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Bibliometric Study of Academic Interaction: IT, Organization, and Change

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ABSTRACT

This paper explores the degree and nature of the research interaction between the academic fields of Information Technology, Organization, and Organizational Change. This is done so as to see if, and how, the highly digitized modern business world is reflected in related research. The paper analyses 9.669 articles published in 1995-2006 that are derived from major journals within each field. Then the articles are reviewed through the use of the bibliometric methods: frequency, cross-reference, co-citation, shared references, and network analyses. The findings detect a dearth of consistent research interaction between the fields of Information Technology, Organization, and Organizational Change. This fact is critiqued on the basis of previous practical and academic calls for interactional research. The paper provides important insights about the degree and nature of the research interaction and, in addition, recommendations and guidelines for future cross-fertilization between the academic fields are provided.

Keywords (Required)

Information technology, organization, organizational change, research, interaction, bibliometrics.

INTRODUCTION

The contemporary world of business is often referred to as the digital economy (Carlsson 2004). This is so because the nature and structure of work, organizations, and markets have changed enormously the last decade due to digitization and the Internet. Large international companies like Microsoft, Apple, Dell, eBay, and Amazon have either redesigned their visions, strategies, and work practices to benefit from these new conditions, or their entire existence relies on investments in Information Technology (IT) and utilization of the Internet (Peitz et al. 2006).

Moreover, today, IT is seen in most parts of organizations, in the shape of e.g. administrative systems and IT embedded in tools and machinery. This fact – together with IT's abilities to assist crucial business processes and generate e.g. competitive advantages (Bannister et al. 2005) and increases in productivity (Brynjolfsson et al. 1996) – makes IT a very important factor as regards the development of organizations. Likewise, organizational transformations influence advancements in IT. Thus, the concepts of IT, Organization, and Organizational Change (OC) are highly dynamic, having an obvious reciprocal relationship (Barley 1986; Markus 2004). Consequently, over the years, researchers have started to recognize that the previous deterministic view of IT might not be enough to explain this relationship. Therefore more emergent theories have surfaced, which to a greater extent consider IT, organization and OC as highly complex and intertwined phenomena (Orlikowski 1992; Orlikowski et al. 2001b; Volkoff et al. 2007; Zammuto et al. 2007). As a result, the traditional definitions of work and organizations are changing due to e.g. increasing digitization in the shape of IT implementations, the Internet, and globalization. The fact that, because of this, the connections and dependencies between IT, organization and OC are

important to understand so as to comprehend the current dynamics of business, is reflected both in the ongoing academic (Castells 1999; Sinha et al. 2005) and popular science (Economist 2006; Economist 2007a; Economist 2007b) debates.

This said, it seems increasingly essential for the corresponding research disciplines to interact. Or in the words of Orlikowski and Barley:

"Because organization studies (OS) and information technology (IT) are disciplines dedicated respectively to studying the social and technical aspects of organizing, cross-fertilization, if not outright collaboration, between the two would seem to be beneficial – even necessary – for documenting and assessing the changes taking place around us" (2001a, p. 146).

Additionally, there is an academic call – and has been for long (Markus et al. 1988) – for re-conceptualization both as regards IT (Agarwal et al. 2005; Orlikowski et al. 2001b) and OC (Pettigrew et al. 2001; Van de Ven et al. 2005).

In conclusion there is an explicit wish for interaction and integration between the academic fields of IT, organization and OC. A few scholars have speculated on this (e.g. Orlikowski et al. 2001a; Zammuto et al. 2007), but the inquiry has not yet been thoroughly investigated. So, is there any interaction between the fields? If so, what is the extent and nature of the interaction? And how has the interaction fluctuated during the last decade? These are the main questions addressed in this paper. Thus, this investigation aligns itself with recent and similar research in neighboring fields (Furrer et al. 2008; Hambrick 2007) and more classical work (Kuhn 1962) that stresses the importance of reflection upon the structure, interaction, and development of academic fields.

In order to explore the interaction between the academic fields we use a vast empirical material consisting of 9.669 articles – derived from major journals within each field respectively – and apply bibliometric methods such as co-citation analysis, bibliographic coupling, frequencies, and cross-references analysis (e.g. Moed 2005; Moed et al. 2004; Van Leeuwen et al. 2003). These tools are considered scientifically rewarding and are often utilized when conducting similar investigations (Danell 2000; Danell et al. 1997; Schildt et al. 2006). Furthermore, the study has an exploratory character in the sense that the fields - and their interaction - are investigated without predetermined assumptions, instead of e.g. confirming hypotheses.

The outline of this paper is the following: After a brief account of the theoretical concepts, definitions, and prerequisites, the used methods and data are described. Then the results are presented, analyzed, and discussed. Finally, the paper ends with theoretical and empirical recommendations for future exploration of the cross-fertilization of the academic fields of IT, organization and OC.

THEORETICAL BACKGROUND

The less aggregated level of the firm illustrates, through the related distinctive research, the increasing and clear relevance of the interaction between IT, organization and OC as the development goes towards a more dynamic approach. It is necessary to briefly reflect upon the development of the concepts of organization and IT, and adherent theory, because doing so creates a more complete and reliable picture of the basis of our analysis. The subsequent text demonstrates that the research fields have evolved over the years in regards to both conceptualization and theoretical foundation.

