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AN EXTENSIVE REVIEW OF INTERORGANIZATIONAL SYSTEMS RESEARCH 2006-2015

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Abstract

There has been a large quantity of research that has been carried out on interorganizational systems in recent years. Because research in this area has been carried out for a long time, it is becoming increasingly difficult to find new aspects of it to explore. The aim of this study is to identify the published literature on IOS from 2006 to 2015, review them, and apply a suitable framework to categorize them based on the aspect of the topic they explore. The categorization framework employed for the study consists of four broad categories: IOS infrastructure, IOS assimilation, IOS dynamics, and IOS impacts. We further present a comprehensive reference of the reviewed literature. We hope to contribute in guiding future researchers of IOS by showcasing aspects of the topic that has been researched, and help them discover new avenues of IOS to explore.

Keywords: Interorganizational Systems, IOS, Literature Review, Framework, Categorization

1 INTRODUCTION

The use of interorganizational systems (IOS) is without doubt still increasing. Since the significant development of the internet and e-commerce in the 1990's, we have witnessed several changes in the methods that organizations function and operate, all in order to improve performance and reduce costs. One of the ways organizations use information systems is to improve the links between themselves and their suppliers and customers through the implementation of IOS. Being tightly linked with their stakeholders enables organizations to be more agile in environments where demand and supply are always changing.

Interorganizational systems (IOS) are IT systems that are built and implemented to link the business processes of multiple organizations by enabling the exchange of information between them (Steinfeld, C. W., Markus, M. L., & Wigand, 2005). Through IOS, organizations can have access to more resources that they otherwise would not. Such resources include applications, networks, and databases. Improved management of supply chains with suppliers, distributors, partners, and customers is also made possible with IOS. IOS works by enabling its members to work together by sharing data (structured and unstructured) stored in repositories (Kumar, van Dissel, & Bielli, 1998). The implementation of IOS facilitates the collaboration and management of conflicts through the electronic integration of resources (Volkoff, Chan, & Peter Newson, 1999), which results in the redesign of interorganizational processes and the expansion of the organizations business scope (Kambil & Short, 1994).

The aim of this paper is to review the literature on interorganizational systems in the past decade, organize and classify these studies. In total, this review identified 860 journal articles from 2006 to 2015. The paper goes on to discuss the research methodology, the criteria used to classify the literatures, discussion of the analysis results, and finally conclusions and the implications of the study.

2 RESEARCH METHODOLOGY

The research on interorganizational systems is covered under several disciplines. The focus of any review should not be specific to only a handful of selected journals. IOS research articles can be found in journals under information technology, business and management, and even engineering. This study follows the guidance of Webster & Watson (2002), and uses some of the methodology employed by previous reviews on similar topics including Ngai & Gunasekaran (2007), Robey (2008), and Ngai, Xiu, & Chau (2009) by searching through several databases to comprehensively capture IOS literature. Table 1 shows the databases that were selected and searched for the articles reviewed in this study. As the aim of the review is to be broad, we considered all published articles between 2006 and 2015. Similar to (Robey, 2008), we searched the databases using several descriptors including different combinations and variations of "Interorganizational", "system", "e-business", "b2b", "inter firm", "supply chain", "logistic", "RosettaNET", "EDI", "ERP". Furthermore, we searched through citation index and references of articles identified in the earlier step for more literature.

We limit our search only included articles from peer reviewed journals. To that end we excluded conference papers, academic dissertations, and all unpublished papers, this naturally extended to include editorials, news reports, and book reviews. This was mainly because journals are considered to have the highest level of research as academics and practitioners usually obtain information and publish their research in journals (Nord & Nord, 1995). Lastly, the text of each of the articles found was reviewed to remove the articles that were not related to IOS one way or the other.

Selected Databases
ABI/INFORM
Academic Search Premier
ACM Digital Library
Business Source Premier
Emerald Fulltext
IEEE Xplore

Inderscience Publishers
Ingenta Journals
Kluwer Online
Science Direct
Springer Link Online Libraries
Wiley InterScience

Table 1: Selected Databases (source: Ngai & Gunasekaran, 2007)

The extensive search resulted in 860 articles related to interorganizational systems from 261 different journals under various disciplines. 832 articles were reviewed and grouped into IOS infrastructure, IOS assimilation, IOS dynamics, and IOS impacts. There were 28 identified articles that were not categorized for various reasons mainly due to issues concerning accessibility and lack of clarity. Figure 1 shows the categorizations used for this study.

