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In Search of Paradigms: Identifying the Theoretical Foundations of the IS Field

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IN SEARCH OF PARADIGMS: IDENTIFYING THE THEORETICAL FOUNDATIONS OF THE IS FIELD

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Abstract

The goal of this paper is identify the theoretical foundations – the core theories – of the IS field. Currently there is a lack of consensus about what the core IS theories are, or even if we have any at all. If we do, they certainly don’t appear in IS curricula or textbooks as they do in more mature disciplines. So far, most of the debate on this issue has been conducted at a subjective and prescriptive (normative) level. We attempt to broaden the debate by taking a descriptive (positive) approach, using relatively objective data. We do this by consulting the “geological record”: the pattern of citations in the leading IS journals. We use a combination of quantitative and qualitative techniques to identify the most influential theories in the IS field. The results of our analysis are surprisingly positive, especially in the light of warnings about IS being overly dependent on reference disciplines (a discipline with no theory to call its own) and being obsessed with research methodology (emphasising how to research at the expense of what to research). This suggests that the negative views often expressed about the progress of IS may be unjustified and that its development has followed the normal evolutionary pattern of any research field. Being aware of our theoretical foundations will help clarify our disciplinary identity and guide teaching and scholarship.

Keywords: theory, disciplinary identity, scientific status, citation analysis
1 INTRODUCTION

The goal of this paper is to identify the core theories of the IS field. We begin by defining what a theory is and examining current conceptions about the state of theory in IS.

1.1 What is a theory?

A recent paper by Gregor (2006) has done much to clarify the nature of theory in IS. We adopt her definition of a theory:

“A theory is an abstract entity that aims to describe, explain and enhance understanding of the world and in some cases to provide predictions of what will happen in the future and to give a basis for intervention and action”

This is a much broader definition of theory than is normally used, but is done deliberately, to be inclusive as possible. In particular, it includes earlier evolutionary forms of theory that are usually not considered “scientific” (cf. Popper 1963) but play a vital role in the early development of a research field. We also distinguish between native and imported theories:

- A native (indigenous) theory is a theory specifically developed to describe, explain, predict, or design IS phenomena
- An imported (exotic, introduced) theory is a theory borrowed from an external (reference) discipline to describe, explain, predict, or design IS phenomena.

Native and imported theories together form the theoretical foundations of a field, in the same way that native and imported species together form an ecological environment. However, only native theories form part of a field’s identity (following Weber 2003):

“The identity of a discipline is established through the contributions it makes to theory. The core phenomena of the discipline are circumscribed via the theories “owned” by the discipline that account for these phenomena. Disciplinary identity and ownership of theories are inextricably linked.”

Identifying the core theories of a field thus provides a way of defining disciplinary identity, as an alternative to prescriptive approaches (e.g. Benbasat and Zmud 2003), which are more commonly used.

1.2 Theories: the intellectual core of a research field

The intellectual core of any research field is its theories: more than anything else, the core theories of a field define its distinct identity. Most disciplines are synonymous with their core theories: for example, when we think of physics we think of Newton’s laws, relativity, and atomic theory; when we think of biology we think of evolutionary theory, genetic theory, and cell theory. In addition, breakthroughs in science are most often the result of new theories (e.g. Copernican theory, Newtonian mechanics, evolutionary theory, genetic theory, general relativity theory, germ theory) rather than advances in research methods or empirical findings.

Theory is also a necessary prerequisite for conducting research: collecting data without theory is not research but observation or reporting (Dubin 1978). For effective scientific progress, members of a field need to be aware of its core theories, so they can interpret their empirical results in terms of these theories and link their results back to them in a cumulative manner (Kuhn 1970). For this reason, there should be agreement among members of a field as to what the theoretical foundations of the field are. All researchers, regardless of their specialty, should know what the core theories are and have a working knowledge of them. They should also be an integral part of the educational curriculum at all levels (as they are in more mature disciplines).

