### In Search of Paradigms: Identifying the Theoretical Foundations of the Information Systems Field

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IN SEARCH OF PARADIGMS: IDENTIFYING THE THEORETICAL FOUNDATIONS OF THE INFORMATION SYSTEMS FIELD

Abstract

The goal of this paper is identify the theoretical foundations of the IS field. Currently there is a lack of consensus about what the core theories of the IS field are or even if we have any at all. If we do, why don’t they 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 and trace their development and evolution. 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 identity and scientific status, and guide teaching and scholarship.

Keywords: theory, disciplinary status, scientific progress, maturity, citation analysis
1. INTRODUCTION

“The distinction between reporting and “doing science” lies in whether data is gathered for its own sake or whether it is used to measure the values associated with “things” (loosely called variables when talking about theories). The first procedure we call description; the second we call research.” (Dubin 1978)

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:

“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” (Gregor 2006)

This is a much broader definition of theory than is normally used, but this is done deliberately: to be inclusive as possible. In particular, it includes earlier evolutionary forms of theory that are not considered to be scientific (Popper 1963) but play a vital role in the early development of any research field.

We also distinguish between native and imported theories in the IS field (in analogy to native and imported species in biology):

- 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 a reference discipline to describe, explain, predict, or design IS phenomena.

Native and imported theories together form the theoretical foundations of a field, just as native and imported species together form an ecological environment. However, only native theories define a field’s identity, following (Weber 2003c):

“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, which provides an alternative to prescriptive approaches (Benbasat and Zmud 2003).

1.2 Theories: The Intellectual Core of a Research Field

The heart of any research field is its theories. Most disciplines are synonymous with their core theories: for example, when we think of physics we think of Newton’s laws, gravitational theory, and atomic theory; when we think of biology we think of evolutionary theory, genetic theory, and cell theory. Most breakthroughs in science have been the result of new theories rather than advances in research methods. More than anything else, the core theories of a field define its distinct identity.

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

1.3 The State of Theory in the IS field

There is a common 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; that it is overly obsessed with research methodology, and focuses on how to research at the expense of what to research (e.g. Keen 1991; Weber 1987, 1997, 2003a). 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 2003a)

These are opinions which in most cases are not backed up by any evidence, though they 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 are (cf. the halo effect (Sagan 1997)). These are propositions that need to be tested using real evidence (like any other propositions). The goal of this paper is to determine whether statements like the ones above are justified.

1.4 Evaluating Scientific Progress

The most widely accepted measure of scientific progress in a field is the emergence of paradigms, which is based on Kuhn’s theory of scientific revolutions (Kuhn 1970b). According to this model, science only progresses when it has a paradigm: a body of knowledge that is “relatively stable over time and represents a consensus among the majority of researchers and practitioners in a field”. 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 (Figure 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 progress.
- **Unification**: at some point, consensus is achieved among the majority of researchers 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.
- **Normal science**: following establishment of a new paradigm is a period which Kuhn calls “normal science”, where researchers test and refine the paradigm.
- **Scientific revolutions**: periods of normal science are punctuated by scientific revolutions (or paradigm shifts where there is a battle for supremacy between the current paradigm and a challenger.

Figure 1. Kuhn’s theory of scientific revolutions

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1 The term “paradigm” is commonly used in IS research to refer to philosophical viewpoints, following its use in organisational science (Burrell and Morgan 1979). This is inconsistent with Kuhn’s usage of the term, with almost all of his examples of paradigms being theories (e.g. Ptolemaic astronomy, Copernican astronomy, Aristotelian dynamics, Newtonian mechanics, Newtonian optics, special relativity). In this paper, we use paradigm to mean theory following Weber (1987, 1997) and Kuhn’s usage of the term.
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).

1.5 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 (e.g. Baldwin and Clark 2000; Ein-dor and Segev 1981; Galliers 1985; Wand and Weber 1990; Weber 1997) and paradigm dissection (e.g. Benbasat and Barki 2007; Lee et al. 2003; Straub and Burton-Jones 2007) but only one at paradigm detection (Weber 1987), though this was done more than 20 years ago when the IS field was in its infancy. (Weber 1987) conducted a secondary analysis of a citation analysis conducted by Ives and Hamilton (1982). Ives and Hamilton concluded that IS research exhibited a strong cumulative tradition based on the average number of references per article. However, Weber observed that it is not just the number of references that is important but also the nature of these references. As shown in Table 1, the top 10 cited articles include 4 opinion-based (normative) articles, 2 research frameworks, 2 theories, 1 empirical study and 1 literature review. This is clearly the profile of a “prescientific” discipline and reflects immaturity in both theory and research method. There is also a substantial recency effect, with the average age of the references being 2.8 years, consistent with an immature discipline without a stable theoretical base.