3 CATEGORIZING IOS RESEARCH

Figure 1 showcases the classification framework used to categorize the research on interorganizational systems. This framework is partly based on Robey (2008)'s classification of empirical research of IOS. They classified the research into three categories: adoption of interorganizational systems, impacts of interorganizational systems on governance, and organizational consequences of interorganizational systems. We extend their framework increasing the scope of adoption to include other aspects of innovation diffusion including initial awareness, adoption of technology, and the routinization of the technology (Meyer & Goes, 1988; Rodgers & Chen, 2005). Secondly, we consider the organizational consequences of interorganizational systems to also be an aspect of the impacts of IOS, therefore, increasing the scope of IOS as used by Robey (2008). We then add the dynamics of IOS and IOS infrastructure as separate categories in our framework.

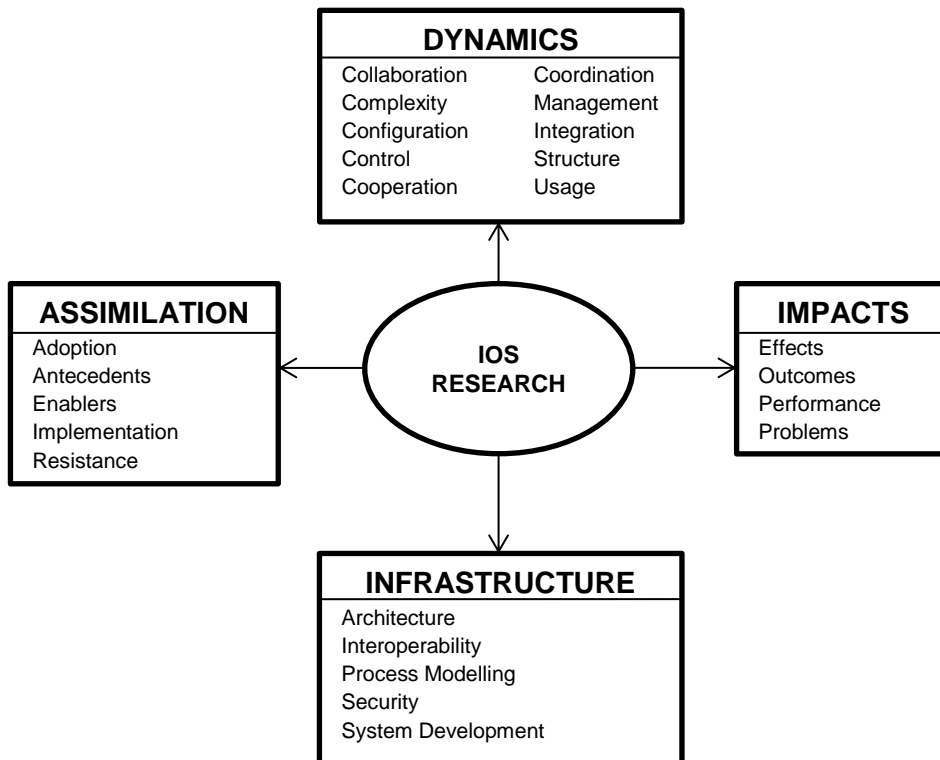


Figure 1: Categorization Framework

3.1 IOS infrastructure

This part of our framework deals with Interorganizational systems research that looks at and contributes to the development of interorganizational systems and standards. Even within this category, there are several different aspects of research. Included in this part are important aspects of IOS development such as their architectures (Roser, Muller, & Bauer, 2011), processes and modelling (Choi, Raghu, Vinze, & Dooley, 2009), engineering (Wasmer, Staub, & Vroom, 2011), and security (Fang, Parameswaran, Zhao, & Whinston, 2014). This level of research is very abstract and descriptive in nature. It is equally, if not, more important than other levels of IOS research as they provide the very foundation for the development of interorganizational systems and standards.