At this point it is also important to underline that our definition of the IT field is all-inclusive, i.e. includes research about administrative systems as well as IT embedded in tools and machinery, and the sub-field called Information Systems (IS) is of course incorporated. Also, the organization and OC fields are defined as including all research regarding the subject matters. Furthermore, articles mentioned here that primarily refer to the concept of organization in general, are indirectly referring to OC in terms of altered conditions for organizations due to IT developments. Therefore, in most instances, the phrase OC is used. When another term – such as organizational theory or organization – is used in tables, graphics or text, it indicates a broader perspective. Mainly, though, the OC expression denotes the use of the specific keywords, and other terms signify exclusion of the keywords. Concerning IT, the use of keywords only serves as delimiting factor, restricting the sample to articles using the term IT explicitly in major terms or paragraphs – i.e. in order to distil the selection to further specify IT dense articles.

Moreover, in the current paper, interaction denotes the following: the extent to which organization and OC research conducts research connected to IT and vice versa (e.g. the popularity of the subject through frequency analysis), and to what extent organization, OC and IT research uses a similar theoretical base (e.g. cross- and shared references).

CONCEPTUALIZATION OF ORGANIZATION AND ORGANIZATIONAL CHANGE

The conditions for the concept of organization have changed from the traditional Weber notion of the word. In the contemporary knowledge-intensive business world the boundaries between and across organizations have been blurred,

resulting in changing circumstances for work (e.g. Barley et al. 2001; Sinha et al. 2005) and for the organization (e.g. Davenport 2005; Nonaka et al. 1995).

The post-bureaucratic organization is conceived less as a monolithic and isolated construct and is gradually becoming more dynamic as the milieu in which it is situated is characterized by high flexibility and uncertainty. This transformation to the post-bureaucratic organization is – to a great extent – enabled by IT (Malone et al. 2003). As a response to new organizational phenomena, scholars have devoted their efforts to exploring issues such as network organizations (Powell 1990), electronic communication (Fulk et al. 1995), bounderyless career and organizations (Rousseau et al. 1996), technology and roles (Barley 1990), and loosely coupled organizational forms (Sahaym et al. 2007) – just to name a few.

More recently, the journal of Organization Science devoted a special issue (Vol. 18, No. 5, September-October 2007) to the subject where the authors argue that there is an increasing relevance to study the reciprocal relationship between IT and OC, thus advocating a stronger inter-connectedness. Since the phenomena that organizational scholars explore are changing, due to individual and organizational adoption of IT, they are risking using unrelated theories if they do not incorporate these changes (Zammuto et al. 2007). In their own words:

"This emerging coordinative role of IT has made it one of the threads from which the fabric of organization is woven. It is no longer possible to design or modify organizations without recognizing that IT is part of the fabric. And it does not make sense to study the dynamics of human behavior within organizations without taking into account how information technologies might affect it" (, p. 760).

CONCEPTUALIZATION OF IT

Parallel developments concerning conceptualization can be seen within IT. Earlier research has viewed IT as either an external object separated from the organization (e.g. Woodward 1965) or as a mere social construction created by human agents (e.g. Bijker et al. 1987). More recent research treats IT as something that mutually interacts with the organization (e.g. Barley 1986). For instance, in the field of IT implementation, Markus (2004) coins the notion of technochange management so as to elucidate its alignment, and to highlight that earlier failures of implementation are due to isolated mindsets regarding organization and technology.

Likewise, Agarwal and Lucas (2005) allege that in order to understand the transformational power of IT, the artifact must be viewed holistically, instead of researchers being blinded – as is often the case in earlier research – by a micro focus. Furthermore, IT has been prescribed narrow and monolithic characteristics. Instead IT should be seen in a broader perspective taking contextual, organizational and strategic aspects into consideration.

On a similar note, Orlikowski and Iacono (2001b) have demonstrated how research commonly treats IT as a stable and fixed entity, often missing a broader explanation of how IT influences the organization and the social structure in which it is embedded. IT should instead be given dynamic features, they argue, given the emergence of new IT phenomena with social aspects of IT such as open-coding and globally distributed work. With this perspective, IT is a part of the social structure, having a fluid nature and changing depending on time, use and space (Orlikowski 1992).

ASSUMPTION, DATA AND METHODS

We study the interaction of the research fields IT and organization (including OC), mainly by looking at the connections between the fields through their citation patterns. In other words, the examination deals with how IT researchers have cited organization research, and vice versa, which makes this a bibliometric study.

For the sake of data manageability, our material consists of a limited number of journals from each field respectively. In other words, the interaction of the fields is explored through investigating the journals and the incorporated articles. The journal selection is based on Impact Factor (according to SSCI™ and SCI™) – the higher the better, as a high impact factor is considered indicating great scientific importance – and relevance concerning IT and organization. Additionally, in order to see the interaction fluctuations over the last decade, and other trends, the journal sample covers the years 1995-2006. Moreover, journals with European and North American origin are selected. This is so partly to limit the sample to a handy mass of articles, and partly in order to avoid a skewed distribution towards a North American sample (Engwall 1996). Also, personally, we are especially interested in these areas and the interaction between them as regards IT and organization. Of course, the fact that the journal's origin does not say much about the individual article author's origin is acknowledged in the analysis.

To be able to further analyze the interaction, the article collection is divided into two separate groups: One including all articles and one consisting of articles that use specific keywords in their title, abstract, or author-supplied-keywords (table 2).