### Table 1. 10 Most Influential Sources in IS Research: 1970-79 (theories shaded)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Reference</th>
<th>Short Title</th>
<th>Type</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ackoff, 1964</td>
<td>Management Misinformation Systems</td>
<td>Opinion (normative)</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>Mason and Mitroff, 1973</td>
<td>A Program for MIS Research</td>
<td>Research framework</td>
<td>28</td>
</tr>
<tr>
<td>4</td>
<td>Codd, 1970</td>
<td>Relational Database Theory</td>
<td>Imported theory</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>Dickson and Powers, 1972</td>
<td>MIS Project Management</td>
<td>Empirical study</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>Dearden, 1972</td>
<td>MIS is a Mirage</td>
<td>Opinion (normative)</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Ashenhurst, 1972</td>
<td>Curriculum recommendation</td>
<td>Opinion (normative)</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>Cougar, 1973</td>
<td>Evaluation of systems analysis techniques</td>
<td>Literature survey</td>
<td>13</td>
</tr>
<tr>
<td>9</td>
<td>Nolan, 1973a</td>
<td>Computer databases: the future is now</td>
<td>Opinion (normative)</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>Nolan, 1973b</td>
<td>Stage theory of IS growth</td>
<td>Native theory</td>
<td>11</td>
</tr>
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</table>

Of the 2 theories identified, the highest ranked one (Codd 1970) is from a reference discipline (computer science) while the other (Nolan, 1973b) is “owned” by the IS field but contradicted by most of the 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.

1.6 ISWorldNet Theory Resource (IS World 2008)

Perhaps the closest thing we currently have to a definitive list of theories in IS research is the IS WorldNet theory resource (IS World 2008). Its aim is to “provide researchers with summarised information about theories widely used in IS research” and is maintained by two IS researchers with input from an editorial board. This is a highly impressive and useful resource, and includes a total of 75 theories, which suggests that rumours about the lack of theory in IS have been grossly exaggerated. However, there are a number of problems with this list:

- The process used to select theories is not explained, but appears to be based on consensus among editorial board members. This means that the set of theories is likely to reflect the knowledge bases of those involved rather than being representative of the field as a whole.
No distinction is made between native and imported theories. The overwhelming majority (almost 90%) of theories included are from outside the IS field, which seems to confirm Weber’s (2003a) concern that IS relies primarily on theories borrowed from other disciplines.

There is no indication of the relative influence of theories. The theories are listed alphabetically, with the “top 5 theories” identified based on frequency of access during the month.

There is no indication of the paradigmatic status of the theories (degree of consensus).

1.7 Preliminary Survey

One way of identifying the theoretical foundations of a field is to ask researchers themselves: after all, paradigms are primarily established as a result of consensus among members of a field (Kuhn 1970b). When we tried this with members of our own department, we found a remarkable lack of consensus. We asked each faculty member to identify what they thought were the core theories of the IS field: theories that are widely accepted (paradigms or paradigm candidates) and belong to the IS field rather than to reference disciplines. We asked them to do this individually, without collaborating with anyone else. In all, a total of 34 candidate theories were mentioned:

- Only 4 of these (12%) were mentioned by more than 1 person
- Almost a third (29%) were not theories but research topics (e.g. IS strategy) or research methods (e.g. design science), which seems to reflect a lack of a common understanding even about what a theory is.
- More than half of the theories mentioned (54%) were from reference disciplines, which seems to reflect uncertainty about the boundaries of the IS field.

Overall, the level of convergence was 2.73%. This may reflect the fragmented nature of IS (Banville and Landry 1989): each researcher may be aware of the most important theories in their own research specialty, but is unaware of the core theories of the field as a whole. Our conclusions from this informal survey were: (a) using opinions to identify the theoretical foundations of IS was unlikely to give satisfying results and (b) there must be a better way!