3.2 IOS assimilation

This is the part of our framework that is concerned with the research of how organizations assimilate interorganizational systems. According to the diffusion literature, there are three stages to the organizational assimilation of innovations. The process begins with the technology initiation which involves “identifying and prioritizing needs and problems on one hand and to searching the organization’s environment to locate innovations of potential usefulness to meet the organization’s problems” (Rogers 1995, p. 391). At this stage, organizations examine the degree to which an innovation will be useful in improving their performance by reducing costs, improving supply chain coordination, and increasing their customer reach. After the initial process of examining an innovation, the adoption of the innovation takes place. At this stage, organizations make their decision to use the innovation, allocate resources towards that end and obtaining the innovation (Zhu, Kraemer, & Xu, 2006). Even after the decision to adopt an innovation, organizations often fail in routinizing it and as a result the complete assimilation of the innovation fails. To be completely assimilated, an innovation must be accepted, adapted, routinized, and institutionalized in the organization (Fichman & Kemerer, 1999). Sodero, Rabinovich, & Sinha (2013) examined the influence of institutional pressures on organizational decisions to adopt IOS. Hsu, Lin, & Wang (2015) use institutional and organizational legitimacy theory to propose that the cross cultural assimilation of IOS innovation is dependent on its alignment with three institutional pillars in different countries and the deployment of legitimation strategies by stakeholders. Several other studies have contributed to this level of research by also examining the assimilation of IOS using different theoretical lenses.

3.3 IOS dynamics

Studies in this category of interorganizational systems research cover a big scope. We add studies that look at IOS governance, coordination, interoperability, information sharing, usage, and other similar aspects under this category. Naturally there is a very broad array of theories that have been used to explore different aspects within the dynamics of IOS. Employing agency theory, Wilkin, Campbell & Moore (2013) looked at how the governance of IOS in partnership between public and private institutions can impact the value gained by participating stakeholders. Turker (2014) extended communication theory in his study, he determined that unequal power impacts the nature of communication between organizations in strategic partnerships, and this might deter the organizations from achieving some of the possible benefits that can be attained through IOS. Zhao & Xia (2014) argue that IOS standards are important innovations that facilitate the development of interoperability between organizations by positing that capability building within organizations and also community readiness across organizations impact the development of interoperability, thus extending IT capability and network effects theory. We add these and other similar research into the IOS dynamics class of our categorization framework.

3.4 IOS impacts

The final aspect of interorganizational systems that has been significantly researched is the impacts of the technology. For any innovation, people must be aware of the possible adoption benefits and drawbacks that it brings. Without knowing what the impacts of IOS are, organizations would find it harder to consider these technologies. For the continuous development of such innovations, the general interest in it must be maintained. One way of achieving this is through the continuous

exploration of their impacts. A few of the studies in this category are Borges, Hoppen, & Luce (2009) who investigated the impact of IT on the market orientation of IOS, they found that significant investments in interorganizational systems strongly supports the development of market orientation capabilities of organizations. Qu & Wang (2011) explored the impact of organizational experience in using EDI and its influence on their attitude towards IOS. Their findings confirmed the impact of EDI experience on different aspects of IOS. Through the asset orchestration perspective, Zhang, Xue, & Dhaliwal (2016) discovered that the breadth, depth and a balanced alignment of IOS deployment can increase an organizations competitive performance through the improvement of their operations. Other aspects of the impacts of IOS added to this category include research on the benefits, drawbacks, risks, effects, and outcomes of interorganizational systems.

4 ANALYSIS AND RESULTS

832 articles were reviewed and classified into the above four broad categories. In each of the categories, there are sub categories of research that are based on the subject natures of the research within the categories. IOS dynamics was found to be the broadest category both in terms of sub categories identified and the total number of articles found. The next broadest category was IOS assimilation, followed by IOS impacts, and lastly IOS infrastructure. The reviewed articles are analyzed further based on the yearly publication distributions, journals, subjects, and theory. The analysis can be used as a platform for future research on IOS as it shows how research on the topic has evolved through the last decade, the interesting avenues of IOS research, and be a significant source of information for different categories of research on IOS. We present the results of our analysis below.

4.1 Publication Year

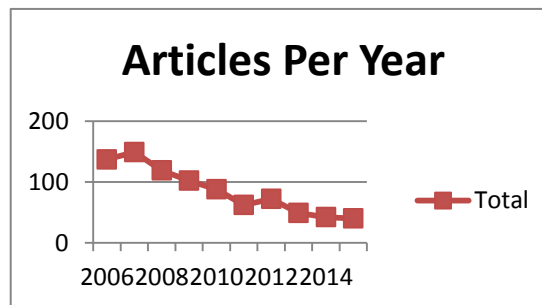


Figure 2: Yearly Distribution of Articles

Figure 2 shows the yearly distribution of the published articles on interorganizational systems. While the total sum of articles in this period is very large, the distribution has been steadily reducing since the beginning of this period. The distribution of articles in 2006 is more than three times that of 2015. While this highlights that less researchers are studying IOS, it also implies that there is less competition in publishing IOS research, and thus, researchers currently studying it will have improved chances of publication. This can also serve as an encouragement for future researchers as they are venturing into a research area with a lot of references which will enable them to better understand the subject and therefore discover even more interesting aspects of it.