1.3 The state of theory in the IS field

There is a widely-held perception that the theoretical foundations of the IS field are inadequate. For example, that IS lacks substantive theories of its own and survives largely by feeding off its reference disciplines; also, that it is overly obsessed with research methodology, and focuses on how to research at the expense of what to research (e.g. Weber 1987; Keen 1991; Weber 1997; Weber 2003). For example:
“The inter-logic of any scientific discipline is its theoretical underpinnings and scientific growth is possible only through proliferation of theories. Not surprisingly, the rather insignificant progress of MIS can be attributed, to a large degree, to the fact that it lacks articulated theories of its own.” (Farhoomand 1987)

“As a discipline we have a reputation for using and adapting theories developed in other disciplines. Little wonder, that we see few high-quality standalone theory papers in our discipline, in spite of the significant insights that such papers can provide about information systems-related phenomena.” (Weber 2003)

These are opinions which in most cases are not backed up by any evidence, though are based on the wisdom and experience of some of the most senior researchers in the IS field, so cannot be easily discounted. However, the fact that many people believe something doesn’t make it true, regardless of how knowledgeable they may be (cf. the halo effect (Sagan 1997)). These are propositions that need to be tested (like any other propositions). One goal of this paper is to determine whether statements like the ones above are supported by the evidence.

2 RESEARCH METHODOLOGY: EXAMINING THE “GEOLOGICAL RECORD”

2.1 Evaluating scientific progress

The most widely accepted measure of scientific progress in a field is the emergence of paradigms, based on Kuhn’s theory of scientific revolutions (Kuhn 1970). According to this theory, science only progresses when it has a paradigm: a theoretical base that is “relatively stable over time and represents a consensus among the majority of researchers and practitioners in a field”. In this paper, we consider a paradigm to be a type of theory (specifically, a widely or universally accepted theory), following Weber (1987, 1997). Kuhn’s definition of a paradigm is much broader than this and includes “laws, theories, examples and experiments” but almost all of his examples are theories (e.g. Ptolemaic astronomy, Copernican astronomy, Aristotelian mechanics, Newtonian mechanics, Newtonian optics). “Paradigm” is commonly used in IS research to refer to philosophical viewpoints in research, following its use in organisational science (Burrell and Morgan 1979), but this is inconsistent with Kuhn’s usage of the term.

Consensus on a common paradigm enables more effective progress because efforts of researchers are united rather than dispersed among competing “schools”: research is cumulative rather than piecemeal. According to Kuhn, any field goes through a series of distinct evolutionary phases (Error! Reference source not found.):

1. **Prescientific chaos**: In the beginning, there are many competing schools of thought, a “primeval swamp” of theories all competing for survival. Progress is limited because of diffusion of effort among the various research schools and a lack of cumulative results.
2. **Unification**: at some point, consensus is achieved among the majority of researchers either on one of the existing schools of thought or a completely new one. This is the field’s first paradigm and marks its birth as a scientific discipline.
3. **Normal science**: following the establishment of a paradigm, a period of relative stability ensues, in which researchers test and refine the paradigm.
4. **Scientific revolutions (paradigm shifts)**: periods of normal science are punctuated by scientific revolutions, where there is a battle for supremacy between the paradigm and a challenger.

According to this theory, scientific progress is not measured by the number of theories in a discipline but by the level of consensus on these theories: proliferation of competing theories is actually a barrier to progress. For this reason, normal science is considered the goal state for most scientific disciplines (Weber 1997). This is the state that mature disciplines spend most of their time in, where research is cumulative and progress incremental. While revolutions often result in major breakthroughs, they happen very rarely (Kuhn 1970).
2.2 Citation analysis

To identify the theoretical foundations of the IS field, we decided to consult the “geological record”: the pattern of citations in the IS literature. In the same way that the geological record provides information about how has life evolved, the record of citations (the bibliometric record) in a discipline provides information about how knowledge in a discipline has evolved. It provides a (relatively) objective way of tracing the development of theory in a discipline and evaluating its scientific status. While not perfect, we believe this provides the most reliable basis for identifying the theoretical foundations of the IS field (if indeed we have any).

Citation analysis has been previously used for many purposes in IS research, including identifying reference disciplines (e.g. Glass, Ramesh et al. 2004; Grover, Ayyagari et al. 2006), citation classics (Hamilton and Ives 1982; Walstrom and Leonard 2000; Whitley and Galliers 2007), and intellectual communities (Culnan 1986; Culnan 1987; Larsen, Monarchi et al. 2008). However, surprisingly, it has not been used to identify the core theories in the field, even though it seems ideally suited for this purpose. We complement the traditional approach to citation analysis, which is highly quantitative, with qualitative analysis of sources. Citation analysis naturally lends itself to qualitative analysis as the source data itself is qualitative (i.e. scientific papers consist primarily of words rather than numbers).