2. Research Methodology: Examining the “Geological Record”

Instead of relying on opinions or expert consensus 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 life evolved on Earth, the record of citations (the bibliometric record) provides information about the evolution of theory in a discipline. While not perfect, we believe this provides the most reliable basis for identifying the core theories of the IS field. The record of citations in the leading journals of a discipline provides a (relatively) objective way of tracing its evolution and evaluating its scientific status.

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

We conducted our analysis using 5 leading IS journals: MISQ, JMIS, ISR, ISJ and EJIS. These are 5 of the 6 journals listed by the senior scholars of IS discipline as being of excellent quality (“A” journals) and representative of the IS discipline as a whole (Saunders et al. 2007). We extracted 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 our citation analysis using the “raw” reference lists of the papers rather than

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2 The sixth journal (JAIS) was not included because citations from this journal are not electronically available. We are currently working on extracting citations from this journal manually (from the pdf versions of the papers) so by the time of the conference our data set should cover the complete set of IS journals.
using ISI citation counts, as these only record citations to other articles held in the ISI database (which excludes references to books and articles not electronically available in ISI).

3. **PARADIGM DETECTION**

As a first step towards identifying the core theories of the IS field, we began by identifying the most cited sources (often called **citation classics** (Whitley and Galliers 2007)), to enable 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

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<thead>
<tr>
<th>#</th>
<th>Reference</th>
<th>Type</th>
<th>Source</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Davis 1989)</td>
<td>Technology Acceptance Model (TAM)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
</tr>
<tr>
<td>2</td>
<td>(Fornell and Larcker 1981)</td>
<td>Evaluating structural equation models</td>
<td>Research method (quant)</td>
<td>Journal (non-IS)</td>
</tr>
<tr>
<td>3</td>
<td>(DeLone and McLean 1992)</td>
<td>IS Success Model (ISM)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
</tr>
<tr>
<td>4</td>
<td>(Yin 1994)</td>
<td>Case study research</td>
<td>Research method (qual)</td>
<td>Book (non-IS)</td>
</tr>
<tr>
<td>5</td>
<td>Klein and Myers, 1999</td>
<td>Evaluating interpretive field studies</td>
<td>Research method (qual)</td>
<td>Journal (IS)</td>
</tr>
<tr>
<td>6</td>
<td>(Davis et al. 1989)</td>
<td>Technology Acceptance Model (TAM)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
</tr>
<tr>
<td>7</td>
<td>Rogers 1995</td>
<td>Innovation Diffusion Theory (IDT)</td>
<td>Theory (imported)</td>
<td>Book (non-IS)</td>
</tr>
<tr>
<td>8</td>
<td>(Venkatesh et al. 2003)</td>
<td>Unified Theory of Acceptance and Use of Technology (UTAUT)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
</tr>
<tr>
<td>9</td>
<td>(Eisenhardt 1989)</td>
<td>Case study research</td>
<td>Research method (qual)</td>
<td>Journal (non-IS)</td>
</tr>
<tr>
<td>10</td>
<td>(Fishbein and Ajzen 1975)</td>
<td>Theory of Reasoned Action (TRA)</td>
<td>Theory (imported)</td>
<td>Book (non-IS)</td>
</tr>
</tbody>
</table>

There are a number of points to note about this analysis:

- **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 the previous analysis (**Table 1**).
- **Theory vs research methodology**: theory sources outweigh research methodology sources in both quantity and influence. This suggests that the IS field is relatively well-grounded theoretically and not, as it has often been accused of being, overly obsessed with research methodology.
- **Native vs imported theories**: there are twice as many native theories as imported theories, which have almost three times the level of influence (73:27). This suggests that there is also no problem with disciplinary ownership of theories.
- **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 research over-emphasises quantitative research.
- **Age of references**: the average age of the sources is 12.4 years. This compares favourably with the previous study which showed a average age of 2.8 years. The highest ranked native theory is 20 years old, which suggests that the 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 et al. 2004)) or too derivative of reference disciplines.
- **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).

*Merger 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 is that they 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: choosing just one of them is likely to understate its influence. The #10 ranked source (TRA) exists in the form of two books (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975), 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 different authorship).

This shows the dangers of conducting citation analysis in a purely quantitative manner: 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, these 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”): firstly, it is never possible to be sure that you have identified all synonyms; secondly, 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 represents a set of logically equivalent citations.

