty, Industry			
(Sharma et al., 2020)	Students	Practice		
(Spears, 2018)			Current	
(Sopha & Balkan, 2014)	Students			Professionally
(Stefanidis et al., 2013)	Alumni, Industry, Faculty, Students, professional bodies	Practice	Future	Professionally
(Tan et al., 2018)	Industry	Workplace, IS Curriculum		
(Thouin et al., 2018)	Students			Professionally
(Thouin & Hefley, 2024)	Students	Practice		Personally
(Van Den Berg, 2018)	Students	Practice	Future	
(Wang et al., 2023)	Students			Personally, socially, professionally
(Wymbs, 2016)	Industry, Students	Context		Professionally
(Xinogalos & Satratzemi, 2022)	Students			Personally
(Xu & Frydenberg, 2021)	Students	Context		Professionally
(Ye & Zhao, 2023)	Students			Professionally

4.2. 'Relevant to whom?' and 'relevant how?'

In the papers that we reviewed, industry and students were the stakeholders whose views and needs were most prominent (Akbulut, 2015; Annabi & Mcgann, 2019; Chan et al., 2014; Eymann et al., 2014; George & Marett, 2019; Jamil & Isiaq, 2019; May & Lending, 2015; Shah et al., 2018; Sharma et al., 2020; Sopha & Balkan, 2014; Wymbs, 2016). The bias towards industry makes sense in light of the views by Hadidi and Power (2019) who argue that industry and students are the two most important stakeholders in the curriculum process. According to Stefanidis et al. (2013), one of the ways to determine what is relevant to industry is by obtaining the views of employers or alumni regarding what skills are important to succeed in the workplace (Stefanidis et al., 2013). This approach to determining industry relevance is used by Cummings and Janicki (2020) who surveyed IT and IS professionals in the United States of America (USA) to ascertain the skills needs of employers. The authors highlighted maintaining industry relevance as one of the main challenges that IS/IT faculty face (Cummings & Janicki, 2020). Other articles

demonstrate ways to attain relevance to industry. One interesting approach is to integrate certifications into the curriculum. Ouh and Shim (2021) describe how they integrated Amazon Web Services (AWS) certifications into their undergraduate program while Tan et al. (2018) describe how they aligned their Masters in Business Analysis program to an industry certification (Tan et al., 2018).

As discussed in the conceptualisation section, there are different types of relevance associated with students. Professional relevance was the relevance type that was most referred to in the literature in relation to students. Professional relevance is important because the potential to secure employment is one of the reasons students are motivated to pursue a tertiary qualification (Thouin et al., 2018). Therefore, for IS faculty, demonstrating the professional relevance of their academic programs to students is an important concern. This position is supported by Alshare et al. (2015) who conducted a study on factors that influence the effort of students when learning Enterprise Resource Systems (ERPs) (Alshare et al., 2015). The findings showed that one of the most important factors to students when determining the usefulness of learning ERPs is the relevance of ERPs to their future careers (Alshare et al., 2015). Ye and Zhao (2023) described a Social Media Analytics capstone that they implemented in their undergraduate business information analytics program. An important component of the course was experiential learning. Ye and Zhao (2023) justified the need to include experiential learning in their capstone course by arguing that doing so would help students see the value of the course to their future careers.

Personal relevance to students received less attention in the literature. There were studies that alluded to personal relevance for students (Thouin & Hefley, 2024; Xinogalos & Satratzemi, 2022). These studies sought to evaluate courses and asked students if the course content aligned with their interests. Xinogalos and Satratzemi (2022) is a case study on the use of an educational game in a web programming course. The students were asked to evaluate the game by answering a series of questions. One of the questions that were asked was whether the game was relevant to their interests Xinogalos and Satratzemi (2022). Thouin and Hefley (2024) describe how they integrated a learning software called SlimAgile into their project management class. In assessing how students experienced the course one of the constructs the authors sought to measure was the relevance of the course (Thouin & Hefley, 2024).