We conducted our analysis using 5 leading IS journals: MISQ, JMIS, ISR, ISJ and EJIS, which are 5 of the 6 journals identified by the AIS as being of excellent quality and representative of the IS discipline as a whole (Saunders, Avison et al. 2007). We used the reference lists of all papers published in these journals over the last 5 years (2003–2007) as the basis for our analysis. We conducted the analysis using raw reference lists rather than the ISI citation database, as we were interested in all sources cited by the articles during the analysis period (outward rather than inward citations). We chose 5 years as our sampling frame in order to get the most up-to-date picture of IS theoretical foundations. There is no standard timeframe for conducting citation analysis studies and rarely any justification for the period chosen. In a review of citation analysis studies conducted in IS and in other fields, we found 5 years to be the modal value. Increasing the period of analysis would better support trend analysis but would reduce the depth of analysis and bias the results towards older (possibly) obsolete theories.

3 PARADIGM DETECTION

3.1 IS as a “prescientific” field

(De Mey 1982) classifies paradigm-related activities into three categories:

- **Paradigm hunting**: proposing a paradigm or promoting a search for it
- **Paradigm detection**: attempts to identify paradigms through bibliometric or sociometric methods
- **Paradigm dissection**: analysis of existing paradigms

So far, there have been several attempts at paradigm hunting (Ein-dor and Segev 1981; Galliers 1985; Wand and Weber 1990; Weber 1997; e.g. Baldwin and Clark 2000) and paradigm dissection (Lee, Kozar et al. 2003; e.g. Benbasat and Barki 2007; Straub and Burton-Jones 2007) but only one at paradigm detection (Weber 1987). However, this study was conducted more than 20 years ago, when the IS field was in its infancy. (Weber 1987) conducted a secondary analysis of the results of a citation analysis conducted by Hamilton and Ives (1982). Hamilton and Ives concluded that IS research exhibited a strong cumulative tradition based on the average number of references per article. However, Weber argued that it is not just the number of references that is important but also the nature of these references: to be cumulative in Kuhn’s sense, research should be based on paradigms (i.e. theories). As shown in Table 1, the top 10 cited articles include 4 opinion (normative) articles, 2 research frameworks, 2 theories, 1 empirical study and 1 literature review. This is clearly the profile of a prescientific discipline, with the dominance of opinion-based articles and research frameworks reflecting its immaturity. There is also a substantial recency effect, with the average age of references being 2.8 years, consistent with a discipline without a stable theoretical base.

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1 The sixth journal (JAIS) was not included because citations from this journal are not electronically available.
Table 1. 10 Most Influential Sources in IS Research: 1970-79 (theories shaded)

Of the 2 theories in Table 1, one (Codd 1970) is from a reference discipline (it is one of the core paradigms in Computer Science) while the other (Nolan, 1973b) is owned by the IS field but contradicted by most available empirical evidence. Based on this, Weber concluded there were no paradigms in the IS field nor were there any credible candidates in sight. He argued that the IS discipline needed to develop a unifying paradigm rather than rely on paradigms from reference disciplines if it was to survive as a discipline in its own right.

3.2 Identifying most cited sources

As a first step towards identifying the core theories of the IS field, we began by identifying the top cited sources in the IS literature (sometimes called citation classics (Whitley and Galliers 2007)). While this was not the main purpose of our analysis, the nature of the top cited sources can tell us something about a field’s scientific status and maturity as Weber’s analysis showed. It also enables comparison with Weber’s findings (the previous attempt at paradigm detection). Table 2 lists the most cited sources in the top 5 IS journals over the past 5 years. These are classified as follows:

- Type: theory, research methodology, research framework, empirical study, opinion piece
- Source: journal, book, conference (IS, non-IS)
- Influence: total number of citations during the period

The results are in clear contrast to the results of the previous study (see Table 1):

- Type: all sources are either theories or research methodology: there are no opinion pieces, research frameworks or empirical studies, which shows that the field has matured significantly since Weber’s analysis.
- Theory vs research methodology: theory sources outweigh research methodology sources in quantity and influence (by a ratio of 60:40). This suggests that the IS field is relatively well theoretically grounded and not (as it has often been accused), overly obsessed with research methodology.
- Native vs imported theories: there are twice as many native theories as imported theories, and they have almost three times the level of influence (73:27). This suggests that there is also no problem with ownership of theories and disciplinary identity.
• Quantitative vs qualitative research: the research methodology sources are mostly qualitative (75/25 in quantity, 68/32 in influence), which contradicts the conventional wisdom that IS over-emphasises quantitative research methods.