These keywords are chosen to select articles that primarily deal with IT (sample 1) and OC (sample 2) issues. Of course, the list of keywords could be longer. For instance, words and phrases like ERP, SAP, SIS, electronic communication, re-organization, and innovation could be relevant additional keywords. We did, however, investigate the relevance of several possible additional keywords. For example, a search for ERP rendered no extra hits. Thus, we considered our selection to be fairly adequate. However, here it is simply a matter of putting together an appropriate and inclusive list without pondering endlessly and being too specific. This results in two sample pools – one including IT articles focusing on OC (sample 2), and one composed of organization articles focusing on IT (sample 1). The general idea is to narrow down the total selection and detect IT and OC specific articles. The journal selection (table 1) and the keywords (table 2) are put forth below:

	Journal	Origin	Impact factor
Organization	Academy of Management Review	US	4.515
	Academy of Management Journal	US	3.535
	Organization Science	US	2.815
	Administrative Science Quarterly	US	2.455
	Journal of Management	US	1.954
	Journal of Management Studies	Europe	2.0
	Journal of Organizational Behavior	Europe	1.959
	Organization Studies	Europe	1.583
	Organization	Europe	1.329
	Journal of Organizational Change Management	Europe	0.479
Information Technology	MISQ	US	4.731
	Information Systems Research	US	2.537
	Communications of the ACM	US	1.509
	Journal of Computer Information Systems	US	0.680
	Information Systems Management	US	0.645
	Information & Management	Europe	2.119
	Information Systems	Europe	1.887
	Information Systems Journal	Europe	1.543
	Journal of Information Technology	Europe	1.239
	European Journal of Information Systems	Europe	0.862

Table 1. The Journal Sample

Keywords	
Information Technology (Sample 1) (Keywords used in organization journals to highlight IT specific articles)	Organizational Change* (Sample 2) (Keywords used in IT journals to highlight OC specific articles)
information technology information technologies IT information systems information system	organisational change organisation change organizational change organization change organisational development organisation development organizational development organization development organisation

IS	organisational transformation	transformation
	transformation	organization
	organizational	transformation
	transformation	
	* all plural forms are also included	

Table 2. The Keywords used for Article Selection

The data used in this investigation are downloaded from the SSCI™ (Social Sciences Citation Index) and SCI™ (Science Citation Index), and processed by a number of software applications in order to compile, analyze, and present the material. The major bibliometric software used is Bibexcel and Pajek. The final analysis is based on several bibliometric methods such as co-citation analysis, bibliographic coupling, frequencies, and cross-references analysis. In this study, the methods and analyses are amalgamated, as the methods per se actually play a vital role in the overall scrutiny. However, this is not seen as a problem; instead, the different bibliometric methods are treated as an intertwined part of the analysis. Below is a matrix, which illustrates the main layers of analysis and the five key methods (table 3). Subsequently the different terms and methods are described.

		US 1995-2006	Europe 1995-2006	US + Europe 1995-2006
Organization	with keywords (IT, Sample 1)	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis
	without keywords	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis
Information Technology	with keywords (OC, Sample 2)	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis
	without keywords	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis	• frequencies • top cited • cross-references • shared references • co-citation and network analysis

Table 3. Analysis Matrix

In this paper, frequency analysis simply involves comparing the number of articles published in the different selections for e.g. year and geographic area.

Next, the top cited investigation fairly obviously results in lists of the most cited articles or authors per year and research field. By looking at these articles, authors, and main topics, much can be concluded about the research trends as regards IT, organization and OC over the last decade. What is more, Engwall (1995) and Danell et al. (1997) have shown that similar frequency measures can be useful tools for mapping and analyzing research fields and their interaction.

The cross-references analysis explicates to what degree articles in the IT, organization and OC selections cite each other. It is believed that if many articles in the IT pool cite articles in the organization and/or OC pools (i.e. with or without keywords) at a high frequency, and vice versa, it is a sign of high interaction. Also, for instance, if sample 1 cites sample 2 often, but the same is not the case the other way around, that also says something important about the nature of the interaction.

The fourth bullet point called shared references represents a type of bibliographic coupling where two separate articles – one from sample 1 and one from sample 2 – cite a third article within any of the fields. This can, as theoretically pointed out and practically demonstrated by Danell (2000; 2001), be a rewarding way to examine the levels of interaction between or within research fields. In other words, the shared references method shows whether, and how often, authors from the two different fields base their research on the same sources. Basically, although rather simplified, a high degree of bibliographic coupling indicates a high level of interaction. Though, of course, factors like article topics and authors' scientific extraction have to be taken into consideration before anything possibly definite can be expressed. For more inclusive theoretical descriptions of the method, see e.g. Mählck and Persson (2000), Van Leeuwen et al. (2003), and Moed et al. (2004).

In order to deepen the analysis, an interlinked co-citation and network analysis is done, which results in a graphic illustration of the articles and authors that have the most citation connections within and between the samples. Moreover, these connections are visualized so that the interactional structure is clarified. Another way of putting it is that co-citation studies determine the number of times two separate articles (A and B) are cited by a third article (C) (Mählck et al. 2000). If the two co-cited articles (A and B) are cited simultaneously by many other different third articles (C, D, E…), they are considered belonging to the same research field or intellectual base (Danell 2001). Co-citation analysis has been an accepted scientific tool for a long time now, and it has been proven beneficial when conducting similar research (e.g. Moed 2005; Moed et al. 2004; Schildt et al. 2006). The network analysis essentially involves taking the next analytical step by detecting and visualizing the actual citation links within a predefined article sample (e.g. Mählck et al. 2000; Persson 2000). This is done to see which references are the ones with the most connections and thereby can be considered as important trendsetters.