Like personal relevance, social relevance, received scant attention in the literature. Wang et al. (2023) conducted a survey of students of a Massive Open Online Course (MOOC). In their findings they were able to establish that personal and social relevance were positively associated with student satisfaction of the course (Wang et al., 2023).

In our analysis of the literature, we uncovered other relevance types which we did not have in our initial framework. One of these was cultural relevance which was discussed by Rorrer et al. (2018). The authors conducted a study of undergraduate computing students who were part of an undergraduate research program in the USA. The aim of the study was to assess student outcomes for the program and determine any disparities in outcomes due to gender and ethnicity. One of the outcomes was propensity to pursue graduate research. The study found that minority students were less likely to pursue graduate research even though they fared better than their peers in some outcomes. The explanation the authors offered was the lack of cultural relevance in the pedagogy (Rorrer et al., 2018). By this the authors meant that the pedagogy did not embrace the cultural identity and socio-political consciousness of minority students (Rorrer et al., 2018).

Alumni perspectives were sought to a lesser extent than those of students and industry. However, like students and industry, the focus when engaging alumni was in relation to professional needs. Legier et al. (2013) argue that alumni are best placed to ascertain the relevance of what is being taught to industry needs. Nagarajan and Edwards (2015) surveyed IT graduates in Australia to ascertain their views of the practical relevance of their education. The graduates implied that practical relevance was lacking because they felt that many professional skills were not taught to them at university but instead acquired in the workplace (Nagarajan & Edwards, 2015). The notion of practical relevance was raised in other papers such as Föll and Thiesse (2021) who suggested that practical relevance can be achieved through the use of group work and industry internships. This aligns with the views of Hogan and Young (2020) who view close cooperation with industry as key to attaining practical relevance.

Other stakeholders mentioned with regards to curricula relevance include academic faculty and professional bodies. Stefanidis et al. (2013) did a study of the career tracks offered in IS programs at

universities in the United Kingdom (UK). Although the authors mainly discussed relevance to industry and students they did recommend eliciting the views of academics and professional bodies as well (Stefanidis et al., 2013).

4.3. 'Relevant to what?'

In this category we observed 3 themes. The first theme was relevance to IS education. Several studies that alluded to the idea of what should be included in an IS degree. Lending et al. (2019) described the evolution of their undergraduate Computer Information Systems (CIS) program at their university in the USA. Part of this evolution has involved the introduction of analytics and cloud computing courses. Lending et al. (2019) argue that topics such as analytics and cloud computing are relevant to the IS curriculum given their increasing popularity in the job market. Coady and Berg (2014) surveyed 3rd and 4th year IS students at a UK university regarding their perceptions of the program. The students indicated that they found some of the management programs irrelevant because they did not view them as applicable to an IS program (Coady & Berg, 2014). Attaining relevance to IS education is a challenge because there is no consensus on what the discipline of IS consists of Case et al. (2019). Therefore, the notion of what should be included in the IS curriculum is not universally accepted.

The second theme is relevance to practice. Relevance to practice was mentioned by authors such as Schlimbach et al. (2023) and Van Den Berg (2018). Schlimbach et al. (2023) made the argument that design science research is important to teach IS students because it has both research and practice applications (Schlimbach et al., 2023). Van Den Berg (2018) emphasized the importance of students seeing the relevance of their coursework to the workplace when teaching digital innovation (Van Den Berg, 2018).

Relevance to context is another theme we observed with local needs being prominent. In their paper Bohler et al. (2020) mention local job market requirements as one of the factors that higher education institutions pay attention to. Augustine and Kabanda (2024) interviewed Human and Computer Interaction (HCI) curriculum developers in Africa. The curriculum developers cited the importance of making their curricula relevant to the local context in order to prepare their students to work in their local communities. The job market context also emerged as an important contextual factor. Xu and Frydenberg (2021) explained their implementation of an introductory python programming course for an IS curriculum. This course was introduced to cater to the skills needs for the business analytics industry. Xu and Frydenberg (2021) explained that the rapid growth of the data analytics industry is forcing IS educators to improve their data analytics offering to remain relevant. Relevance to market needs were also used by Romanow et al. (2020) to justify why their Business Intelligence course is reviewed on an annual basis.