• Age of references: the average age of the sources is 12.4 years. This compares favourably with the previous study which showed an average age of 2.8 years. The highest ranked native theory is 20 years old, which suggests that its theoretical foundations are relatively mature and stable.

• IS vs non-IS sources: there is roughly a 50/50 split between IS and non-IS sources, which seems healthy in an interdisciplinary field like IS: it is neither too insular (e.g. software engineering has a scarcely believable 98.1% self-referencing rate (Glass, Ramesh et al. 2004)) nor too derivative of reference disciplines (as it has often been accused).

• Publication type: most of the sources are journal papers, with 2 books and no conference papers.

• Reference disciplines: the reference disciplines from which the non-IS sources originate are sociology (2), social psychology (1), management (1) and marketing (1).

3.3 Merging synonyms (logically equivalent sources)

However the raw figures don’t tell the full story because of the existence of synonyms: references that can be cited interchangeably when referring to a particular body of work. These occur for two reasons:

• Theories are often published in multiple sources. For example, #1 and #6 in Table 2 are publications in two different journals describing the same theory (TAM). There is also a third source, the original PhD thesis (Davis 1986). All of these are logically equivalent for our purposes, as researchers who refer to TAM can cite these sources interchangeably and choosing just one of them is likely to understate its influence. The #10 ranked source (TRA) exists in the form of two books (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980), either of which could be cited as the source of the theory. Theories can also be published in both book and paper form (e.g. Nonaka 1994; Nonaka and Takeuchi 1995).

• An issue unique to books is that they are often published in multiple editions. Researchers can cite different editions depending on which edition they happen to have. For example, the #4 ranked source in Table 2 has 3 editions while the #7 ranked source has 5 editions (with the 2nd edition having a different name and slightly different authorship).

This shows the dangers of conducting citation analysis in a purely quantitative manner (as is usually the case): half of the sources listed in Table 2 (#1, #4, #5, #7, #10) have synonyms, meaning that their true influence will be understated. To get a more accurate picture of the relative influence of sources, synonyms need to be consolidated together. This is not an exact science (which is why we say that our analysis is based on “relatively objective data”): it is never possible to be sure that you have identified all synonyms and it introduces the possibility of double counting (if authors cite multiple “physical” sources of the same “logical” source in the same paper). Despite these reservations, we argue that Table 3 presents a more accurate picture of the most influential sources in IS research: each row in the table corresponds to a single logical source (rather than physical sources as in Table 2).

<table>
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<tr>
<th>#</th>
<th>Source reference(s)</th>
<th>Description</th>
<th>Type</th>
<th>Source</th>
<th>Influence</th>
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<tr>
<td>1</td>
<td>(Davis 1986; Davis 1989; Davis, Bagozzi et al. 1989)</td>
<td>Technology Acceptance Model (TAM)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
<td>144</td>
</tr>
<tr>
<td>2</td>
<td>(Rogers 1962; Rogers and Shoemaker 1971; Rogers 1983; Rogers 1995; Rogers 2003)</td>
<td>Diffusion of Innovations Theory</td>
<td>Theory (imported)</td>
<td>Book (non-IS)</td>
<td>85</td>
</tr>
<tr>
<td>4</td>
<td>(Fishbein and Ajzen 1975; Ajzen and Fishbein 1980)</td>
<td>Theory of Reasoned Action (TRA)</td>
<td>Theory (imported)</td>
<td>Journal + Book (non-IS)</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>(Yin 1984; Yin 1994; Yin 2003)</td>
<td>Case study research</td>
<td>Research method (qual)</td>
<td>Book (non-IS)</td>
<td>74</td>
</tr>
<tr>
<td>6</td>
<td>(Fornell and Larcker 1981)</td>
<td>Evaluating structural equation models</td>
<td>Research method (quant)</td>
<td>Journal (non-IS)</td>
<td>73</td>
</tr>
<tr>
<td>7</td>
<td>(DeLone and McLean 1992)</td>
<td>IS Success Model (ISM)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
<td>64</td>
</tr>
<tr>
<td>8</td>
<td>Goodhue 1995; Goodhue and</td>
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18th European Conference on Information Systems
After merging synonyms, the picture changes significantly. 3 of the original sources disappear and there is considerable jostling among positions. As before, there is around a 60/40 split in favour of theory over research methodology in both quantity and influence. However, there is now a more even split between native and imported theories, but with native theories still more influential overall (56/44). There is also a roughly even split between quantitative and qualitative research methodology: 54/46 in favour of quantitative methods in terms of influence (which reverses the original result). There is now a 60/40 split in favour of non-IS sources, with non-IS sources also more influential (58/42). The disciplines from which the non-IS sources originate are sociology (2), marketing (1), social psychology (1), statistics (1) and organisational science (1). There is also a more even split between journal papers and books (around 60/40 in favour of journal papers), which is surprising given the relative weights given to books in tenure and promotion decisions in IS. Notably, all of the books come from outside the IS field, which may reflect the lack of recognition of books in IS. Providing disincentives to write books may provide a structural barrier to developing substantive theory in the IS field. As Keen (1991) says:

“Books are considered to be worth 1.88 journal articles. However it is books that often move fields forward. Every field has books which are definitive and are an essential reference for ongoing research.”

Overall, this paints a rather rosy picture of the state of the IS field, which would confound the doomsayers and surprise even the most optimistic members of the field (it certainly surprised us). While there are no disciplinary norms or “benchmarks” for such analyses, there seems to be a remarkable level of balance across all classifications, which appears healthy in terms of diversity of the field. The results show that the IS field has its own distinct identity without being either too insular or too dependent on reference disciplines. It also shows that it is well theoretically grounded, with most of the top 10 sources being theories, and with native theories having greater influence than imported theories. This shows that the IS field has matured considerably since the last time such an analysis was conducted (Table 1).

### 3.4 Merging evolutionary forms (identifying theory clusters)

The final analysis involves (a) reducing the list of sources to theories and (b) consolidating different versions or evolutionary forms of each theory. Theories tend to evolve over time: extension and refinement of paradigms are the primary activities of normal science. In most cases, researchers will refer to the most recent version of the theory rather than the original source: for example, few contemporary research papers in biology refer directly to Darwin’s *Origin of the Species* but many (if not most) current theories in biology can be traced back to this.

As an example of theory evolution in the IS field, De Lone and McLean’s IS success model (ISM) was originally proposed in 1992 (De Lone and McLean 1992). In 1997, Seddon proposed a revision to this model (Seddon 1997) and in 2003, De Lone and McLean published a second revision, incorporating the results of 10 years of empirical research (De Lone and McLean 2003). Together these three theories represent a theory cluster or genus (a family of related theories). In using ISM, a researcher could conceivably refer to any of these variants (species). However only by taking all of them together is it possible to estimate the true influence of the theory. Similarly, the true influence of Darwin’s theory can only be accurately evaluated by considering citations to the original theory plus all subsequent extensions and refinements to it. We argue that using theory clusters rather than individual versions of a theory as the basis for our analysis provides a more reliable way of identifying the most influential theories: an important indicator of the importance of a theory is that it results in modifications and extensions through the processes of normal science.
Theory clustering is not an exact science as it is difficult to be certain that you have included all versions of each theory (e.g. especially in the case of TAM where there are so many different versions and extensions (Lee et al. 2003). Also, there is a point at which a theory is changed so much it becomes a new genus. The rules we applied were:

- **Law of Common Descent**: a theory can only be included in a theory cluster if it is a descendent of the parent theory and that theory alone. If a theory is produced by combining elements from two extant theories (e.g. combined TAM-TPB (Taylor and Todd 1995)), it is not a new evolutionary form of either theory but a new **bloodline** (genus). Without a clear lineage back to a common ancestor, double counting will result.

- **Law of Common Habitat**: a theory is considered a new genus if there is a major shift in the scope or boundaries of the theory (e.g. when the theory is adapted to a new domain). For example, the Theory of Planned Behaviour (TPB) extends the scope of TRA to include non-voluntary behaviour (simple domain expansion) so is included in the same theory cluster; in contrast, TAM specialises TRA to the IS domain (a small subset of the original domain), so represents a new genus (though people often assume that TAM is just a variant of TRA).

