IT ARTIFACTS AND THE STATE OF IS RESEARCH

Completed Research Paper

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Abstract

To understand the state of IS research is, to a large extent, to understand (1) what are considered IT artifacts by IS scholars, and (2) how do IS scholars approach IT artifacts in their studies. This study addresses these two questions by providing a conceptual model of five types of core IT artifacts and a five-facet framework of IS scholars' approaches to studying IT artifacts. Using a critical literature review, the conceptualizations are tested with the collective wisdom by IS scholars in the most recent IS studies published in the 2009 and 2010 ICIS proceedings. The findings shed light on where the IS discipline is standing in terms of its focus on IT artifacts. Implications for research and practice are discussed. This study contributes to our continued understanding of the development and evolution of the IS discipline and the potential directions it may take.

Keywords: IT artifact, approaches to studying IT artifacts, IS research, critical literature review

Introduction

The identity of the IS discipline, as well as the state of IS research, has been tightly bound with the notion of the IT artifact because IS research has been traditionally situated around people, organizations, and technology (Hevner et al. 2004; Orlikowski and Iacono 2001). Therefore, the question of how to conceptualize the IT artifact has been an issue at the center of longstanding debates within the IS discipline, with the most recent from 2001 to 2005 (Agarwal and Henry C. Lucas 2005; Alter 2002; Alter 2003; Benbasat and Zmud 2003; Hevner et al. 2004; Orlikowski and Iacono 2001; Saunders and Wu 2003; Weber 2003; Whinston and Geng 2004). All too often, IS scholars disagree or express ambivalence about whether certain studies should be regarded as research in the IS discipline, or belong in another discipline such as marketing, management, finance, computer science, engineering, communications, or sociology, to name a few. Such disagreement may stem from the particular IT artifact (or lack thereof) being covered, its relevance (or position) in regard to the phenomena under investigation, the context in which it is situated, and the research approach taken. Additionally, technologies are consistently evolving and transforming, thus changing and forming new phenomena that continue to attract IS scholars' attention. As people develop, exploit, and apply IT for different activities in different contexts, additional challenges can present themselves such as what the main object of a study is or should be and what an IT artifact is or should be.

To understand the state of IS research is, to a large extent, to understand in what ways IS scholars approach IT artifacts (Orlikowski and Iacono 2001). Despite recent efforts to understand scholars' approaches to IT artifacts (Akhlaghpour et al. 2009; Nevo et al. 2009; Zhang and Scialdone 2010), several pertinent questions still remain. For example, to what extent do recently published studies consider IT artifacts? What are the IT artifacts being studied collectively by IS scholars? How do IS scholars conceptualize and approach IT artifacts? In what contexts and from what perspectives are IT artifacts studied in IS research? Beyond these questions, defining the IT artifact has continued to be a challenging endeavor for the IS field.

The purpose of this study is to address two questions: (1) What are considered IT artifacts by IS scholars? (2) How do IS scholars approach the IT artifacts? We first develop a conceptual understanding of IT artifacts that represent IS scholars' interests and efforts, and reflect many notions of IT artifact in the IS literature. Then we construct a multi-facet framework to outline the ways scholars study IT artifacts. Guided by these conceptualizations, we examine the most recently published research articles that represent the IS discipline. Specifically, we apply multiple coding schemes to the most recent two years (2009 and 2010) of completed research papers published in the proceedings of the International Conference on Information Systems (ICIS). With both quantitative and qualitative analysis results, we provide discussions and implications for the IS discipline.

Conceptual Development

To address the two research questions, we first develop a conceptual understanding of IT artifacts that comply with existing notions in the IS literature.

IT Artifacts

Among the many notions of IT artifact, Table 1 lists several of the most cited ones. These notions demonstrate that IT artifacts have both material and abstract properties. Capabilities of IT artifacts are created, developed, applied, implemented, integrated, and administered to support certain human endeavors. IT artifacts also have diverse manifestations and forms. They might be configured in various ways to compose different hardware, software, applications, and innovations. The notions from King and Lyytinen (2004) and Agarwal and Lucas (2005) point out IT artifacts' information processing capabilities. IT artifacts process information or other types of input based on pre-defined rules, logic, structures, routines, and values embedded in them. In addition, the notions from Benbasat and Zmud (2003) and Agarwal and Lucas (2005) highlight the applications of IT artifacts to serve specific purposes and needs in contexts and the resultant interactions between contexts and IT applications. From these points of view,

IT artifacts are both instrumental and contextual. Hence, they are applied in organizational settings, personal settings, and in other social contexts of relevance (Benbasat and Zmud, 2003). Benbasat and Zmud's notion is consistent with that by Hevner et al. (2004) in that the latter conceptualizations and classifications embody the approaches system designers might take and produce to solve specific problems identified in specific contexts. Their notion implies practical applicability and pragmatic significance of IT artifacts Overall, these notions tend to address IT artifact designers' or planners' work and contexts to fulfill their stakeholders' needs.

