Defining Information Systems Integration: A Literature Review About ISI

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ABSTRACT

The importance of information systems integration has been growing in every organisation, and the significance of the field in academics has also been on the rise. The large interest, however, has not resulted in an accepted theory of the concept, or a consistent definition across the literature. This lack of definitions can lead to problems regarding the process and result of any research surrounding this concept. The paper aims to tackle that problem by conducting a literature review about the definitions throughout the literature. The definitions are compared to highlight the main differences between them. By finding these distinctions this research may help understand the concept. It may also serve researchers in finding or creating a perfect definition for their uses. The research could also help create a new theory for the concept.

Keywords

Information systems, integration, information systems integration, literature review

1. INTRODUCTION

1.1 Background

In the last twenty years interest in the field Information Systems Integration(ISI) has skyrocketed both in the professional and academic world. Research is extremely interested in the field, but there has been both research confirming and disconfirming the positive impact of IS and IT [15, 9]. These contrary results may be confusing, but this research may give some insight into where these discrepancies stem from. There is also claims of the importance of ISI in other industries for example healthcare[20].

The value of the enterprise resource planning(ERP) market was estimated to be worth over 60 billion USD at around the start of the millenium [11]. The market probably only grew ever since then, and ERP is only a part of ISI. The exact size of the markets are hard to estimate, but is expected to be larger [11].

1.2 Problem Definition

Despite the importance of the field, the literature is split and difficult to join into a coherent whole [7]. There are

also multiple researchers in the field calling for further examination of the theory and concept of integration[7]. The split nature of the literature is evidenced and worsened by the fact that there are a number of different definitions used [7]. This can cause problems in the process of research, whereby because of the different definitions researchers have to be careful that cited papers use the same definitions. It can also make research difficult to reproduce. This paper aims to address these problems by analysing and comparing the different definitions in the literature. By showing the differences in the literature we can confirm that these definitions cannot be used interchangeably and that without care this can cause problems. Finding the differences also helps highlight the important parts of the concept by figuring out where the differences in the definitions lie. This may help future researchers in placing their concept of ISI in a broader context. Creating formal definitions can also be considered an important first step in creating a theory of ISI [19]. By giving insight to these definitions this paper may also serve as a stepping stone for any future overarching theory.

1.2.1 Research Question

- RQ: What are the principal differences in the definitions of ISI?

2. METHODOLOGY

The method of research is a literature review. There are similar examples of research concerning definitions of a term conducting literature reviews to get at a given concept [16, 1].

2.1 Literature Collection

This section describes the process of collecting the literature. This is essential so the research may be reproducible, and that its validity is ensured.

The database used is Business Source Elite of EBSCO as it offers a focused but wide array of papers in the field.

The keywords are 'information systems integration'. This is deliberately kept as wide as possible, as with the focus provided by the more specific database, the broad keywords ensure that the definitions of ISI will not originate from only one discipline. Only publications between 2005 and 2020 are included to ensure that the found papers are recent and relevant. The following filter is specific to the given database. The name of the filter is "Subject: Thesaurus Term". This method helps filter the papers by subject. This link provides some further explanation. To make this process less arbitrary a subject is included in case they have more than twenty papers concerning it at the time of the selection. Included subjects are: information technology, information resources management, com-

puter software, business enterprises, management information systems, mergers & acquisitions, enterprise resource planning, industrial management, supply chain management, business planning, supply chains. The research only includes academic journals written in English for further filtering and to ensure the academic integrity of the paper.

In the next step, the papers are filtered based on their abstracts to ensure that the analyzed literature concerns the concept of ISI. Most papers which in their abstract explicitly mentioned ISI are included, some which are too specific or ones that only lightly touch on the term of ISI (e.g.: mentioning how the research might also affect the field of ISI) are excluded. There is further discussion of this last step in the Validity section.

2.2 Synthesis

We search the literature for definitions. The included definitions have to be explicit definitions of the term of information systems integration. Variations are accepted (e.g.: integration of information systems). In some cases, studies use IT almost interchangeably with IS. We ignore these definitions due to the uncertainty of including this new term.

First, the definitions are coded in an in vivo coding process to make them more digestible and highlight possible differences that the following codings would miss. Then the definitions are further coded based on two aspects. How they approach the concept of ISI, and what themes of information systems they highlight.

For coding the concepts, the in vivo codes are further coded, with some concepts altered from [7], in which the authors mention how different theories of ISI talk about the concept of integration. The codes used are slightly altered as no explanation is provided how the authors used them exactly. The codes that are used are process and artefact.

For the thematic coding the codes are from a paper describing information systems [8]. By seeing how complicated the field of IS itself is, it becomes more clear why its integration is also complicated why the concerned literature is so fragmented. The relevant aspects of IS based on the paper are people, data, hardware, software and telecommunications. The codes of hardware, software and telecommunications were unified into a code called computer systems. The rest of the aspects looked broad enough to help classify the definitions. Classifying the definitions based on these codes help confirm that most concepts of ISI are concerned with different aspects of IS, which is one of the root causes of the fragmented literature.