<table>
<thead>
<tr>
<th>#</th>
<th>Source reference(s)</th>
<th>Description</th>
<th>Type</th>
<th>Source</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Davis 1986, 1989; Davis et al. 1989)</td>
<td>Technology Acceptance Model (TAM)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
<td>144</td>
</tr>
<tr>
<td>5</td>
<td>(Yin 1984, 1994, 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 Thompson, 1995</td>
<td>Task to Performance Chain Model (TPC)</td>
<td>Theory (native)</td>
<td>Journal (IS)</td>
<td>61</td>
</tr>
<tr>
<td>10</td>
<td>Klein and Myers, 1999</td>
<td>Evaluating interpretive field studies</td>
<td>Research method (qual)</td>
<td>Journal (IS)</td>
<td>54</td>
</tr>
</tbody>
</table>

After merging synonyms, the picture changes significantly: 3 of the 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 much 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 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 a 60/40 split between journal papers and books in terms of both quantity and influence, which is surprising given the relative weights typically given to them in tenure and promotion decisions. Notably, all of the books come from outside the IS field,
which reflects the lack of recognition given to 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 too insular or too dependent on reference disciplines. It also shows that it is well theoretically grounded, with the majority of the top-cited 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 (Weber’s 1987 analysis).

3.2 The Theoretical Foundations of the IS field (merging evolutionary forms)

The next analysis requires (a) reducing the list of sources to theories only and (b) consolidating different versions or evolutionary forms of each theory. Theories tend to evolve over time: extension and refinement of paradigms is one of the primary goals of normal science. In most cases, researchers will refer to the most recent version of the theory rather than the original theory (e.g. few research papers in biology refer to the Origin of the Species but it is possible to trace many contemporary theories in biology back to this). As an example of theory evolution in the IS field, the IS success model (ISM) was originally proposed by De Lone and McLean in 1992. In 1997, Seddon proposed a revision to this model and in 2003, De Lone and McLean published a second revision, incorporating the results of 10 years of empirical research. Together these three theories represent a theory cluster or family of theories (genus). In applying ISM, a researcher could use any of these variants (species). However only by taking all of these variants together is it possible to estimate the real influence of the theory. Similarly, the true influence of Darwin’s theory can only be accurately estimated by considering citations to the original theory and all subsequent extensions and refinements to it. We argue that using theory clusters as the basis for analysis rather than individual versions (species) of a theory provides the most reliable way of identifying the theoretical foundations of a field.

Theory clustering is not an exact science as it is difficult to be certain that you have included all versions of a particular theory: for example, consider the many different modifications and extensions to TAM since it was first proposed (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), 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 as 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 begins a new theory cluster.
- **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 a matter of judgement.
- **Empirical tests or applications of theories are specifically excluded from the clustering process**: only theories and significant extensions to them can be included in a cluster. Continuing the evolutionary metaphor, applications of a theory correspond to phenotypes (individual organisms) rather than genotypes (classes of organisms).
Table 4 presents the results of the clustering analysis, which we argue provides the most accurate picture of the core theories used in IS research and their relative influence. Each row in the table corresponds to a theory cluster as defined above e.g. the TAM cluster includes original TAM plus its various extensions (cf. Lee et al. 2003); TRA includes TPB and TPC includes both its synonyms (Goodhue 1995; Goodhue and Thompson 1995). For simplicity, only the primary (most cited) reference for each theory is listed in the table. These define the theoretical foundations of the IS field: the core theories that we should all be familiar with. It includes both native and imported theories, as both form a legitimate part of a field’s theoretical foundations. While only native theories contribute to our disciplinary identity, imported theories help root IS research in more established disciplines.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Theory</th>
<th>Primary Reference</th>
<th>Field</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<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 et al. 2003)</td>
<td>IS</td>
<td>72</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>

There are a number of 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 (Benbasat and Barki 2007; Lee et al. 2003; Straub and Burton-Jones 2007). However it is far from being the only influential theory in the IS field, contrary to what many believe: “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-recognised 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”).