Table 1. Popular Notions of IT Artifacts

Source	Description
Orlikowski and Iacono (2001)	"bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (p. 121)
Benbasat and Zmud (2003)	"the application of IT to enable or support some task(s) embedded within a structure(s) that itself is embedded within a context(s)," whereby its hardware/software design "encapsulates the structures, routines, norms, and values implicit in the rich contexts within which the artifact is embedded" (p. 186)
King and Lyytinen (2004)	"systematic processing of information in human enterprise" (p. 541)
Hevner et al. (2004)	"constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems)" (p. 77)
Agarwal and Lucas (2005)	"the integration of the processing logic found in computers with the massive stores of databases and the connectivity of communication networks", so that it "includes IT infrastructure, innovations with technology, and especially the Internet" (p. 394)

Since the purpose of our study is to reveal what IT artifacts are being studied and how they are studied by IS scholars, we do not adopt any one ideology expressed from the existing debates, but rather consider all notions that are either openly or subtly expressed by the scholars. This is in agreement with considering IS as a fragmented adhocracy (Banville and Landry 1989). We believe that it is healthy to allow IS scholars to explore whatever IT artifacts they are interested and take whatever approach to investigating IT artifacts that they deem appropriate. Only in this position can we capture and understand the current state of IS research. Specifically, we develop the following general definition of IT artifacts as a guideline to examine existing research articles in our empirical study stage.

> *An IT artifact is an entity/object, or a bundle thereof, intentionally engineered to benefit certain people with certain purposes and goals in certain contexts. It is developed, introduced, adopted, operated, modified, adapted, discarded, and researched within contexts and with various perspectives.*

This is to say that IT artifacts cannot be made sense of without considering contexts, purposes and beneficiaries. This is in agreement with the notions in Table 1 as well as the majority of IS studies that we are familiar with. On the other hand, one still needs to pin point the entity/object or the bundle thereof that are at a more refined level and exist for their own sake without contexts and other factors. For example, the notions in Table 1 touch upon elements such as hardware, software, communication networks, etc. For the purpose of developing, adopting or using, or studying IT artifacts, there is a need to clearly identify the core elements of IT artifacts that exist independent of the contexts, purposes, and beneficiaries. Such core elements focus on the WHAT aspect of IT artifacts, and not so much on the meaning (SO WHAT) of the IT artifacts in a particular phenomenon a scholar is interested in. Based on our examination of existing notions of IT artifacts, we identify the following five specific core elements: *hardware, operating and system software, application software, application content, and auxiliary artifacts*. Among these five, the first four can be considered tangible elements or IT artifacts, and the final one represents intangible elements.

Operating and system software give basic and general functionalities to the hardware (devices, equipments, raw machines, peripherals) and other computational resources and infrastructures. Application software facilitates more advanced and specific functionalities that are specific to the

purposes, goals, and/or contexts. Application content is data or information that is collected, organized, stored, manipulated and otherwise made useful to represent and support human activities in a particular application domain. Auxiliary artifacts depend on and extend the tangible IT artifacts to provide additional meanings, characteristics, aspects, attributes, substances that make the tangible elements feasible, doable, and eventually usable. These intangible elements are dependent on and about the IT artifacts. Such are similar to the auxiliary materials of a textbook (such as instructor's kits, test bank, and lecture materials, among others). Therefore, we coin the term "auxiliary artifacts" to represent human-constructed elements that cannot exist by themselves, but add value and meaning to tangible IT artifacts. For example, the intellectual property behind Microsoft Word (application software) is not tangible, but has its own meaning that has been created by humans, is relevant to particular parties, and is an element of value to certain stakeholders. Another example is authentication policies of application software, without which, the application software would not function properly.

Each of these five types may be dependent or built on other types when they are part of one specific IT artifact bundle. Yet, a particular research study or a particular IT development project may have a specific IT artifact as the target that can be in any of these types. For example, a study on users' acceptance of authentication policies of application software at a particular organization may only consider the authentication policies of application software as the IT artifact, rather than the application software or anything underneath it.

Approaches to Studying IT Artifacts

The notions of IT artifacts may be broad and ambiguous (such as King and Lyytinen 2004), or narrow and specific (such as Agarwal and Lucas 2005), or anywhere in between. Yet, it is commonly understood by IS scholars that IT artifacts cannot be studied in vacuum. In order to make sense of IT artifacts for their meanings and roles, scholars very often consider a set of factors when examining IT artifacts. In addition, scholars may be interested in certain phenomenon surrounding IT artifacts, not on or about IT artifacts. For example, research on IT professionals or outsourcing policies is not quite about IT artifact per se, thus sometimes IT artifacts cannot be clearly identified in these studies. Thus, to truly understand the state of IS research, any analysis of the discipline benefits from considering multiple factors regarding the identifiable factors in IS studies. Such is consistent with the approach of Zhang and Li (2005) who suggest that research can be examined upon a number of facets to truly reveal its nature, and to understand it in relation to other studies. In this study, we use a framework that includes a number of dimensions to depict an IS study: perspectives, contexts, beneficiaries, views and roles, and methodological orientations. We acknowledge that this framework may not represent all possible facets of an IS study. Yet, the framework can guide our investigation to understand and appreciate the richness of IS research.