4.4. 'Relevant when?'

This theme refers to the temporal nature of IS relevance. Some of the articles we analysed referred to current relevance while others implied a focus on relevance in the future. Adebayo and Mcgrath (2013) reflected on the evolution of the IS courses at their university. The authors were focused on contributing to the literature on IS relevance in the business environment that was current at the time (Adebayo & Mcgrath, 2013). Cummings et al. (2023) and Legier et al. (2013) point out that maintaining such relevance is a continuous challenge due to the constant changes in a discipline driven by technological advancement. Addressing this challenge is important because stakeholders such as students expect IS curricula to reflect current trends otherwise they may view the curriculum as irrelevant (Chan et al., 2014). Unfortunately, curriculum changes typically require significant time and effort (Bell et al., 2013). IS educators sometimes turn to model curricula to help in this regard. Model curricula consolidate industry trends and provide guidance on how to implement IS programs thus saving IS educators time and effort in research and planning (Bell et al., 2013; Janicki & Cummings, 2022). However, model curricula themselves can also face challenges of staying up to date because they are updated periodically with several years between each publication (Saulnier et al., 2019). Cummings et al. (2023) agree with this concern and argue that there need to be supplemental reports in the periods between the publication of

curriculum recommendations. Another way to ensure a curriculum remains current is to employ pedagogies such as service-learning (Spears, 2018). Service-learning is an approach to teaching and learning that combines an academic program with community service (Spears, 2018).

While making sure curricula remain current is important, Mahaney and Fisher (2019) and Saulnier et al. (2019) suggests that future relevance is also important. Saulnier et al. (2019) argues that students are being educated for jobs in the future that do not currently exist and to solve problems that have not yet been uncovered. Therefore, IS curriculum developers have the dual challenge of designing curricula that keep pace with current trends while also preparing students for what they will face in the future (Saulnier et al., 2019).

4.4.1. Factors Affecting curriculum relevance in information systems

In this section, we consider the factors that affect relevance. These factors were determined inductively, and the results are shown in Table 3.

4.4.1.1. Stakeholder perspective. In section 4.1, we discussed the question 'relevant to whom?'. In that discussion, we highlighted that there are several stakeholders who have an interest in IS curricula, including students and industry (Akbulut, 2015; Eymann et al., 2014). These stakeholders have different needs and views regarding curricula. Industry has specific skills that they are looking for while students have professional, personal and societal interests that they seek to fulfil (Rorrer et al., 2018; Wang et al., 2023). Therefore, because the concept of relevance is subjective, the determination of whether a curriculum is relevant is dependent on whose perspective is being taken into consideration. There is an acknowledgement by Thouin et al. (2018) that a successful academic program considers the views of a wide range of stakeholders such as industry, alumni, faculty and students (Thouin et al., 2018). Stefanidis et al. (2013) agree with this view in their suggestion that industry, alumni, faculty, government and students are important stakeholders in the curriculum process (Stefanidis et al., 2013). However, in our literature review, we found that students and industry were the stakeholders whose perspectives and views garnered the most interest.

4.4.1.2. Stakeholder involvement. The level of involvement of stakeholders in the curriculation process also appears to affect the relevance of curricula. In their study regarding how to develop groupwork skills in IS students Hogan and Young (2020) recommended that industry partnerships should be created to ensure practical relevance (Hogan & Young, 2020). Wymbs (2016) is also concerned with industry relevance. In discussing how to develop relevant data analytics courses Wymbs (2016) says, '*The simplest way to get course relevance is by getting business input…*' (Wymbs, 2016, pp67). Shah et al. (2018) describe the development of a master's level IS program. In their paper, the authors suggest that interaction amongst faculty members is necessary for developing relevant curricula. Shah et al. (2018) argue that IS faculty tend to work in isolation. This can lead to the development of courses that may have relevant content but are not aligned with the rest of the program. This mismatch can threaten the relevance of a curriculum (Shah et al., 2018).