- Adaptive structuration theory is counted as an IS theory even though it was published in a non-IS journal (Organisational Science), as it was specifically developed to explain IS phenomena. It is a

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3 We adjusted the raw number of citations for UTAUT to compensate for date of publication (citation lag). This was published in the first year of the analysis period and did not receive any citations in the first two years, which is likely to understate its true influence.
specialisation of structuration theory to the IS domain and qualifies as a separate genus by the Law of Common Habitat (in the same way that TAM forms a new genus distinct from TRA).

- There is close competition for the final place on the list, with little separation between AST and the next theory (Moore and Benbasat 1991). This is classified as a native theory as it represents an extension and specialisation of IDT to the IS field. This is both a competitor for TAM as well as being partially descended from it (as it incorporates constructs and measures from TAM).

### 3.3 Relationships among core theories

What is remarkable about the top 6 theories is the degree of interrelationships among them: they compete with one another, are genetically related to one another and overlap with one another (Figure 2).

**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 theories 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 predictions adoption of technologies in general not just information technologies)
- 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 and TPC (as usage is included within both models).
- ISM and TPC overlap as they both explain and predict IS impact (the final dependent variable in both models)

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

- TAM, UTAUT, TRA and IDT are competitors as they are all used to explain the same dependent variable (IS usage)\(^4\)
- ISM and TPC are competitors as they both attempt to explain the same dependent variable (impact of IS)

**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

### 3.4 Results of “paradigm hunting” efforts

There have been a number of explicit attempts to develop a unifying paradigm for IS (e.g. Baldwin and Clark 2000; Ein-dor and Segev 1981; Galliers 1985; Wand and Weber 1990; Weber 1997). However none of these appear in the top 100 cited sources (or are even close). This seems to confirm Ban-

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\(^4\) 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.
ville 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.”

3.5 Reactions to Normal Science

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

This seems a fairly good description of “normal science”, 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 1970a)

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’s laws, Newton’s universal gravitation theory) 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, but that theory development has slowed significantly since then, which is 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 theories and research methodology in the top cited sources, but 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 its theoretical content.
- The IS field does not exhibit a recency effect: the average age of the top cited sources is over 10 years old and the two theoretical paradigms are close to 20 years old. This reflects a high level of maturity in the field’s theoretical foundations which suggests that it is in a state of equilibrium.
- There are no design theories (Type V theories in Gregor’s taxonomy) in the top cited theories, which suggests that theory development in this area is still in its infancy. The recent paper by Gregor and Jones (2007) may help to advance this area of theory development.
- There is a high level of competition and common descent among the leading IS theories. There is also considerable overlap among them. Some of this overlap seems to have been unrecognised, which means there may be opportunities for consolidation and rationalisation.
The IS field appears to have had a total of three paradigms during its short history, with two of these still dominant. However this equilibrium state seems far from stable: a *paradigm shift* seems imminent in one of these areas (IS acceptance) and a *power struggle* in the other (IS success).

The leading reference discipline 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 early beginnings when it was more closely associated with its “sister” computing disciplines: computer science and software engineering (in Weber’s analysis, a computer science theory was the most influential theory). The recent emphasis on *design science* (Hevner 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 the IS field

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 nomological net, which defines the boundaries of the IS field (Figure 3). Together, the core theories provide very broad coverage of the IS domain. This seems to contradict concerns expressed about the lack of research attention to the IT artifact (e.g. Orlikowski and Iacono 2001; Weber 2003b), 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 3. Disciplinary Coverage of IS Theories](image)

### 4.2 Contributions of this Research

The contributions of this paper are to:

- Evaluate the state of theory development in the IS field using relatively objective data, rather than relying on opinions as in most previous analyses. In doing so, we have refuted some common myths about the state of theory in the IS field.
- Identify the theoretical foundations of the IS field (which includes both native and imported theories) as a basis for *scholarship*. All IS researchers, regardless of their specialty, should have a working knowledge of these theories to ensure their research is *cumulative* and links back to the “common core” of knowledge in the field.
- Identify theoretical foundations as a basis for *teaching*: the core theories should be incorporated in IS curricula and textbooks. In more mature disciplines, the core theories are typically taught at undergraduate level.

### 4.3 Related Research

This paper builds on recent work in the IS field in the area of disciplinary identity and 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 notion of a field’s identity being defined by the theories it “owns”. It builds on Gregor’s (2006) analysis of the *types* of theories that exist in the IS field by identifying the *most influential theories.*
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