Perspectives

Given a particular phenomenon, scholars can approach it from different perspectives. For example, Malone (1985) lists four perspectives for design-oriented theories: information processing perspective, motivational perspective, economic perspective, and political perspective. The perspective a scholar takes can be indicative of the reference disciplines he or she draws upon and the research approaches used in a study.

In recent IS research, we commonly see that scholars may approach a particular study from any of the following broad perspectives: managerial, behavioral, economic, and technological. Studies with a managerial perspective focus on managerial aspects and implications. These might be about risk or asset management, system development control, integration and implement of ERP systems or IT innovations in specific organizations, and functionality of IT services. These studies often draw from disciplines such as business, management and organization sciences. Studies with a behavioral perspective place an emphasis on the human side of a IT related phenomenon, and typically borrow theories and approaches from psychology, sociology and other behavioral and social sciences. Such studies may be interested in non-developers' participation in open source communities, users' acceptance of and interaction with specific ICTs, revoking behaviors of buyers and sellers of e-Commerce websites, and knowledge sharing practices in global organizations. Those with an economic perspective may be interested in managerial decisions in IT investment in specific organizations or countries, the relationship between viral pricing

strategies and competing technologies, scale economies of firms employing different software delivery business models, and market configuration of software products. Such studies are likely to draw upon theory and research from economics and are concerned with business values and return on investment. Finally, studies with a technical perspective are likely to investigate technical issues or solutions, focusing on development methodologies, approaches, mechanisms, or systems to improve various human endeavors or solve problems by technological means. These studies may integrate knowledge and approaches from computer science or engineering.

Contexts

The context in which a study is carried out is important to understanding the findings, their implications, and potential applicability and generalizability. This is explicitly consistent with some of the descriptions provided in Table 1. Orlikowski and Iacono refer "cultural properties", while Benbasat and Zmud (2003) describe the IT artifact as including norms, structures, and values of the "rich contexts" within which it's embedded. The importance of considering the context of a study can also be seen by looking back at the early days of the IS discipline. Avgerou (2000) note that researchers in IS have increasingly expressed interest in the impact of technology in contexts beyond the workplace. Zhang and Scialdone (2010) note that "it has been well recognized that although the IS discipline was initiated within the organizational context, current research interests have extended to phenomenon outside of this context" (p. 1255). As such, the context where IT artifacts are studied helps us understand where scholars are rooting their conceptualizations of IT artifacts, not just simply what their conceptualizations are. In examining a selected set of studies in the IS research, Zhang and Li (2005) identify the major contexts within which researchers situate their investigations: organization, commerce or marketplace, home, social, cultural, and other.

Beneficiaries

IS studies have traditionally focused on analyses at the individual, group, and organizational levels. The notion of the user as the primary beneficiaries has been widely expanded on by IS scholars (DeSanctis 2006; Preece and Shneiderman 2009). All IT artifacts are created by humans to support activities that are consequently important to humans. The notion of context somewhat speaks to this, representing where the IT artifacts are used, and consequently what types of users find an artifact meaningful. However, the activities that IT artifacts support in a given context may be considered based on the level of human engagement required to make the activity meaningful. That is, a specific IS phenomenon studied by scholars may involve one or more individuals engaged with IT artifacts for an activity. Such leads us to analyze IT artifacts in terms of supporting their users at different levels: individual, group, organization, and community.

Views and Roles

IS scholars do not all share the same worldviews, epistemologies, and methodological orientations. Even the same IT artifacts within the same contexts can be investigated distinctly through different phenomenological lenses, focusing on different aspects of the IT artifact. Thus scholars' various conceptualizations of IT artifact are critical to the understanding of the current state of IS research. Based on a critical analysis of research articles published in ISR during 1990 to 1999, Orlikowski and Iacono (2001) inductively develop a conceptual framework showing five categorical views and fourteen specific roles IT artifacts conceptualized by IS scholars. These are summarized in Table 2.

Orlikowski and Iacono's framework (referred to as O&I in the rest of this paper) has been adopted in several efforts to depict approaches to studying IT artifacts in IS literature. Akhlaghpour et al. (2009) use the same coding scheme for views and roles to analyze all research articles published between 2006 and 2008 in three IS journals: ISR, JAIS and MISQ. They observe that "nearly 10 years after the original call by Orlikowski and Iacono, even fewer studies employ rich conceptualizations of IT artifact" (p. 7); they believe their study highlights "the needs for (a) defining the concept of IT artifact in a clearer and more encompassing fashion, (b) paying more attention to materiality of IT, and (c) mindfully revising the institutional barriers to theorizing about IT artifact" (p. 10). Zhang and Scialdone (2010) apply

Orlikowski and Iacono's coding scheme, along with context and granularity, to analyze ICIS 2009 proceedings papers. Capturing the contexts of research studies allows examining not only what is conceptualized as an IT artifact, but also where the impact or significance of the IT artifacts occurs. Capturing granularity (an IT artifact is general, specific, or a feature of another named artifact) allowed comparisons of IT artifact coverage in different studies.