When co-occurrences analyses are made Salton's Index is used, which normalizes co-citations by the number of citations for the individual articles. Based on this index, the intensity of the citation relationships are shown and the core groups of references are revealed.

As with any research methods, there is, of course, critique against bibliometric methods - some more relevant than other. The most common criticism is probably that merely looking at citations et cetera cannot say anything fundamental about researchers and general scientific activity. In short, critics of bibliometric research question the validity and reliability of the research as they claim that it does not capture the implicit characteristics of science (Borgman 1990; Danell 2001). Occurrences like tacit knowledge and intellectual clusters, of course, cannot be fully explained through only examining formal communication such as research articles, but we believe that bibliometrics can provide significant indicators. These indicators can then be viewed in their context, and play an important part in a more comprehensive analysis.

RESULTS AND ANALYSES

The material is derived from the journal sample and is based on the incorporated articles, excluding e.g. book reviews and editorial notes et cetera. When looking at the citations within the individual articles, though, all publications are comprised. The total number of investigated articles in this paper is 9669, of which 181 included the specified keywords and 9488 did not. The material consists of 4327 articles in the organization field and 5342 in the IT field over the period 1995-2006, and the total percentage share of articles that include the keywords is 2.5% regarding organization and 1.4% concerning IT. Considering the abovementioned calls for interaction and integration between the fields, these percentages seem very low.

One important remark at this stage is that the lead-times for scientific articles and published research topics result in a displacement as regards cause-and-effect. This is so because when the articles have gone through the review process and finally get published, most often a significant amount of time has gone by. This is even more noteworthy when it comes to analyzing change and research interaction, since the research topic itself requires consideration of these matters. In other words, in the current context, there is a time lag between reality and academia that can have a decisive effect on the final interpretation of trends and interaction. For instance, a reaction to the dot.com era might not be seen in academia until well into the 2000s. This is taken into account throughout the paper.

Furthermore, since some of the samples used in this investigation are based on a predefined selection of journals and publication years (1995-2006), occasionally there is an implicit accumulating effect as regards the number of articles. In other terms, every passing year the sample size increases, which results in more material to analyze. Thus, plausibly, the number of e.g. shared references and/or co-citations should increase every year merely for this reason. Consequently, when trends, in this connection, are negative, they can be regarded even more so, and vice versa. This is kept in mind throughout the entire study.

General Remarks

Concerning the organization field, our investigation shows that during the last decade there has been a continuous positive trend as regards the number of published articles within the specified journal sample in Europe (+46.26%), but a very slight decline when it comes to the US (-19,77%). This might depend on contextual factors such as the increasing popularity concerning scientific research in Europe, resulting in escalating publication frequency and number of articles per issue. Also, while the number of articles published in the US (-16.48%) has experienced a dip during the last years (2005-2006), the opposite is true for Europe (+4.93%).

Moreover, the trend regarding the number of published articles within the IT field is quite similar to that in organization although, in the IT field, the overall development has been continuously positive irrespective of geographical location (+2.28%). Furthermore, it is interesting that, in Europe, the number of published IT-articles decreased (-2.78%) during the most recent time period (2005-2006), while it is the other way around as regards organization (+4.93%). Also, there is a clear peak, concerning the IT field, for the period of approximately 2002-2003 (+19.45%), which might be a reaction to the intense digitization during the late 1990s.

In general, though, and in line with previous discussions, the trends were expected to be more aggressively and continuously positive during the entire time period due to the increasingly digitized world. In addition, a downturn regarding the number of published articles in the IT segment around 2003-2004 was identified (-15.13%). This is also true when it comes to the number of published articles in sample 1 (-50.00%). On a more speculative note, this might indicate a move from a digitization to a post-digitization era, resulting in less interest in IT and digitization. These observations might not be of crucial interest here, but it confirms that the publication opportunities for articles with an interactional approach have not decreased significantly in any respect, at least not concerning the number of possible pages.

Looking at sample 2, the trend has been that the interaction has been low and rather stable during the last decade (-13.33%). It would have been desirable, though, or at least more logical, for the composite development to be continuously positive. For example, organizations (especially in association with OC) are far more saturated with IT today than in 1995 through e.g. the Internet and ERP (Enterprise Resource Planning) systems. Thus, all this strengthens the notion of low field interaction. Contrary to the above, the trend regarding sample 1 has been much more positive. Still, the number of articles in the US has been decreasing within both samples, while the European trends are positive.

Another interesting fact is that there seems to be some truth to the recent speculations (Orlikowski et al. 2001a; Zammuto et al. 2007) about the amount of cross-fertilization (or interaction) between the fields of IT and organization (and OC). For instance, the organization field almost exclusively refers to journals within the own field – MIS Q being the only IT journal in the top ten cited journals in the keyword selection. Conversely, organization is more frequently referred to in IT journals (even without the keywords). This might be an effect of the IT field being relatively new and less conservative, and therefore more open to influences from other fields.