Table 3. Factors affecting curriculum relevance.

Reference	Factors
(Akbulut, 2015), (Alshare et al., 2015), (Annabi & Mcgann, 2019), (Chan et al., 2014), (Coady & Berg, 2014), (Cummings & Janicki, 2020), (Eymann et al., 2014), (Hadidi & Power, 2019), (Hogan & Young, 2020), (Jamil & Isiaq, 2019), (May & Lending, 2015), (Nagarajan & Edwards, 2015),(Ouh & Shim, 2021), (Rorrer et al., 2018), (Schlimbach et al., 2023), (Shah et al., 2018), (Sharma et al., 2020), (Sopha & Balkan, 2014), (Stefanidis et al., 2013), (Tan et al., 2018), (Thouin et al., 2018), (Thouin & Hefley, 2024), (Van Den Berg, 2018), (Wang et al., 2023), (Wymbs, 2016)	Stakeholder perspective
(Adebayo & Mcgrath, 2013), (Bell et al., 2013), (Bohler et al., 2020), (Cummings et al., 2023), (George & Marett, 2019), (Hadidi & Power, 2019), (Janicki & Cummings, 2022), (Legier et al., 2013), (Leidig et al., 2019), (Lending et al., 2019), (Romanow et al., 2020), (Xinogalos & Satratzemi, 2022), (Xu & Frydenberg, 2021)	Technological advances
(Augustine & Kabanda, 2024), (Cummings & Janicki, 2020), (Lending et al., 2019), (Wymbs, 2016)	Context
(Saulnier et al., 2019)	University resources
(Stefanidis et al., 2013), (Shah et al., 2018)	Stakeholder Involvement

4.4.1.3. Context. As discussed in Section 3, context can consist of demographics, political environments, geography, and socioeconomic conditions (Leidig et al., 2020; Oppong, 2017). Contexts can differ according to regions, and it is important to consider the local conditions when seeking to attain curriculum relevance. One theme that emerged from our analysis was the idea that certain stakeholders can have different levels of influence depending on the context. For example, Cummings and Janicki (2020) argued that accreditation agencies such as the Association to Advance Collegiate Schools of Business (AACSB) have requirements that hinder the ability of faculty at their university in the USA to keep curricula up to date (Cummings & Janicki, 2020). This challenge may not exist in other countries that do not rely as much on accreditation. This is why it is important to conduct country-specific studies when focusing on curriculum relevance. The local employment market is another contextual factor that can impact relevance. Lending et al. (2019) point out that consulting firms are the dominant IT firms in the surrounding area of their university in the USA. As a result, consulting-related skills dominate their curricula (Lending et al., 2019). De Salas et al. (2013) also cited meeting local skills needs as one of their objectives when they redesigned their undergraduate computing and IS degrees (De Salas et al., 2013).

4.4.1.4. Technological advances. Technology is a central part of IS and advances in technology naturally impact IS education. Technological changes were cited in several papers as posing a challenge to IS curriculum relevance (Janicki & Cummings, 2022; Leidig et al., 2019). Part of the reason for this is that the curriculum update process in educational institutions is not fast enough to keep pace with the change in technology (Bell et al., 2013; Bohler et al., 2020).

4.4.1.5. University resources. The importance of university resources is partly due to the challenges brought about by rapid technological change. For IS faculty to keep their curricula up to date, the IS faculty themselves need to keep their knowledge up to date (Cummings & Janicki, 2020; Legier et al., 2013). This can be achieved through a variety of activities, including certifications, conferences and training. However, budgetary constraints at universities are continuously increasing, leaving less opportunity for faculty to engage in these activities (Saulnier et al., 2019). This, in turn, threatens the relevance of IS curricula.