Table 2. Views and Roles of IT Artifact (Orlikowski and Iacono 2001)

View	Role	Definition
Nominal View	Absent Technology	IT is invoked in name only, or as background details, or conceptualized in a relatively broad and general way
Computational View	Technology as Algorithm	IT is developed, or represented or manifested through the computational algorithms that yield specific functionality to serve specific purposes
	Technology as Model	IT is represented by data simulation, or specifying, building, and programming models
Tool View	Labor Substitution Tool	IT is designed to performs specific activities to replace or substitute human efforts
	Productivity Tool	IT as labor augmentation, extending or enhancing human productive capabilities
	Information Processing Tool	IT as managing, storing, and/or controlling flow of information, and access to it
	Social Relations Tool	IT alters or enhances social relations (or roles) through media and communication
Proxy View	Technology Perception	IT is indirectly approached by how humans perceive it in contexts
	Technology Diffusion	IT is represented by measures of diffusion and penetration
	Technology Capital	IT is conceptualized and measured by costs associated with tools or infrastructures
Ensemble View	Development Project	IT as a work in progress, focused on social design, development, and implementation processes
	Production Network	IT as a work in progress, with focus on the group-level of development and implementation
	Embedded System	IT is conceptualized as shaped by dynamic, complex social contexts
	Technology as Structure	IT as it embodies social structures, purposefully designed with sets of rules and resources that might alter original practices

Methodological Orientations

Another dimension that can show the state of IS research is the methodological orientation taken in a given study. Hevner et al. (2004) note two distinct paradigms that make up much of research seen in IS: behavioral science and design science. Of the behavioral science paradigm they state that much of this research is geared toward predicting or explaining phenomena that occur with respect to the artifact use (intention to use), perceived usefulness, and impact on individuals and organizations (net benefits) depending on system, service, and information quality (DeLone and McLean 1992; DeLone and McLean 2003; Seddon 1997). Design science "creates and evaluates IT artifacts intended to solve identified organizational problems. Such artifacts are represented in a structured form that may vary from software, formal logic, and rigorous mathematics to informal natural language descriptions" (p. 77).

As these two paradigms speak to how researchers may approach the IT artifact, we find justification for the importance of capturing researchers' methodological orientations. For the sake of this paper, we broadly group methodological orientations by empirical, non-empirical, or design science research. Empirical studies rely on observations to answer research questions by carefully constructed qualitative or quantitative inquires with data elicitation, collection, and analysis. Non-empirical studies are often based on ideas, frameworks, and speculations rather than systematic observations (Alavi and Carlson 1992). These two categories address research that is geared toward the behavioral science paradigm as described above, focusing on predicting or explaining phenomena. Design science research, meanwhile, is geared toward the creation and evaluation of new and innovative artifacts intended to extend the boundaries of human and organizational capabilities (Hevner et al. 2004).

Research Method and Data Analysis

This study utilizes a multi-facet critical analysis of the publications of the IS research. Similar to the approach taken by Zhang and Scialdone (2010), in order to exhibit a holistic picture of the state of current IS research in terms of what IT artifacts are and how they are studied by IS scholars, as well as to make the task manageable, we decided to use the completed research articles from the proceedings of the International Conference on Information Systems (ICIS) over the last two years (2009, 2010). ICIS is the most prestigious annual IS conference, representing the breadth of interests within the discipline as opposed to journals which often have specialized themes or styles that may bias their selection of the acceptable articles. Additionally, choosing to focus on conference papers rather than journal articles has the advantage of timeliness, as research tends to take much longer to get published in journals than in conference proceedings. Consistent with past research similar to what we present here (Akhlaghpour et al. 2009; Orlikowski and Iacono 2001; Zhang and Scialdone 2010), only complete research articles are selected, excluding those that focus on the field's debates, identity, or development. We also exclude papers that are about research methods, research-in-progress, teaching cases, and panels. As a result, a total of 274 papers (127 in 2009 and 147 in 2010) are selected for data analysis.

Each paper is examined and coded along the various facets discussed in the conceptual development section. In addition, for most of the papers, we were able to extract the exact IT artifact(s) being studied using the authors' original terms. For empirical studies, the IT artifacts are often found in the research method sections where the specific IT artifacts (if any) are described or implied.