An additional analysis of the top cited authors in sample 1, sample 2, and the complete selections (without keywords), rendered a fragmented and disparate picture indicating low levels of interaction. This so because a highly limited number of authors appear in all samples. Thus, there are a few authors that appear in both fields and samples, most notably Orlikowski and Davenport. It seems reasonable to assume that they represent a view of the fields as being highly intertwined and in need of interaction. Of course, they might focus entirely on IT when being published in the IT related journals, and vice versa, but that is considered very doubtful. Moreover, an examination of the top cited articles, and their contents, shows that the IT related articles, in general, more often talk about IT in an organization context, while OC research does not take IT into consideration to the same extent. The trend, however, is that OC research in recent years has started to focus more on IT.

Further Results, Discussions, and Analysis

Given the above, the argument presented in Zammuto et al. (2007) – that there has been a significantly low amount of interactional research dedicated to the subjects of organization (and OC) and IT – is well grounded. Because of the notion that the post-bureaucratic organization is highly intertwined with IT, these findings can even be considered somewhat

conspicuous. However, up until now, the results have been inconclusive and somewhat disperse. Therefore further analyses are developed below (figures 1-5 and table 4), and the following elaborations, in greater depth, illustrate the citation patterns within and between the various selections of articles:
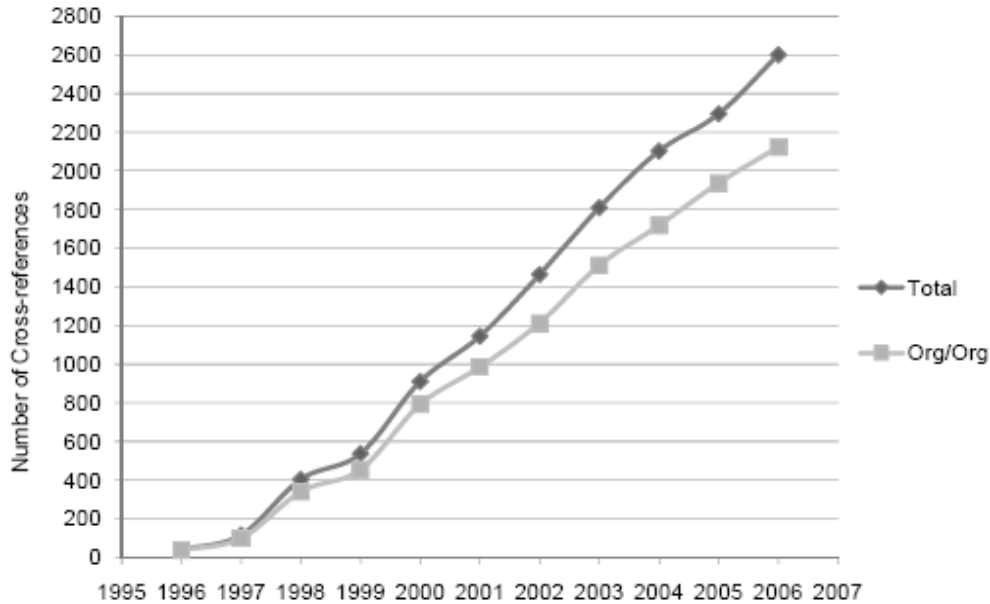

Figure 1. Cross-references within IT and Organization for the entire Selection

Regarding the cross-references between the IT and organization fields (figure two), there is a positive trend, and more specifically, a clear tendency for IT to cite organization, while organization is citing IT significantly less – signifying a low interaction. This further underlines the aforementioned argument concerning the low tendency for organizational scholars to cite publications in the IT field.

Figure one primarily serves as a point of reference to demonstrate how much lower the number of cross-references is between the fields. Moreover, the same graph clearly illustrates that the organization field frequently cites within its own discipline. In contrast, the IT field is less internally integrated, which might suggest a more open attitude towards influences from outside its own immediate area.

Based on the nature of the cross-references both within and between organization and IT, one might speculate that the observed tendency is due to the fact that organization is an older field compared to IT, and a more closed discipline. It is, however, noteworthy to point out – regarding both figures above – that there is an accumulating effect concerning the number of articles – due to the fact that the sample size increases every year – which should give a higher number of citations as the years go by per se. As a result, reasonably, a positive trend can be regarded even more so, and vice versa. This further emphasizes the low interaction.

In order to nuance this picture, an investigation of the cross-referenced and cross-published authors follows below:

Sample 1: 108 IT articles published in Organization journals
The articles consist of 133 Authors and 51 of these (38%) are referred to by the OC articles published in IT journals
3 articles were directly referred to by the OC articles published in IT journals
Top 5 cited authors: Orlikowski WJ   Walsham G

Robey D
Hirschheim R
Ciborra C
Sample 2: 73 OC articles published in IT journals
The articles consist of 195 Authors and 26 of these authors (13%) are referred to in the IT articles published in the Organization journals
4 articles were directly referred to by the IT articles published in Organization journals
Top 5 cited authors: Orlikowski WJ Markus ML Robey D Pinsonneault A Sahay S
Cross-published authors: Hirschheim R Levina N Montealegre R Orlikowski WJ Pinsonneault A Pozzebon M Robey D Ruhleder K Sabherwal R Sahay S

Table 4. Cross-references Analysis - authors (with keywords)