- **Law of Incremental Change**: a theory is considered to be a new genus if it radically changes the structure of the theory rather than simply adding constructs or relationships. Such changes represent revolutionary (paradigm shifts) rather than evolutionary changes (normal science), though this is of course a matter of judgement. For example, the causal structure and operationalisation of TAM is fundamentally different to TRA so qualifies as a new genus on this criterion as well.

- **Empirical tests or applications of theories are specifically excluded from the clustering process**: only theories and significant extensions to them are included in a theory cluster. Following the evolutionary metaphor, applications or instantiations of a theory correspond to **phenotypes** (individual organisms) rather than **genotypes** (classes of organisms).

Table 4 presents the results of this analysis. Each row in the table corresponds to a theory cluster rather than an individual theory or source: for example, the TAM cluster includes TAM plus its various extensions (cf. Lee, Kozar et al. 2003); the TRA cluster includes TPB (which is an extension of TRA to cover non-voluntary behaviour) and the ISM cluster includes its major variants (De Lone and McLean 1992; Seddon 1997; De Lone and McLean 2003). For simplicity, only the primary reference (the most cited source) for each theory cluster is listed in the table. We argue that these are the most influential theories in the IS field: the core theories we all need to be aware of and familiar with, regardless of our research specialty. The list includes both native and imported theories, as both form a legitimate part of our theoretical foundations. While only native theories help define our disciplinary identity, imported theories help root IS research in more mature disciplines.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Theory</th>
<th>Primary Reference</th>
<th>Field</th>
<th>Influence</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>Technology Acceptance Model (TAM)</td>
<td>(Davis 1989)</td>
<td>IS</td>
<td>384</td>
</tr>
<tr>
<td>2</td>
<td>IS Success Model (ISM)</td>
<td>(De Lone and McLean 1992)</td>
<td>IS</td>
<td>114</td>
</tr>
<tr>
<td>3</td>
<td>Theory of Reasoned Action/Planned Behaviour (TRA/TPB)</td>
<td>(Fishbein and Ajzen 1975)</td>
<td>Social psychology</td>
<td>108</td>
</tr>
<tr>
<td>4</td>
<td>Innovation Diffusion Theory (IDT)</td>
<td>(Rogers 1995)</td>
<td>Sociology</td>
<td>81</td>
</tr>
<tr>
<td>5</td>
<td>Unified Theory of Acceptance and Use of Technology (UTAUT)</td>
<td>(Venkatesh, Morris et al. 2003)</td>
<td>IS</td>
<td>72²</td>
</tr>
<tr>
<td>6</td>
<td>Task to Performance Chain Model (TPC)</td>
<td>(Goodhue and Thompson 1995)</td>
<td>IS</td>
<td>61</td>
</tr>
<tr>
<td>8</td>
<td>Organisational knowledge theory</td>
<td>(Nonaka 1994)</td>
<td>Organisational science</td>
<td>58</td>
</tr>
<tr>
<td>7</td>
<td>Resource-based view of the firm (RBV)</td>
<td>(Barney 1991)</td>
<td>Management</td>
<td>52</td>
</tr>
<tr>
<td>9</td>
<td>Structuration theory</td>
<td>(Giddens 1984)</td>
<td>Sociology</td>
<td>43</td>
</tr>
<tr>
<td>10</td>
<td>Adaptive structuration theory (AST)</td>
<td>(De Sanctis and Poole 1994)</td>
<td>IS</td>
<td>41</td>
</tr>
</tbody>
</table>

*Table 4. Theoretical Foundations of the IS Field (native theories shaded)*

² The raw number of citations for UTAUT was adjusted to compensate for publication date (citation lag). This theory was published in the first year of the analysis period and did not receive any citations in the first two years. The number of citations in the last 3 years were extrapolated over the 5 year period to give a more accurate estimate of its influence.
There are a number of important points to note about this analysis:

- Of the top 10 theories, 5 are native theories. The overall influence of native theories is almost twice that of imported theories, which provides strong evidence that IS has its own intellectual content and a distinct disciplinary identity.
- There is a large gap between the most cited theory (TAM) and the rest: it is more than 3 times as influential as the next most cited theory (ISM), which makes it a clear choice as the leading paradigm in the IS field. This accords with popular perceptions of TAM being the most influential IS theory (Lee, Kozar et al. 2003; Benbasat and Barki 2007; Straub and Burton-Jones 2007). However it is far from being the only influential theory in the IS field, contrary to common belief: “The Technology Acceptance Model (TAM) is generally referred to as the most influential and commonly employed theory in information systems. Some also consider it to be the only well-recognized theory in IS.” (Benbasat and Barki 2007)
- The second most influential theory is also a native theory: De Lone and McLean’s IS Success Model (ISM). This was developed only 3 years after TAM, which means the two most influential theories are both close to 20 years old. This suggests a high level of stability and maturity in the field’s theoretical foundations.
- 4 of the top 5 native theories were developed between 1989 and 1995, which represents a “golden age” for theory development in the IS field. This was during the field’s teenage years (ages 12-18) if we take the “birth” of the IS field to be when the first IS journal was created (MISQ in 1977).
- Only one of the theories on the list (UTAUT) has been developed in the last 10 years which may be a sign of theoretical stagnation in the IS field (which means that the doomsayers were right after all) or may simply reflect the slow processes involved in paradigm development and evolution in mature disciplines (i.e. the state of “normal science”).
- 3 of the 5 native theories (TAM, UTAUT and AST) are adaptations or syntheses of theories from other disciplines. IS researchers could therefore be accused of lacking originality to come up with theories of their own. On the other hand, this could be seen as a positive: rather than trying to reinvent the wheel, IS researchers have been highly resourceful in adapting theories from other disciplines to explain and predict IS phenomena.

Relationships among core theories

What is remarkable about the top 6 theories is the degree of interrelationship among them: they compete with one another, are genetically related to one another and overlap with one another.

Scope. There is a high degree of overlap in the scope (boundaries) of the theories:

- TAM’s scope is a subset of UTAUT’s: both explain and predict IS usage; however UTAUT covers both voluntary and non-voluntary usage, while TAM only addresses voluntary usage.
- TAM and UTAUT form subsets of the domain of IDT, which explains and predicts adoption of technology generally rather than only information technology.
- TAM forms a subset of the domain of TRA while UTAUT forms a subset of the domain of TPB (as TRA and TPB explain and predict all human behaviour, not just computer usage behaviour)
- TAM and UTAUT form subsets of the scope of ISM, as usage is included within ISM as one component of IS success. Usage also appears in TPC, which means that it overlaps with TAM, UTAUT and ISM.

Competition. There is also a great degree of competition among the theories:

- TAM, UTAUT, TRA and IDT are competitors as they can all be used to explain the same dependent variable (IS usage)
- ISM and TPC both attempt to explain the same dependent variable (IS impact)

Common descent. There are also genealogical relationships among the theories:

- TAM is a descendant of TRA
- UTAUT is a descendant of TRA, TAM and IDT

3 TRA is much broader than TAM or IDT as it can be used to explain almost any human behaviour, but in IS it is primarily used to explain acceptance behaviour, which puts it in direct competition with TAM, IDT and UTAUT.
3.5 Results of “paradigm hunting” efforts

There have been a number of explicit attempts to develop a unifying paradigm for IS (Ein-dor and Segev 1981; Galliers 1985; Wand and Weber 1990; Weber 1997; e.g. Baldwin and Clark 2000). However, none of these appear in the top 100 cited sources or are even close. This seems to confirm Banville and Landry’s view that paradigms emerge as a result of natural evolutionary processes and that deliberate attempts to create them are bound to fail:

“A call to arms [to develop a paradigm] therefore seems absolutely useless as a paradigm will emerge only if certain conditions are met. One should always remember that paradigms are largely a matter of implicit social consensus and that their emergence requires time and the combination of many favourable factors which can, at best, be facilitated.” (Banville and Landry 1989)

3.6 The price of maturity?

Recently, some research critiques have emerged criticising the narrowness of paradigm-based research, especially in relation to TAM (e.g. Lee, Kozar et al. 2003; Benbasat and Barki 2007; Straub and Burton-Jones 2007). For example:

“TAM researchers may have fallen into the trap of following an incremental approach based on replicating previous studies with minor adjustments” (Lee, Kozar et al. 2003)

This seems like a reasonable approximation to what Kuhn calls “normal science”, considered to be the goal state for most scientific disciplines:

“Periods of normal science consist largely of mopping up operations and puzzle solving that produce no major novelties.” (Kuhn 1970)

It seems that we have now come full circle: from lamenting the lack of a paradigm (e.g. Farhoomand 1987; Weber 1987) to complaining about the loss of freedom that results from having one!