A two-step approach was used in preparing the data before analysis: Step 1 includes examining, coding and validating the results; Step 2, which occurred several months after Step 1, revalidated the results by randomly sampling a subset of the 274 papers. Specifically, Step 1 includes examining and coding papers through an iterative process. Two authors independently coded a small subset of articles from 2009 on the facets, compared and discussed (mediated by the third author when necessary) any disagreements, adjusted understanding, and continued with the rest of the 2009 papers. For the 2010 papers, the two coders divided the papers into two sets and each coded his/her set independently. Then each coder did a sampling of 10% papers from the other coder's set for reliability check. Then coding results of the entire set of papers on all facets were crossed checked for coding reliability. For example, we rechecked all the papers that were coded with "non-empirical" method and the role of "development project" because such a coding combination does not make sense. Similarly, we re-examined all the papers that were coded with an empirical method and a technological perspective because such a combination does not match our understanding. When some combinations could happen but did not, such as studies that used design research method and the tool view, we rechecked again to make sure that was the case. Whenever there were doubts on any aspect of any paper, all three authors re-read the paper and discussed it until consensus was achieved. This process continued until we felt confident that the coding results accurately represented the tenets of our conceptual framework, and that there were no coding discrepancies due to different understandings or human errors. In Step 2, four months after Step 1 was finished, a subset of 60 out of the 274 coded papers were randomly selected from the two years, freshly coded by two authors independently along two facets (the most difficult ones we encountered in Step 1, including the views, roles), then discussed and finalized with the involvement of the third author. The finalized results in Step 2 showed a less than 6% of difference in the two facets from the results in Step 1. Thus we are confident that our coding results reflect our conceptualizations.

The coding results were analyzed descriptively and qualitatively along individual facets and across multiple facets.

Analysis Results

In this section, we present the findings based on the conceptualizations we detailed before. In doing so, we address the research questions raised in the introduction section.

IT Artifacts

For empirical studies or design research where there is a section that describes the research method and/or data collection, we extracted information about the exact IT artifact(s). For non-empirical studies or design research where no specific settings for data collection are specified, we examined the main body of the text to extract IT artifact information. As much as possible, original labels for IT artifacts were extracted and compiled. Many articles have only general names/labels, such as "IT," "Information Technology," "IS," "Internet," "ERP," "PC," "ICT," to name a few. Interestingly, few of the same labels for specific IT artifacts are used in more than one of the 274 articles. This indicates that using the original labels of IT artifacts alone may not reveal much about them. After further examining the nature of the IT artifact in the context of each study, we classified the IT artifacts with the conceptualization of five types of core IT artifacts we introduced in the conceptual development section. It is worth noting that although some studies may have an IT artifact that appears to be hardware on the surface, what is addressed really goes beyond just the hardware according to the content of the study. For example, a study on RFID adoption does not treat RFID as a piece of hardware but is really interested in the whole system of RFID application for various purposes (Goswami et al. 2009). In this particular case, the IT artifact is coded as the application software. Table 3 summaries the core IT artifacts and provides samples of the instances for each core IT artifact. Interestingly, no studies are found to focus on hardware as the IT artifact.

Table 3. Core IT Artifacts Studied by IS Scholars

Core IT Artifact	Sample Instances in the 274 Articles
Hardware	•
Operating and system software	• Open source software (e.g. Linux)
Application software	• RFID, mobile IT, mobile apps • Emergency response systems, airport information systems • Enterprise applications (CRM, SCM, ERP), business rule management systems, business intelligence, groupware • Inter-organization information systems • car infotainment system, e-procurement applications, business rules engines, sale point systems, 3D rendering software, virtual workspace technology • Web services, media site with social networking features, portal, multimedia, Online fora, e-newspaper, middleware • Open source software
Application content	• Online (health, stock) fora, blogging forum • Animated advertisements • Wikipedia • Facebook, twitter, instance messages, email messages • Media sites • Virtual workspace technology • Document management, content management, data center
Auxiliary artifacts	• Theory or principles of design, approaches for developing OSS • Intellectual property rights • IT investment, IT decision rights • Username/password authentication policies

Perspectives, Contexts, and Methodological Orientations

Among the 274 articles, each article is coded with the primary context, primary perspective, and primary method. This means, for example, that when a study references two contexts to any extent, we consider the primary context where the findings make most sense. This is similar for perspectives. Table 4 summarizes the distribution of papers on each of these three facets. The dominant are the organizational context, managerial perspective, and empirical method.

Beneficiaries

Table 5 lists the beneficiaries of the IT artifacts within various perspectives. Due to limited space, we only list some sample topics (including beneficiaries tasks/goals/purposes related to and/or behaviors on IT artifacts) for each cell for illustration purposes. The table is by no means comprehensive.

At the individual level, IT artifacts are studied primarily from the behavioral perspective. Many studies in this category have identifiable individual users and focus on activities, tasks, motivations, cognitive processes, as well as personality and other factors. At the group level, involved people tend to be either end user groups working together on tasks that are mediated or supported by IT artifacts, or developers working on IT development projects. Such studies span multiple perspectives. At the organization level, all four perspectives are taken with a variety of topics. Finally, there is a large number of articles that focus on IT artifacts supporting community level interactions. Communities are larger gatherings of people than organizations, and tend to have less restrictive structures and more open-ended or ambiguous missions. Most members of communities are voluntary participants; and communities in general are outside any organization's boundaries. Several studies focus on government level support. We loosely cluster these studies into the community level for the sake of parsimony. All four perspectives are taken to study IT artifacts that support communities. A good number of studies do not make a distinction on which level of support an IT artifact may be for, or they may imply that all levels are possible. Such cases occur in studies within all four perspectives.