5. Discussion

Stakeholders are an important aspect of curriculum relevance as suggested by the question 'relevant to whom?'. This suggests that the relevance of a curriculum is not objective but subjective. Therefore, when considering the relevance of a curriculum, it is necessary to state which perspectives are being used. Our results show that in the IS field, a relevant curriculum means a curriculum that prioritises the needs of the industry and students. This contradicts the views of authors such as Stefanidis et al. (2013) and Thouin et al. (2018), who argue that a relevant curriculum prioritises multiple voices. Different stakeholders have different curricula needs, hence the question 'relevant how?'. Industry is interested in a curriculum that provides them the skilled labour they need. This leads to curricula that focus primarily on the professional needs of students. Students, however, have different types of relevance that are applicable to them, namely, professional, personal, cultural and societal relevance. Although professional relevance is important, it is important to cater for the other types of relevance as this can positively impact student performance (Wang et al., 2023).

Curriculum relevance is influenced not only by stakeholder perspectives but also stakeholder involvement. The literature suggests not merely getting input from stakeholders but forming partnerships that foster deeper stakeholder involvement in the curriculum (Hogan & Young, 2020). An interesting point that emerged regarding stakeholder involvement is the notion that stakeholder groups need to collaborate internally as well as externally. Shah et al. (2018) noted the importance of faculty working together to ensure coordination and alignment. This is because stakeholders from the same group do not always speak with one voice or have the same interests. An example of this is industry. IS graduates can follow many different career paths and work in different industries, many of which have different skill requirements. Depending on the geographical context that a university is in, there may be specific types of employers in the vicinity, and their skill needs would become a priority (Lending et al., 2019). This shows

one of the ways that context influences curriculum relevance. Context can influence which stakeholders are prioritised, which in turn has a bearing on what perspectives are being reflected in the curriculum. Hence, asking the question 'relevant to what' is also important in determining what relevance means. In the case of IS, our research shows that an IS curriculum must be relevant to the IS discipline, IS practice, and contextual realities such as job market needs.

The question of 'relevant when?' is influenced by the constant evolution of technology. Given that industry is one of the main stakeholders whose needs are prioritised in IS curricula, IS curricula must keep up with current technological advancements. This is difficult to achieve given the length of time that it takes to navigate university bureaucracy to update a course or adopt a new technology. There is also the consideration of whether the university has the resources to allow the faculty to upskill themselves. This raises the question of whether it is possible for university curricula to be as current as industry demands. At the same time, IS curricula need to prepare students for an uncertain future (Saulnier et al., 2019). This uncertainty can be mitigated by deciding what the IS means as a discipline, determining the core aspects of the discipline and ensuring those are taught to students. Several of the topics that are considered core to the IS discipline, systems development and IT infrastructure have remained similar for decades (Leidig et al., 2020). However, as Case et al. (2019) pointed out, there is no universally accepted definition of the IS discipline, making it difficult to determine whether a curriculum is relevant to IS education. It is therefore important, when discussing IS curriculum relevance, to also explain what is meant by the Information Systems discipline. This is why the question 'relevant to what?' is important.

Another factor that influences curriculum relevance in relation to the question 'relevant to what?' is context. When considering IS education literature, there does seem to be an appreciation of the importance of context and how there can be differences in the relevance of IS education depending on the context. That is why model curricula such as IS2020 have moved away from prescribing core and elective courses (Leidig et al., 2020). However, there can be contradictions within these same documents. For example, IS2020 has a section which discusses the potential job profiles for IS graduates. That discussion is based on the European e-Competency Framework (ECF), the Skills Framework for the Information Age (SFIA) and an AIS Job Survey conducted in the USA. These frameworks and surveys are based on Western and developed contexts. Thus, using them exclusively to inform a section of global curriculum guidelines results in a bias towards Western contexts. This is not a criticism of IS2020 but an attempt to highlight that although there is a recognition in IS education literature that contextual differences need to be recognised, these differences are not always catered for in the literature.