In all, the result from this cross-reference analysis (table four) reconfirms the argument – that the IT field is more open – presented in connection to table four. This is so because the 108 articles published in organization journals (sample 1) refer less frequently to IT (13 %), compared to the 73 OC articles (sample 2) that are more prone to incorporate organization citations in their reference lists (38 %). Considering that both samples consist of articles on similar subjects, the frequency of cross-references is significantly low. The number of cross-references further shows that there is low interaction between the fields when it comes to the directly referred articles. Additionally, there seem to be a few recurring authors that publish, and are cited, by both fields – thus constituting interactional forces. Among these, Orlikowski and Robey are the most significant ones. It is also noticeable that Orlikowski alone gets an exceptionally high number of citations – twice as many as the second most cited author in both samples. Moreover, a large amount of the cited authors are information systems scholars. For example, all top five cited authors in both selections, and nearly all the authors that have been cross published, are connected to information systems departments.
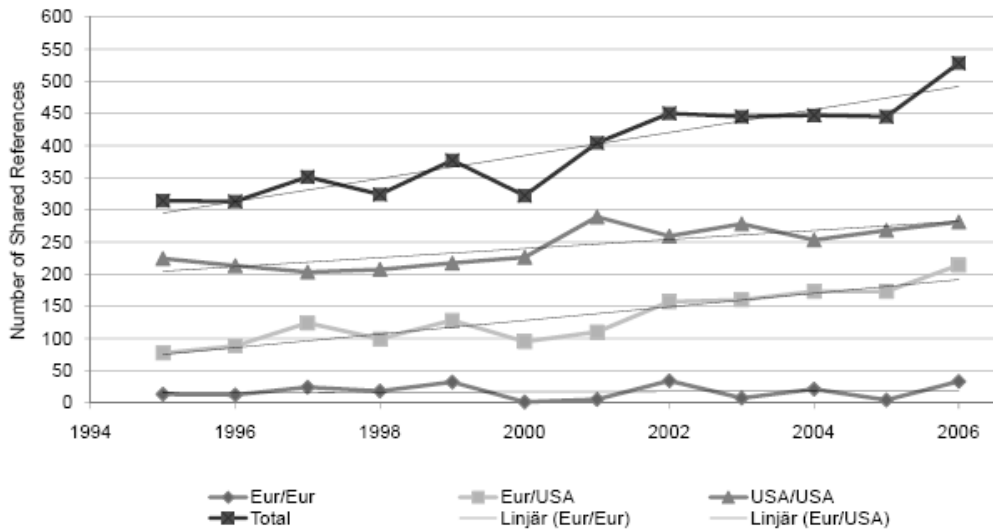
Figure 3. Shared References between IT and Organization Research (without keywords)

This graph (figure three) illustrates shared references – i.e. how many times an article in an IT journal and another article in an organization journal cites the same source within any of the sample pools. This is a good indicator of interaction simply because if articles from the two fields use the same references they are considered likely to rest upon a similar knowledge base and, in the end, treat organization and IT as intertwined phenomena.

