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## Dynamics of Alignment and the Internal Response Lag Concept

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### Abstract

*Alignment between IS and the business has been broadly acknowledged as key to IS and business success. Considerable work has been done on modelling the process of alignment between IS and business strategies and structures. However, the way in which alignment changes over time as external circumstances change is not well understood. Given the rapidly changing environment in which many businesses operate, this is a key concern. This paper develops an internal response lag model as a means of investigating the dynamics of alignment from the perspective of IS and business managers. The model is illustrated using a broad based questionnaire and a series of interviews. Initial research outcomes are positive, and therefore a programme of further research in this area is proposed.*

### Keywords

Strategic Information Systems, Strategy, Dynamics of Alignment, Response lag, Business – IS relationships

### Introduction

Alignment of IS with the business has been the subject of many studies which have stressed its importance to the success of an organisation – (Sabherwal and Chan 2001; Chan 2002). It is still a key issue for IS managers today (Luftman 2005). Underpinning most of the work is a model which represents alignment as a series of adjustment processes operating between four “domains”: IS strategy, business strategy, IS structure, and business structure. (Henderson and Venkatraman 1993, 1993 & 1999, 1994)

While the Henderson and Venkatraman model assumes that alignment occurs via continuous adaptation between the domains, it does not take into account the effect on alignment of changes to the external environment over time. There has been some work in this area, notably a coevolutionary view (Peppard and Breu 2003), and a punctuated equilibrium model (Sabherwal, Hirschheim et al. 2001).

This paper adds to the investigation of alignment in the context of broader, external dynamics by looking at a specific aspect: the role of time lags and how they affect adjustments between the four domains in the alignment model. Time lags have been shown to affect returns to strategic IS investments in many industries (Brynjolfsson 1993; Brynjolfsson and Hitt 1996).

A model is developed to represent time lags, called the internal response lag model. This draws on related work on temporal effects including a framework developed to investigate the effect of time lags on competition between organisations (Piccoli and Ives 2005), and a punctuated equilibrium model used to investigate alignment over time (Sabherwal, Hirschheim et al. 2001).

The model is illustrated by quantitative and qualitative explorations of the perceptions of IS and business managers regarding time lags. These explorations suggest that a more comprehensive research programme in this area is justified.

### Background

Henderson and Venkatraman modelled IS and business alignment as a set of adaptation processes between four domains – business strategy; information technology strategy; organizational infrastructure and processes; and information systems infrastructure and processes. While there have been dissenting voices to this conceptualisation– see for example (Ciborra 1994) – the model has underpinned many subsequent works in this area – see for example (Chan, Huff et al. 1997; Sabherwal, Hirschheim et al. 2001; Chan 2002). Figure 1 shows Sabherwal and Hirschheim’s adaptation and extension of this model, and Table 1 gives their definitions of alignment. They use updated definitions of the domains: IS strategy, business strategy, business structure, and IS structure. The arrows between the domains reflect the different types of alignment; each of which is two way, reflecting the fact that adaptation occurs amongst all four. Sabherwal and Hirschheim have extended the model

to include typologies for each of the four domains: - this is discussed in more detail below (Sabherwal, Hirschheim et al. 2001).

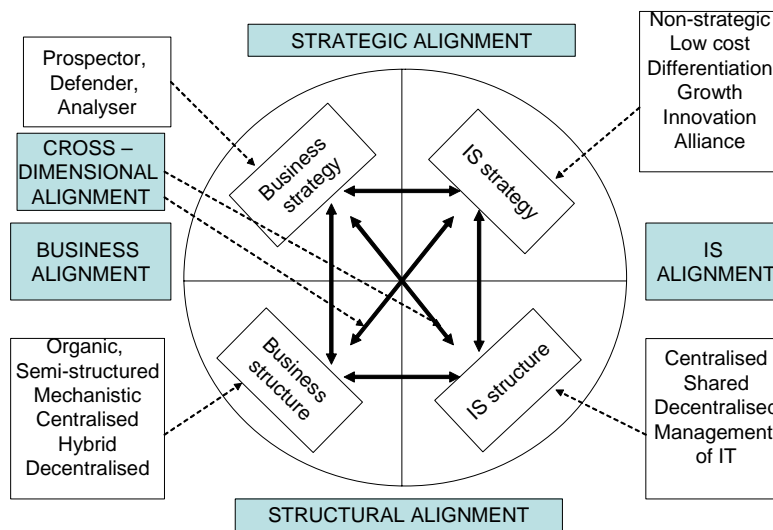


Figure 1: Strategic Information Systems Management Profile

Table 1: Alignment definitions

Strategic alignment	Alignment between business and IS strategies
Structural alignment	Alignment between business and IS structures
Business alignment	Alignment between business strategy and structure
IS alignment	Alignment between IS strategy and structure
Cross dimensional alignment	Alignment between business structure and IS strategy Alignment between business strategy and IS structure

As it stands, the model in Figure 1 allows us to investigate the alignment processes within an organisation. What is outside its scope, however, is the representation of alignment over time as the organisation is subject to the broader dynamics of external change.