The codings are expected to be able to answer the research question separately. These codings were chosen to confirm the presupposition that the differences will be in line with how they conceptualize integration and the different aspects of IS they highlight.

2.3 Validity

2.3.1 Literature Selection

The most important concern regarding the literature selection process is how the papers were filtered based on their abstract. Picking papers based on the abstract could be considered subjective. This could become a problem if a large number of definitions or some important ones were missed. Firstly, out of the analysed papers, only a fraction of them defined the concept of ISI in a meaningful way, so we cannot assume that papers that mention the concept

Table 1. Number of definitions

Contains definition	12
No explicit definition	43
Total	55

in a throwaway manner would include a relevant definition. Secondly, several distinct definitions were found, so it is reasonable to think that definitions that may have been missed resemble those definitions that were found. In other words, the sufficient number of definitions assure representation, so in the rare case where an excluded paper includes a definition, it is more unlikely that there is a similar definition already included. Thirdly, there is only a small number of papers that fit this criterion for exclusion, even further lowering the chances of missing (important) definitions.

2.3.2 Synthesis

The main concerns in the Synthesis section are regarding thematic codes. Specifically, the code of *data*. This code can be considered problematic because in the code of *computer systems* the code of *data* is implied. This concern is valid, but we will see some definitions do emphasize the theme of data explicitly, thus making it a relevant difference. This is evidenced by the fact that data integration is a term in and of itself which is used in similar contexts[14].

2.3.3 Scope

The scope of this research is limited greatly by three factors. Firstly, only a very short period of time is available. Secondly, it is conducted by only one researcher. Thirdly, the research has limited experience in both the field and in doing research.

3. RESULTS

Conducting the literature collection as described in the Methodology section leaves us with 55 papers to be reviewed. The number of papers containing definitions can be seen in Table 1.

Table 2. Definitions

ID	Ref	Definition
1	[20]	Integration of information systems is an indicator for the measurement of availability of the generated information of one of the information components by other components. Integrated information systems include integrated manual and computer components that are designed for gathering, processing, controlling, and storage of information and to ensure of the accuracy of information flow in the organization, and the ease of the operational functionalities to support management information in decisions

ID	Ref	Definition
2	[4]	ISI represents the implementation of a common enterprise wide database and a unified reporting system through which that database can be accessed.
3	[15]	To help clarify the impact of IS integration on firm profitability, we first follow Fayard et al. (2012), Bergeron and Raymond (1992), and Ward and Zhou (2006) by categorizing IS integration into two distinct, but closely related, capabilities: internal IS integration and external IS integration. Internal IS integration refers to a firm's electronic links in information technology applications to data acquisition and storage systems that facilitate the sharing of accurate and timely information in support of cross-functional processes (Hammer, 2001). External IS integration is the degree to which a firm's IT is compatible with that of other firms, such as customers and suppliers (Barua et al., 2004; Bharadwaj, 2000; Ward and Zhou, 2006; Zhou and Benton, 2007).
4	[17]	Technically, integration refers to the degree of interoperability and interconnectivity among technical components, and relies on standardization at a certain level
5	[13]	It(ISI) concerns the context of intra-enterprise where it is mainly a question of interconnecting diverse heterogeneous applications of the same company. It can also concern the context of inter-enterprise in order to create a context between enterprises that permits communication between the different partners' applications.
6	[2]	IS integration is defined as the integrated technology that allows sharing of information and applications (Wyse and Higgins, 1993).
7	[6]	IS integration is not just the exchange of information on demand and inventory levels, but multiple, collaborative working relationships across the organizations at all levels.
8	[5]	Gabler and Pickton (1998) pointed out that information systems integration meant that the originally independent information systems could be connected to a certain type or with a single interface by means of a certain integrating method.
9	[10]	The degree of integration of a company's information system (IS), called IS integration, can be considered a proxy of IT maturity and quality.
10	[3]	Building on these contributions we define integration as the planned and emergent process of linking different stakeholders and technology into existing socio-technical networks.

ID	Ref	Definition
11	[18]	Their research surfaced the notion that integration in the context of ES emerged not as a unitary concept but as a concept involving different types of integration in different contexts.
12	[12]	IS integration has been described as an alignment process, whereby the IS integration strategy should follow the business benefits expected from the merger [18, 20, 28, 33].

In Table 2 we can see the collection of all definitions from the collected literature. In Table 2 an ID number is provided to make referring to them simpler. Some of the reviewed papers the concept of integration was defined while lacking an explicit definition for ISI, these papers had to be excluded to assure relevancy. However, some definitions seem to be doing the same. These definitions were included as it is made clear in the paper that they are discussing the concept in the context of ISI.