In Europe there has been no significant increase while the trends in the US, between the US and Europe, and in total, have been positive. Although these trends might contradict what has been suggested earlier – that the interaction is low – one has to keep the before mentioned accumulating effect in mind, and consider that the number of shared references in general is very low. Also, the graphs with keywords presented above display only a few articles. This makes the conclusion that the interaction is low still very plausible.
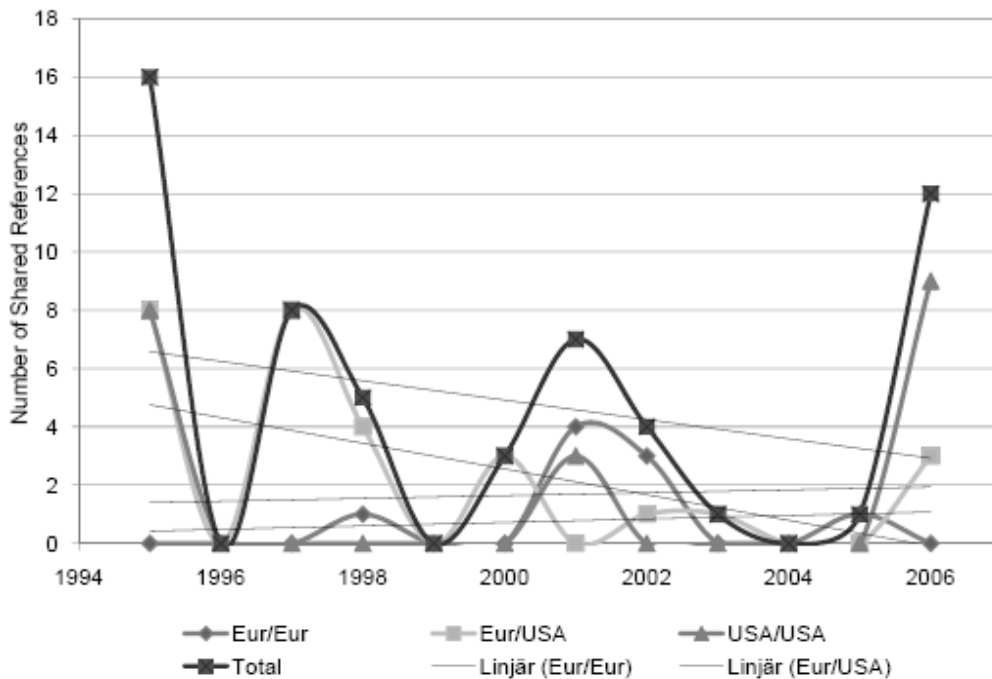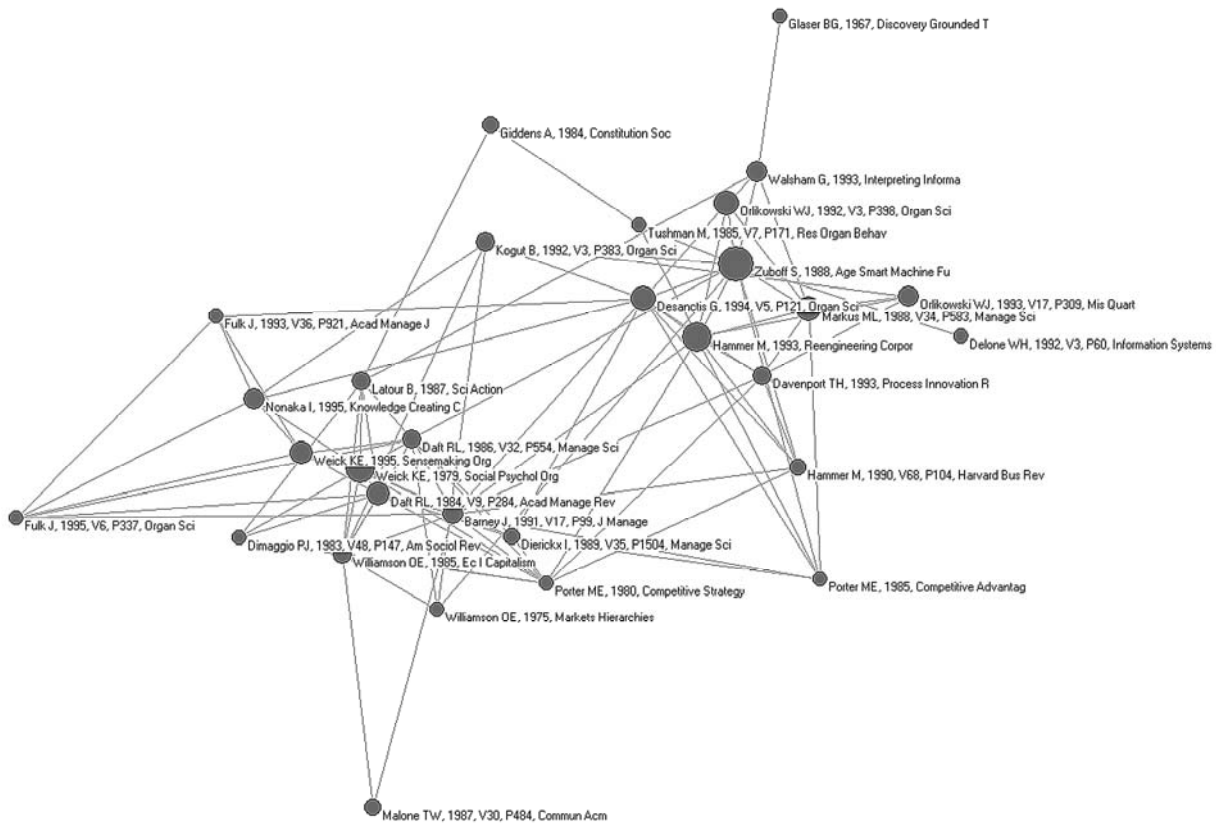

Figure 4. Shared References between sample 1 and sample 2

For this selection (figure four), it is interesting to see that the number of shared references between the samples was considerably higher in 1995 than in 2006 for both the total and between Europe and the US. In Europe there was a peak around 2001, but during the rest of the investigated twelve years there were almost no shared references at all. The curves for the number of shared references for the US, between the US and Europe, and the total, have fluctuated rather similarly with peaks around 1995, 1997, and the turn of the millennium. There was a general peak around 2006 as well, except for in Europe. These fluctuations might depend on many different factors. For instance, the peak around 2000 could be a response to the dot.com era, and the downturn after 2002 could be a reaction to the intense digitization in the late 1990s resulting in a decreased interest as the digitization matures. On the whole, the trends have been negative as regards the total and between the US and Europe, and positive concerning Europe and the US. The most important remark here, though, is that the general number of shared references is very low, which contributes to the notion of low interaction between the fields.

The network diagram (figure five) shows the most important references (all kinds of published material, not only articles) – and the links between them – within sample 1 and 2 for the entire time period 1995-2006. The size of the dots represents the number of citation connections and the strength – through Salton's index – of the links. In other words, the circumference of the dots corresponds to the frequency of citations, and the length of the lines between the dots illustrates the degree of co-citation. Therefore, the longer the distance between the authors, the lesser they are cited together.

Furthermore, while it is an illustration of the interaction between the samples, the citation links and the theoretical significance within each field are also considered. Thus, the description includes the interaction between and within the samples. Consequently, the references with the biggest dots might not be the most important ones for the interaction, but they are indeed the key elements when including all aspects and selections. Nevertheless, the interaction is still highly represented by the size so, all things considered, it is very much plausible that the references with large dots also play important parts as regards the IT and OC interaction.

When examining the diagram, it is fairly easy to identify two main clusters. The one to the upper right mainly consists of IT references in the selection, and the one to the lower left chiefly includes organization (and OC) references from the selection. Moreover, it is obvious that there are many more connections within the clusters than between them, which indicates low interaction.