4.2 Journal

For this review, we have discovered 280 different journals of different disciplines including business, management, IT, engineering etc., that have published research on interorganizational systems in the past decade. We have summarized the top 10 journals that have the most number of articles in this period in table 2. Even though the identified journals cover a wide range of disciplines, the majority of them come from the information technology and information systems discipline. According to our results, Journal of Operations Management, IEEE Transactions on Engineering Management, and Supply Chain Management: An International Journal had the highest number of hits with 34 (4%), 28

(3.3%), and 26 (3.3%) articles respectively. The Journal of Operations Management is a level 4* journal that publishes quality original empirical operations management research. The journal publishes 8 issues per year and is considered the best journal in operations management (ABS, 2015). IEEE Transactions on Engineering Management is a level 3 journal that publishes research on operations and technology management (ABS, 2015). The journal publishes quarterly and puts more emphasis on organizational research that can help decision making and policy formation. Lastly, Supply Chain Management: An International Journal is also a level 3 journal that publishes in the operations management and information systems discipline (ABS, 2015). They publish up to 6 issues every year and are known for being very diverse.

For new researchers on the topic of IOS and other similar topics like interorganizational relationships or e-government, table 2 lists the journals with the most published articles. Looking through these journals will give them a head start to finding the relevant information necessary for their. Similarly, researchers of these topics that are looking to publish papers can focus more on the requirements of the journals listed as they are more likely to accept and publish the papers. This is even more relevant considering the current number of yearly publications in this area.

Journal	No
Journal of Operations Management	34
IEEE Transactions on Engineering Management	28
Supply Chain Management Journal: An International Journal	26
International Journal of Operations & Production Management	25
International Journal of Production Economics	24
Industrial Management & Data Systems	22
Information & Management	19
International Journal of Physical Distribution & Logistics Management	18
European Journal of Information Systems	17
Decision Support Systems	16

Table 2: Journals with most articles

4.3 Subject

The results of the article distribution by their subject as in Table 3 show that the majority (390) of the articles are concerned with research on the dynamics of Interorganizational systems. Looking further into the research on IOS dynamics and the sub categories identified, we find that the majority of articles within the category were that on “integration” (106 articles) and “cooperation” (104 articles). The research on IOS was mostly initially focused on its development; this resulted in increased attempts to identify the implications of organizational behavior and the acceptance of interorganizational technologies. Other areas of interest in the dynamics IOS are “collaboration” (74 articles), and “management” (53 articles).

The second most explored category of IOS research is that on “IOS assimilation”. Within the category, articles on “adoption” were the most common. Of the total research on IOS assimilation (229 articles), 134 articles were about the adoption of IOS, which was distantly followed by those on its “implementation” with 45 articles.

The third most researched category was that involving IOS impacts (156 articles). The majority of the research in this category were on “outcomes” (90 articles) discussing topics such as the impacts of IOS towards organizations. The second aspect researched in this category related to “effects” (38 articles). Beyond that, there were articles that looked at other issues including performance, risks, problems and trust.

The least researched category was “IOS infrastructure” with 57 articles. The majority of the articles were on “IOS development” (33 articles) followed distantly by those on “interoperability” and “architecture” (8 articles). The findings discussed above are seen in detail in table 3. The table can be very useful to future researchers of interorganizational systems.

Classification Criteria	Number of Articles	Percentage of Topic	Percentage of all topics
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<i>1. Infrastructure</i>			
1.1. Architecture	8	14	1.0
1.2. Interoperability	8	14	1.0
1.3. Process Modelling	2	3.5	0.2
1.4. Security	6	10.5	0.7
1.5. System Development	33	57.9	4.0
Total	57	100	6.9
<i>2. Assimilation</i>			
2.1. Adoption	134	58.5	16.1
2.2. Antecedents	23	10	2.8
2.3. Enablers	22	9.6	2.6
2.4. Implementation	45	19.7	5.4
2.5. Resistance	5	2.2	0.6
Total	229	100	27.5
<i>3. Dynamics</i>			
3.1. Collaboration	74	19	8.9
3.2. Complexity	2	0.5	0.2
3.3. Configuration	10	2.6	1.2
3.4. Control	4	1	0.5
3.5. Cooperation	104	26.7	12.5
3.6. Coordination	25	6.4	3
3.7. Integration	106	27.2	12.7
3.8. Management	53	13.6	6.4
3.9. Structure	9	2.3	1.1
3.10. Usage	3	0.8	0.4
Total	390	100	46.9
<i>4. Impacts</i>			
4.1. Effects	38	24.4	4.6
4.2. Outcomes	90	57.7	10.8
4.3. Performance	25	16	3.0
4.4. Problems	3	1.9	0.4
Total	156	100	18.8