Definitions 8, 11, 12 were excluded from further analysis as they offer almost no insight into the underlying concept of ISI. This leaves us with 9 definitions that were coded so that they may reveal the important differences.

In Table 3 we can see the in vivo codes of the definitions. This coding lead to two important conclusions. First, an important aspect is lacking in the conceptual codes namely the aspect of capability, as multiple use these or similar words to describe the concept. These definitions were grouped in the new conceptual code of capability. Second, there is an important difference that codes will fail to highlight. The difference of some definitions put emphasis on what one of them calls internal and external integration.

We can see in Table 4 the most prevalent integration concepts are process and capability, while almost no papers talk about it as the technology that is created.

In Table 5 the way the thematic codings were distributed was fairly even most of the papers included at least two themes of IS, and only two definitions were coded as referring to all three concepts. This shows that the definitions are still relatively close regarding their subject, but as will be discussed in the Discussions section these differences may be larger than as suggested by these codes.

As can be seen in Tables 4 and 5, the differences along the lines of the conceptualization of the term and themes of IS are apparent. The conceptual differences should prove that the definitions in the literature are inconsistent, but combined with the fact that the definitions largely differ in what part of information systems they highlight, it should be obvious that the differences are significant, and where these differences stem from. Even these codings however do not encapsulate perfectly how vastly different the definitions may be.

4. DISCUSSION

4.1 Lack of Definitions

As can be seen in Table 1 a large number of papers completely lack an explicit definition of the term. This paper does not mean to imply that this renders these papers obsolete, but it is an interesting finding which can have negative implications. A missing definition raises questions regarding the validity and reproducibility, as there is no guarantee that subsequent reproductions will use the same definition, and it is difficult to validate that other referenced papers have not used a different definition. It

Table 3. In vivo coding

ID	In vivo coding
1	indicator for the measurement of availability of the generated information, manual and computer components, information, organization
2	Implementation, enterprise wide database, reporting system
3	Capabilities, internal, external; internal: electronic links, data acquisition storage, sharing of accurate and timely information, cross-functional processes; external: degree, firm's IT, compatible, customers, suppliers
4	Degree, interoperability, interconnectivity, technical components, standardization
5	Intra-enterprise, inter-enterprise; Intra: interconnecting, heterogenous applications.; Inter:context between enterprises(unclear whether a artefact or a process), communication, different partners' applications
6	integrated technology, sharing of information and applications
7	Exchange of information, relationships, organizations
9	degree of integration of (...) information systems, proxy of IT maturity and quality
10	process, linking, stakeholders, technology, into existing socio-technical networks

Table 4. Conceptual coding

Code	IDs
Process	2, 5, 7, 10
Artefact	6
Capability	1, 3, 4, 9

Table 5. Thematic coding

Code	IDs
People	1, 3, 5, 7, 10
Data	1, 2, 3, 4, 5, 6, 7
Computer Systems	1, 2, 3, 4, 6, 9, 10

also makes it difficult for future more rigorous researchers to use studies without definitions.

4.2 Additional Differences

As mentioned in the Results section these codings do not completely show how different the given definitions are. They do offer some insight into which further research may be based on. The codings of the definitions largely confirmed the presuppositions about where the differences lie. Possible further analysis could introduce hierarchical codes, taking the given codes as a basis. For example, there are still significant differences among definitions that talk about integration as a process, some define it as a process of integrating an information system, while others as a constantly ongoing process of sharing data or even relationships in the company. Other important differences can be seen in the codes of *people*, whereby putting an emphasis on organizations and/or users, or even the aforementioned relationships, were all included as touching on the theme of *people*.

4.3 Superior Definition

Despite the paper analysing definitions it does not seem to be getting closer to a superior definition that may replace all others, and of course, this is not suggested by the paper. Getting to a superior definition is probably impossible especially given that the definitions are different specifically because the authors are trying to talk about different parts of a concept. This paper does not suggest that all research should be halted until there is a superior definition, it does show why it is necessary to place one's research in the landscape of ISI, and it does help shed light on that landscape.

5. CONCLUSIONS

The collection of definitions and their subsequent coding shows clearly where the differences in the analysed literature lie. The main differences are how they conceptualize the concept of integration, and differences on what themes of the concept of IS do they relate to and how. The codes chosen and added highlighted the differences in the definitions well, they confirmed the assumption that the definitions cannot be used interchangeably. Another important difference were how some definitions highlight a context for the integration, namely external and internal or inter-enterprise and intra-enterprise integration. Understanding these differences and where they come from may help future researchers in formulating their own definitions and understanding how their research relates to a larger picture of ISI. The collected definitions and what the codes highlight about them might also be used as a stepping stone of creating a taxonomy of ISI.

Some future research may include introducing additional more fine grained codes to analyse definitions, or using these definitions to see how well they fit into any existing theories of ISI.

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