The main significance of the network diagram for this investigation is that if the previously identified authors and articles with high interaction influence appear with considerable dot size and/or occur several times (preferably in both clusters) in the diagram, with many links, it is positive for the interaction. All things considered, though, this is not the case here. However, some authors occur a number of times, which further strengthens the impression that certain authors constitute interactional, or integrating, forces.

DISCUSSION

The results of this investigation indicate a low general interaction of IT, organization and OC. A telling example of this is that the share of articles including the predefined keywords never exceeds three percent during the entire time period 1995-2006, for either sample. Furthermore, the number of shared references between the fields is constantly low – especially when looking at sample 1 and 2 – even though it has increased slightly over the years.

More specifically, disregarding the overall very low interaction, the total interactional development has been vaguely positive the last twelve years. It has been more so in Europe than in the US. Moreover, examining the total trends, the IT segment has shown a positive interactional trend whereas the opposite is the case for organization.

On a speculative note, the lack of a clear increasing interaction might be an effect of implicit references to IT, for instance, when studying OC within the post-bureaucratic organization. Considering this, still, we argue that the number of articles addressing OC and IT, respectively, is low.

We see several indications that IT research pays more attention to organization and OC matters than the other way around. Thus, it seems like researchers within the IT field are more likely to think of IT in an organization and OC context than organization and OC researchers are prone to include concepts of IT in their scientific activities. For instance, IT-articles published in organizational journals are predominantly written by authors from information systems departments. All this is thought of as rather odd in view of the digitization of society and business that has been going on for so long.

Another example of the above is that the number of co-citations between the fields of IT and organization is diminishingly small for the entire selection between 1995 and 2006, even without the keywords. On the other hand, the number of co-citations within organization is approximately 35 times higher, and as regards IT, the number is roughly three times higher. This obviously suggests a low interaction between IT and organization, but also that the organization field has a far greater internal integration than IT. In turn, this might indicate that the IT field is looking outside its own research arena for influences much more than the organization field – for better or for worse. Subsequently, this could be regarded as a confirmation of the notion that the IT field is younger, more explorative and open than the more mature, closed and esoteric field of organization. These thoughts, however, are fairly speculative.

Furthermore, it is clear that some authors – like Orlikowski and Robey – and articles (and even journals) can be regarded as vital interactional (or integrating) forces. This is so because they, evidently, are of great scientific importance, and they appear in all three fields. The question that arises, however, is whether an informal community (Hambrick 2007; Kuhn 1962) of scholars – that subscribe to the view of IT, organization, and OC as reciprocal and highly intertwined phenomena – is currently forming. According to the research at hand this seems to be the case and, if so, these scholars eventually have the potential – through activities like referencing, work collaboration, and conferencing – to form a new academic field.

However, even though we can see vague indications of such a development, the present stage of digitization calls for a much higher rate of interaction.

CONCLUSIONS, OR WHERE DO WE GO FROM HERE?

The paper contributes with empirical evidence of earlier theoretical discussions (e.g. Orlikowski et al. 2001a; Zammuto et al. 2007). We expected to find a clear and increasing interaction between the fields of IT, organization and OC but what we found instead was rather the contrary. But so what, and where do we go next? With the present exploration as a starting-point, our theoretical and empirical recommendations for achieving – the presumably necessary – cross-fertilization between IT, organization, and OC are the following:

- As most of us have experienced, the accumulating use of IT is becoming increasingly invasive in organizations as well as in everyday life. Because of this, scholars should treat IT less as an isolated and monolithic tool, and more as a broader and omnipresent phenomenon with a fluid nature that influences the way work is organized and executed.

- Since IT – in many respects – drives change, and is continuously transforming, it makes change resemble a process of a moving target rather than a synoptic event of a transition from stage A to stage B. In other words, change is more of a fluid and continuously transforming process and less of a collection of static and isolated events. This implies that research should avoid providing snapshots of change and instead consider e.g. a longitudinal and/or process approach.

- IT has the potential to unbound work and organizing from time and space. Therefore scholars should look beyond the immediate boundaries closely associated with the classical bureaucratic organization. This further implies that, since IT both disables and enables work, the organizational scholars that avoid taking IT into consideration are missing the bigger picture.

- Scholars ought to actively seek the nexus between IT, organization, and OC in the empirical world. This can be done in several ways. One example would be longitudinal case studies of the implementation and utilization of enterprise resource planning systems. In such studies the researcher should follow the traces of IT left in the social and organizational context. This translates into attentiveness for the practices that are obliquely connected to the technology such as learning, management issues and new roles and routines. In doing so, our recommendations aligns with recent research (e.g. Leonardi et al. 2008) that urges scholars to avoid mingling ITs materiality with determinism, and voluntarism with the social in their accounts of change. To do so, however, require researchers to take a step back and ponder the questions of the epistemological and ontological nature of the material and the social and, in turn, the interaction between IT, organization, and OC.

- Last, we conclude that the academic world has been falling behind the empirical one. Therefore it is vital that we work together in order to bridge the boundaries that legacy has set out for us by cross-disciplinary activities such as co-writing, joint conferences, and collaborative in-depth theorizing and discussions. In other words, we encourage a communion between the academics of IT, organization, and OC if we are to understand the technology we use in everyday life, as well as the way we manage our organizations.

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