6. Conclusion

Our first research question was 'What does curriculum relevance mean within the field of Information Systems?'. Our results show that in the IS field a relevant curriculum means a curriculum that prioritises the needs of industry and students. A relevant IS curriculum is generally focused on the professional interests of students and pays lesser attention to personal, societal and cultural relevance. Relevance to contextual realities and the IS discipline are also important considerations. A relevant IS curriculum must also manage the tension between current and future relevance. Our second research question was 'What factors impact curriculum relevance in the field of Information Systems?'. Based on our conceptualisation and review we determined that factors that impact IS relevance include stakeholder perspective, context, technological advances, stakeholder involvement and university resources.

Several of the themes that we noted can be found in studies that focus on different disciplines and different education levels. Raselimo (2017) discussed the relevance of secondary school curricula in Lesotho and noted that it has been criticized in the past for lack of relevance to industry and the societal context. This has been partly attributed to the use of Cambridge curricula, which was not suitable to the Lesotho context and required localization (Raselimo, 2017). This has been a criticism that has also been levied against IS model curriculum guidelines (Mwalemba & Mashingaidze, 2022). Adil et al. (2022) investigated the students' perceptions of the relevance of high school mathematics education in the USA. In their study, they noted that mathematics educators often connect mathematical education to real-life scenarios to improve relevance. This is similar to the practical relevance theme that our study highlighted (Adil et al., 2022). Hiim (2017) addressed challenges related to the relevance of vocational

education in Norway. One of the challenges that Hiim (2017) cited was that vocational education was viewed as not relevant to the actual vocations. This echoes what we found in our study where we discuss the notion of curricula being relevant to the IS discipline under the 'relevant to what?' question. Another challenge Hiim (2017) cited was that employers were complaining that graduates were not qualifying with the relevant skills. Our study also highlighted the importance of industry views and the gap between industry expectations and the reality of IS curricula. What these examples show is that there are some aspects of our findings, such as relevance to the discipline, contextual relevance and relevance to industry, that are applicable across different disciplines and education levels.

The research extends the theoretical question-based framework by deriving a set of factors that contribute towards curriculum relevance in IS. The practical contribution of this paper is providing IS educators with an understanding of the nuances of curriculum relevance and what aspects influence curriculum relevance. This provides a platform for meaningful discussions amongst faculty and stakeholders regarding curriculum relevance and what can realistically be achieved. For example, the literature indicates that the industry repeatedly calls for a curriculum that reflects the latest technologies. What is missing from the literature is an acknowledgement that this may not be possible, why that is not possible and what can be done as an alternative. We call on IS educators to take this research into account when addressing the issue of relevance in their curricula. We encourage them to explicitly state what stakeholders they prioritise, acknowledge their contextual realities and the resultant limitations, the impact this has on their curriculum process and how this shapes the resulting graduates they produce. This would, in our view, help to close the gap in expectations between IS curricula stakeholders that exists as shown in previous literature.

7. Limitations and future research

During our analysis, we observed that 27 of the papers were focused on the USA. Four were from the UK, three were from Germany and Australia had and Africa had two papers each. Three articles were not specific to any country. Ireland, Macedonia, Singapore, and South Africa all have one article each. This indicates a significant gap in research from Africa which can potentially be explained by the choice of data sources and a lack of research on the topic of IS curriculum relevance in Africa.

This indicates a need for more research regarding postgraduate curricula and research focusing on countries other than the USA. Future research can also consider the perspectives of stakeholders other than industry and students as recommended by Stefanidis et al. (2013). One of the limitations of this review was that it focused only on IS. IS is part of the computing family therefore a larger study comparing the relevance of computing curricula would also be of academic interest. Although we established that industry is one of the more salient stakeholders in IS curricula, we were not able to explore the nuances of which members of industry are the most prominent. Are advisory boards dominated by members of the software development industry or IT consulting for example? This would reveal further insights into what voices are being privileged when it comes to IS curriculum relevance.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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