Table 4. Comparison of IT artifact studies' Views and Conceptualizations

Perspective	%
Managerial	45.6%
Behavioral	34.3%
Economic	10.9%
Technical	9.1%

Context	%
Organizational	58.4%
Marketplace	25.2%
Home	0%
Social	12.8%
Cultural	3.6%

Method	%
Empirical	89.1%
Non-empirical	0.7%
Design research	10.2%

Table 5. Beneficiaries and Perspectives

Perspective	Individual	Group	Organization	Community	Other
Managerial	Cloud computing	Knowledge sharing practice;	Adoption; Crowdsourcing; Off-shore service; Outsourcing	Adoption; Idea generation; Open source software development	IT platform governance processes
Behavioral	Adoption; Human nature & motivation; Multi-tasking; Disclose info; Use	Group interactions in 3D virtual world	Knowledge seeking; Learning; Disclose info	Adoption; Use; Participation; Disclose info; Content generation and use; Online consultation	Everyday practice of developers
Economic			Outsourcing; Market configuration; Channel mix strategy	Product review; Word of mouth; Social capital in marketplace	IT values; Outsourcing contracts ; Software delivery
Technical	Unified naming during modeling	Collaboration model	Enterprise ontology	Social computing tools	Design approach; Design processes

Scholars' Views of IT Artifacts

All 274 papers were coded with the O&I framework of five views and 14 roles. As a result, the most dominant view is ensemble, followed by the proxy view. The most dominant role is technology as structure, followed by technology as perception. The uniqueness of our study is that we do not simply show the views and roles of IS scholars' conceptualizations of IT artifacts. By combining the views and

roles with several facets such as contexts, perspectives, and methodological orientations, we are able to provide a more accurate picture of the nature of IT artifact conceptualization. In Table 6, the percentages are presented for the total number of papers that represent each facet. While most studies seem to follow the pattern of being studied in the organization context, with the managerial perspective, and with empirical method, the exceptions are: (1) more studies in the computational view take the technical perspective (7.7%) and with a design science method (9.1%), and (2) more studies in the proxy view are from the behavioral perspective (17.5%).

Table 6. IT Artifact Views by Perspectives, Contexts, and Methods

	Perspective				Context				Method		
	Mgt	Beh	Eco	Tech	Org	Mkt	Soc	Cul	Emp	Non-Emp	Dsgn
Nominal	9.9%	2.6%	0.7%	0.0%	10.6%	1.5%	0.7%	0.4%	12.4%	0.7%	0.0%
Computational	2.9%	0.4%	0.7%	7.7%	6.6%	3.6%	1.5%	0.0%	2.6%	0.0%	9.1%
Tool	4.0%	1.5%	1.8%	0.4%	5.5%	1.5%	0.7%	0.0%	7.7%	0.0%	0.0%
Proxy	4.7%	17.5%	4.4%	0.0%	10.2%	9.1%	6.2%	1.1%	26.6%	0.0%	0.0%
Ensemble	24.1%	12.4%	3.3%	1.1%	25.5%	9.5%	3.6%	2.2%	39.8%	0.0%	1.1%
Total	*45.6%*	*34.3%*	*10.9%*	*9.1%*	*58.4%*	*25.2%*	*12.8%*	*3.6%*	*89.1%*	*0.7%*	*10.2%*

Legend: Mgt = managerial; Beh = behavioral; Eco = economical; Tech = technological; Org = organization; Mkt = marketplace; Soc = social; Cul = cultural; Emp = empirical; Non-Emp = non-empirical; Dsgn = design science

Discussions

Before we discuss the findings and their significance, we need to realize the limitations of this study. As with any critical analysis of the literature, the findings are restricted by the selection of the publications. For the purposes of reflecting the entire IS discipline and revealing its most up to date status, we selected complete research articles from the most recent years proceedings of the most prestigious international conference in IS, which often has a lower acceptance rate than some of the journals. To make our results timely, and to keep the scope manageable, only two years of publications were considered. All our discussions are based on this restricted selection of IS publications.

Our results show the "hard evidence" as to what exactly are studied as IT artifacts, and how IS scholars study them with various perspectives, in various contexts, for various types of beneficiaries, and with methodological orientations. There are several interesting revelations from the findings of this study. Some of these can address the questions raised in the introduction section.