Table 3: Distribution of articles by topic

4.4 Theory

The review of the identified literature revealed 205 different theories used in the studies. This 205 theories were identified from just over half (425 articles) of all the studies reviewed in this paper. This is mainly because most the other studies did not explicitly specify any theory that their work is based on and also because a large percentage of the studies develop their conceptual model by reviewing and selecting variables from previous research. It is also important to note that a lot of the reviewed studies are theoretically grounded on more than one theory. Table 4 shows a summary of the twenty most common theories as identified in this review of studies on interorganizational systems.

The table highlights the fact that researchers are most focused on resource based view, transaction cost theory and institutional theory in their studies (Chong & Bai, 2014; Sodero et al., 2013; Zhang & Dhaliwal, 2009). While this highlights the big scope of these theories, it also gives future researchers something to think over. Because of the high number of theories that have already been applied in these studies, new researchers can develop and extend theories by examining how some of the theories interact with other theories, and examine theories that logically propose opposing ideas.

Theory	Studies	Percentage
Resource based view	65	15.3
Transaction cost theory	47	11.1
Institutional Theory	33	7.8
TOE framework	26	6.1
Relational view	23	5.4
Innovation diffusion theory	18	4.2

Resource dependence theory	18	4.2
Contingency theory	15	3.5
Coordination theory	12	2.8
Technology acceptance model	12	2.8
Information processing theory	10	2.4
Knowledge based view	9	2.1
Network theory	9	2.1
Social exchange theory	9	2.1
Dynamic capability theory	8	1.9
Structuration theory	7	1.6
Organizational learning theory	6	1.4
Organizational theory	6	1.4
Social network theory	6	1.4
Economic theory	5	1.2

Table 4: Top 20 common theories

5 CONCLUSIONS AND FUTURE RESEARCH

Interorganizational systems have been of great interest to both academics and practitioners alike over the past two decades. Looking at the results of this study, this interest peaked around 2006. Ever since then, the interest on IOS has been steadily declining. The study has identified and reviewed 860 articles on IOS that were published between 2006 and 2015. While this study may not be 100 percent comprehensive, it does go a long way in providing insight into the current state of IOS research. Before carrying out the study, we searched for and examined other similar studies on IOS research, but we were unable to find any that employed our methodology. There has also not been any comprehensive review of IOS in the recent past. A summary of the implications of our study is discussed as follows:

We have not found it too surprising that the majority of the reviewed articles were related to IOS dynamics. Further within dynamics, the majority of focus was on “integration”, “cooperation”, and “collaboration”. In our view this is primarily because IOS has already been extensively researched for a long time and is no longer in its development stage. We also make note of the fact that the most important topics of interest change with the passage of time. For the early stages of the time frame chosen for this review, adoption dominates and eventually the dominant topic becomes impacts. This can be seen as another evidence of the evolution of IOS research.

As new standards for IOS are being developed, the infrastructures that support them need to also be equally considered. Technology in general is constantly advancing, resulting in larger storage capabilities and faster processing times. Interface of systems also need to be modernized to keep up with the necessities of new business models.

To guide future research on IOS we propose that extra effort to put into the assimilation and impact of IOS. Despite the extensive research on IOS, many organizations still find difficulty in its adoption and this often results in the failure to assimilate. This logically implies that organizations are still not aware of the possible impacts of IOS. This review has found several cross disciplinary research that has made significant strides towards this problem. We believe that new research should continue to focus on other unexplored theories, especially from the organizational behavior and psychology disciplines to improve the current understanding on IOS adoption. We further believe that the more diverse the theories used in IOS research are, the more IOS becomes adaptable in different contexts.

In conclusion, the initial process of the methodology employed by the study was searching through several online databases for relevant articles. As not all journals and volumes are accessible through online databases, it is possible that we did not include some articles. To ensure we kept this at a minimum, we employed the recommendation of Webster & Watson (2002) for identifying past literature by searching through citation indexes and references of articles identified.

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