4 CONCLUSION: RUMOURS ABOUT THE LACK OF THEORY IN IS HAVE BEEN GREATLY EXAGGERATED

Our results reveal a surprisingly positive picture of theory development of the IS field, which suggests that negative views often expressed about its progress and scientific status (mostly based on opinion) may be unjustified. It shows that the IS field has matured considerably since its beginnings, when such an analysis was last conducted. In hindsight, the discouraging results from Weber’s (1987) analysis are not surprising, as the field was in its infancy at the time. Perhaps early IS researchers were too impatient for progress, as our analysis seems to show that theory development in the IS field has followed the normal evolutionary pattern of any discipline. It may be that a critical mass of empirical results are required before strong theory can be developed, just as centuries of astronomical observations were required before robust theories of planetary motion (e.g. Kepler, Newton) could be developed. Rather than trying to create paradigms, researchers simply needed to wait for them to happen (as suggested by Banville and Landry). Our analysis shows that the “golden age” for theory development was when the IS field was in its teenage years, and that theory development has slowed significantly since then, consistent with the research profile of “normal science”.

Our main findings are:

- The IS field seems to be theoretically well-grounded and does not focus on research method at the expense of theory. There is a healthy balance between theory and research methodology in the top cited sources, with theories having a clear edge in terms of influence.
- There is no identity crisis: IS has developed a distinct disciplinary identity based on its core theories. IS (native) theories have almost twice the level of influence of imported theories, which suggests that it is not overly dependent on reference disciplines for theoretical content.
- The IS field does not exhibit a recency effect: the average age of the top cited sources is over 10 years and the two leading paradigms are close to 20 years old. This reflects a high level of stability in the field’s theoretical foundations, suggesting that it is relatively mature.
There is a high level of competition and common descent among the leading IS theories as well as considerable overlap among them. Some of this overlap seems to have gone unrecognised so far, meaning that there may be opportunities for consolidation and rationalisation.

The leading reference discipline (imported) theories originate from sociology, social psychology, management, and organisational science, which means that IS exhibits a clear profile as a social science rather than an artificial science. This is a major shift from its beginnings when it was more closely aligned with its sister computing disciplines (computer science and software engineering): in Weber’s analysis, a theory from computer science was the most influential theory. The recent emphasis on design science (Hevner, March et al. 2004) may be an attempt to redress the balance towards technological aspects, though this may lead to identity problems of its own (in differentiation from computer science and software engineering).

4.1 Mapping the Theoretical Landscape of IS

To give an overall picture of the theoretical foundations of the IS field, we map the core IS (native) theories onto Benbasat and Zmud’s (2003) nomological net, which defines the disciplinary boundaries of the IS field (Figure 1). Together, the core theories provide broad coverage of the IS domain. It also seems to contradict concerns expressed about the lack of research attention to the IT artifact (e.g. Orlikowski and Iacono 2001; Weber 2003), as 3 of the 5 theories explicitly incorporate characteristics of the IT artifact. In terms of scope, three of the theories (AST, ISM, TPC) represent global theories, while the other two (TAM, UTAUT) represent middle range theories (Merton 1968). As expected, none are narrow range theories as they are not broad enough in scope to achieve discipline-wide consensus.

Figure 1. Disciplinary Scope of Core IS Theories

4.2 Contributions of this Research

The major contributions of this paper are to:

- Evaluate the state of theoretical development and scientific progress in the IS field using relatively objective data. In doing so, we have challenged some widely held beliefs about the state of theory in the IS field.
- Identify the theoretical foundations of the IS field as a basis for teaching and scholarship. All IS researchers, regardless of their specialty, should have a working knowledge of these theories to ensure their research is cumulative (links back to the common core of knowledge in the field). The core theories should also be incorporated into IS curricula at all levels (undergraduate, postgraduate, doctoral) as they are in more mature disciplines.

4.3 Related Research

This paper builds on recent research on IS disciplinary identity and IS theory development. It complements prescriptive ideas about the identity of the IS field (e.g. Benbasat and Zmud 2003) with a descriptive analysis based on Weber’s conception of disciplinary identity being defined by the theories it “owns”. It also complements Gregor’s (2006) analysis of IS theory, moving the focus from the general to the specific: that is, from “what is a theory?” to “what are the core theories of the IS field?”. This helps to instantiate Gregor’s framework.
References