To The Extent Current IS Publications Consider IT Artifacts

Compared to O&I's findings based on publications in the 1990s in one journal, the proportion of the studies without IT artifacts in our collection decreases considerably, from almost 25% to 13%. The drastic decrease could mean a number of things: (1) IS scholars now become more conscious about specifying and exemplifying IT artifacts; (2) conference papers may show different foci than journal articles; (3) the ISR journal may be very different than ICIS in selection of publishable studies; or (4) the application of the O&I framework is slightly different. This latter point brings up the question of how absent an IT artifact has to be from a paper to fall under the nominal view. The examples in O&I are clear-cut as "references to technology are either incidental (as in studies of CIO compensation or computer security) or used as background information (as in studies of IS personnel or outsourcing practices in the IS industry)" (p. 128). However, there was much debate amongst our research team as we began to apply their coding scheme to our data corpus. This question was especially evident when technology and context were inherently inseparable.

Among the 13% of IS studies that do not have clear IT artifacts, the majority fell within the management perspective, while a few fell within the behavioral and economic contexts. Most of these 13% studies are also within the organizational context. This should not come as any surprise in light of the close ties IS has with management studies and practice. It is certainly conceivable that such research which does not

directly address IT artifacts, but is about other phenomenon not far removed, would find its way into IS research. Thus we anticipate that there will continue be IS research in which no IT artifacts are specified.

For some of the studies that do cover IT artifacts, the specificity of the IT artifacts remain low or ambiguous. Although some research does not necessarily specify IT artifacts to a great detailed level (such as some studies from the economic perspective), the lack of specificity in many other studies may make their research findings hard to compare or generalize. On the other hand, despite the lack of specificity of IT artifacts addressed, some studies may shed light on the diverse roles that IT artifacts play in different situations. They may enhance our understanding of human activities and behaviors mediated by IT artifacts or situated either within or outside IT-related contexts. For example, studies on the turnover conditions of IT entrepreneurs (Mourmant and Voutsina 2010) and the turnover behaviors of IT employees in non-IT organizations (Wang et al. 2010) may have important implications on the education, training, and preparation of students in the IS discipline. Therefore, such studies should not be neglected but be seriously regarded in the IS discipline to unfold the discipline. This seems to be what is happening in the IS discipline. Although there are studies wth less clear IT artifacts in their investigation, IS scholars collectively, through the conference review process, consider them as IS studies and thus accept them into the proceedings. In other words, not all IS studies have to specify IT artifacts.

The Specific IT Artifacts being Studied

Tables 3, 5 and 6 provide some descriptive characteristics of IT artifacts and the ways they are studied in IS research. Examples are found in nearly all cells in these tables. As indicated in Tables 5 and 6, there are many aspects of IT artifacts that can be of focal interest for IS scholars. Besides the normal tangible elements such as operating and system software, application software, application content, scholars have also paid attention to parts of a holistic system, such as functions or components, and features or attributes. The span of instances in all but hardware core IT artifacts is broad and diverse. It is thus to say that the kind of IT artifacts eligible for IS research can go beyond organizational systems. Those such as Facebook, YouTube, Twitter, mobile phones, crowdsourcing, web advertisements have already been considered IT artifacts; some of them, such as web advertisements and YouTube, can be regarded more as application contents than systems. Indeed, scholars have paid a great deal of attention on contents and data, (including an increased interest in user generated content, UGC) rather than only the equipment/hardware or software aspects of the IT artifacts. This may be attributed to the proliferation of recent technological advancements such as Web 2.0 and clouding computing. It can also be the result of scholars' moving to the broader types of IT artifacts, and thus IS research outwards to larger communities and societies that IT artifacts increasingly affect. Additionally, a great deal of IS studies focus on intangible or auxiliary elements such as policies, procedures, intellectual rights, contracts, values, among others.

IS Scholars' Focus on and Approaches to Studying IT Artifacts

Orlikowski and Iacono (2001) conclude that IT artifacts were not clearly addressed enough in IS research during the period of 1990-1999. Furthermore, they assert "all perspectives and methodologies offer distinct and important analytic advantages. What we are arguing for is increased attention and explicit consideration of IT artifacts," and that "all IT research will benefit from more careful engagement with the technological artifacts that are at the core of our field" (p. 130-131). This brings up an interesting point as to how present the IT artifact needs to be in a study in order for that study to be considered actual, serious, and distinct IS research. Orlikowski and Iacono's criticism of the field is that IT artifacts have been too often "black-boxed, abstracted from social life, or reduced to surrogate measures" (p. 130). Yet, our experience in analyzing the 274 ICIS papers is that technology is very often front and center. For example, Lessmann et al. (2010) aim at devising an "IT artifact in the form of a forecasting methodology to address the business problem of estimating cars' residual values" (p. 2). This paper falls under the computational view as they developed a prediction model toward this end. While the technology may be described in such a way that it is "abstracted from social life", it is central to a real-world problem that it is intended to address. Another example comes from Schultze and Leahy (2009) who adopt the proxy view in their study of avatars in second life: they develop a multidimensional conceptual framework of the avatar-self relationship, that is, the interaction between a communicator and his/her virtual

(re)presentation. While the study adopts surrogate measures (under the technology as perception conceptualization) in its approach to the IT artifact, we feel strongly that this study vigorously addresses IT artifact.

The IT artifacts we identify in this research point out that IS scholars address a wide variety of IT artifacts that vary in scale, specificity, role, configuration, composition, and aspects and elements that interest IS scholars. This prompts a need to re-examine the notions of IT artifacts and their position in IS research since the previously proposed notions (such as those in Table 1) cannot encompass some of the IT artifacts that current IS research address. The notions of IT artifacts detailed in Table 1 put strong emphasis on the design, development, packaging, configuration, implementation, and application. However, they don't address subsequent or higher levels of processes and outcomes of the aforementioned activities. For example, our findings show a large portion of current IS studies do not necessarily focus on the mentioned activities per se, but go beyond or underneath those activities. Some particular examples cannot be clearly depicted by the notions in Table 1, such as user-generated content, open source software defects, informed consents in online transactions, Internet use policy at work place, and online advertisements. These IT artifacts related topics derive from specific socio-cultural contexts. They embody specific norms, values, rules, and perspectives. They also have material forces to impact human enterprises and interaction with other IT artifacts, as demonstrated by the study on the impact of word-of-mouth (WOM) on retail sales (Park et al. 2009). It is important to take them into consideration when defining, characterizing, and theorizing IT artifacts that stimulate and constitute IS research to solidify and strengthen our theoretical foundation.

Based on the 274 papers we examined, the five-type core IT artifacts conceptualization seems to work well to represent the diversity and scope of various IT artifacts in IS research. The five dimension framework of approaches to study IT artifacts provide more insight and understanding than just the O&I views and roles.

The State of IS Research and Implications for the Future

Is the IS field moving beyond organizational boundaries? Our findings show that 58.4% of the ICIS 2009-2010 articles took place within the organizational context. This means that more than one-third of them considered IT artifacts situated in non-organizational contexts such as the marketplace, cultural settings, or social environments. Such combined with a large number of studies focusing on supporting communities outside organizations, the findings strike us as an interesting turn for a discipline that was originally committed to organizational issues. In fact, some in the discipline still refer to it as MIS (Management Information Systems). However, the calls to move beyond this context have been going on for years. Ten years ago, Field (2001) observes that the "M" in MIS is becoming less necessary as computing has expanded beyond the workplace. He points to the work of Tricker (1999) in stating that he "makes the point that IS should study what people need to know to live successful lives, build effective organizations, and create worthwhile societies," and notes that King and Kraemer (1998) "took a similar view in concluding that IS researchers should see what they are doing as social studies of computing and communication technologies" (p. 7-8).

Given the results regarding the contexts, beneficiaries and perspectives of current IS research, there is clearly a community of active IS scholars who welcome and appreciate a broad array of research settings and disciplinary perspectives. Such may even expand beyond what we can foresee through our current lenses. For example, in the Human-Computer Interaction (HCI) sub-discipline of IS, Benbasat (2010) encourages researchers to draw upon the field of neuroscience to understand phenomena of interest. For current and future IS researchers, we suspect that the diversity in the field may continue as there is strong evidence that an interest and audience for such exists.

Although all IT artifacts are clearly designed by humans to do "something", the most popular conceptualization of the IT artifact in our analysis, technology as structure, is an indicator that scholars are interested in the impact of IT artifacts at an intimate level. Many other conceptualizations (such as those under the tool view, and technology as perception) also position IT artifacts in such a way as to consider its impact on human activities that may go beyond the organizational and marketplace boundaries. However, what is unique about conceptualizing technology as structure is its focus on how it directs (and maybe redirects) our activities and behaviors. We believe that the salience of this

conceptualization makes sense given the ubiquity of computing technologies in our everyday lives. In respect to the implications for IS research, this denotes ample evidence that such is agreed upon by many scholars to be a meaningful approach to studying IT artifacts.

Conclusion

This study contributes to our continued understanding of the development and evolution of the IS discipline and the potential directions it may take. It hence has significant implications to future research and practices. In this paper, we conceptualize what is considered as IT artifact in IS research, and how IS scholars approach IT artifact in the IS discipline. We then employ a critical analysis approach to understand IT artifacts and the ways in which they are conceptualized in current IS research. By doing so, we reveal the current state of IS research. Our findings suggest that IT artifacts do constitute the main social phenomena that IS scholars investigate, even though not all IS studies specify them. In addition, IS research moves toward examining larger phenomena than IT artifacts themselves, as indicated by a large proportion of studies focusing on higher types of IT artifact core and with the ensemble view. Moreover, the focus on core IT artifacts is more than just the physical or material elements such as the application software and content, but also non-tangible elements such as the auxiliary artifacts. Organization and marketplace remain the focal contexts for IS research, although a considerable number of studies have extended these boundaries. Compared to the roughly 90% studies with the empirical methodological orientation, there are only 10% studies with the design science research orientation, among which the majority takes the computational view of IT artifacts.

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