Two approaches have been taken to modelling the broader dynamics. A fundamentally different approach to the problem has been suggested by Peppard and Breu (2003). They suggest that coevolutionary theory could be used to identify a new approach to organizational adaptation, and have produced an illustrative model for further empirical investigation. The second is the approach taken by Sabherwal and Hirschheim (2001), who build on the notion of four domains of alignment. It is this second approach that is taken forward in this paper, and therefore the main steps in their work are detailed below:-

- They define typologies for each of the four domains of alignment. For example, they use the typology of prospector, defender and analyser for business strategy, where a prospector strategy focuses on flexibility and innovation, a defender focusses on cost containment, and analysers combine elements of the two. Similarly IS strategy might focus on low cost, on growth, etc. Figure 1 gives the complete typology for each of the four domains.
- They define levels of alignment which depend on matching of typologies: a “defender” business strategy is said to be well aligned with a “low cost” IS strategy, but poorly aligned with a growth IS strategy, for example.
- They define the alignment level at a particular point in time.
- They then model the environment in which the business is operating in terms of the punctuated equilibrium model. This model suggests that we can expect organisations to move through short, sharp periods of revolutionary change that ‘punctuate’ slower, more evolutionary change.
- Each time there is a change from evolution to revolution, or vice versa, they plot the level of alignment, using the measures they previously developed.

Their empirical work is based on three case studies. They found that contrary to previous theory, IS and the business is not necessarily better aligned in the evolutionary phases. Their work reinforced previous findings that showed that only exceptional circumstances lead to instances of revolutionary change, finding that “there is

a reluctance in organizations to make revolutionary changes through which all or most of the dimensions of the strategic IS management profile are modified” Their paper suggests five strong triggers for revolutionary change, as shown in table 2 (Sabherwal, Hirschheim et al. 2001):-

Table 2: Triggers for revolutionary change

<b>Revolutionary trigger</b>	<b>Explanation</b>
Environmental shift	External changes such as legal requirements can affect alignment needs.
Sustained low performance	If either IS or the business performance deteriorates
Influential outsiders	External agencies, for example banks, can effect change.
New leadership	New leaders can provide the trigger for revolutionary change.
Perception transformation	Changes to the way IS is perceived, or changes to an organization's skillsets.

While Sabherwal and Hirschheim plot organisational change as a continuum on the revolutionary/evolutionary scale, their alignment models are presented as a series of “snapshots” over time – for example on organisation undergoing revolutionary change has a low alignment “snapshot” when a prospector business, with an organic structure has non-strategic IS, which is centralised. That same business moves to high alignment over a period of evolutionary change as the business becomes a defender with a mechanistic structure, a low cost IS strategy and a shared IS structure (op cit p 186).

This paper extends the concept of changing levels of alignment and asks: how can we move from the alignment “snapshots” developed by Sabherwal and Hirschhiem to a more detailed understanding of the temporal effects as alignment changes. In particular, are there delays in shifting to the new alignment, across any or all of the dimensions defined? Internal delays are known to be an important issue in IS. Research on time lags to returns on IS investment has found that delayed returns are an important indicator in helping us understand why, at the macro-economic level, IS investments can appear to give a negative return – the “productivity paradox” (Brynjolfsson 1993) (Brynjolfsson and Hitt 1996). This paper therefore proceeds to develop a conceptual framework for the study of internal response lags in the context of changing business environments.

In this paper, the internal response lag is investigated in terms of differences of perception between IS managers and business managers. Relationships between IS and business managers have been well researched. Differences between business and IS managers perceptions have been termed a “culture gap” (Taylor-Cummings 1998); the values, beliefs, service quality, structures and processes, leadership and roles of the two groups have been studied, (Peppard and Ward 1999), and the precursors to shared mental models between the two groups have been investigated (Preston, Karahanna et al. 2006). Informing this has been the parallel stream investigating the respective roles and competencies of the two groups, which suggests an increasing overlap over time (Broadbent and Weill 1997; Ross and Feeny 1999; Peppard, Lambert et al. 2000; Ross and Feeny 2000; Broadbent and Kitzis 2005)

## Background

The internal response lag model developed in this paper takes as its starting point a model developed for a slightly different purpose. As part of an extensive review of the literature on the effect of IT - dependent strategic initiatives between organisations, Piccoli and Ives (2005) developed a model of how time delays in implementing strategic initiatives lead to response lags for other firms trying to compete with the “first mover”. They defined a series of drivers for these response lags, as detailed in Table 3 below. (Piccoli and Ives 2005) p 753. They also is point out that there are two dynamic processes that “are often subject to time compression diseconomies and, therefore, cannot be accelerated by the firm.” (op cit p 751) These dynamic processes are organisational learning and asset accumulation. Organisational learning is defined as “the capacity or processes within an organisation to maintain or improve performance based on experience (op cit p 751), and asset stock accumulation is defined as the process by which a firm accrues or builds up a resource over time (op cit p 752).

The concept of a response lag, and the comprehensive analysis of its drivers, is used in the internal response lag developed here. In this model, IS managers’ and business managers’ perceptions of internal response lags, and their appropriate drivers, are captured. Their respective perceptions of how these response lags affect alignment is also captured. It is recognised that there will be feedback loops between the two, and these are also captured. In addition, in accordance with the punctuated equilibrium model, these feedback loops may sometimes reach

the point where they form a revolutionary trigger. Alternatively, revolutionary triggers may arise from external factors. This is also represented in the model, as shown in Figure 3.

Table 3: Barriers to Erosion and Relative Response lag drivers

<b>Response lag</b>	<b>Response lag driver</b>
1. <i>IT Resources Barrier</i>	IT Assets <ul style="list-style-type: none"> <li>• IT infrastructure*</li> <li>• Information repositories*</li> </ul> IT Capabilities <ul style="list-style-type: none"> <li>• Technical skills<sup>†</sup></li> <li>• Management skills<sup>†</sup></li> <li>• Relationship asset*</li> </ul>
2. <i>Complementary Resources Barrier</i>	Complementary Resources* <sup>†</sup>
3. <i>IT Project Barrier</i>	Technology Characteristics <ul style="list-style-type: none"> <li>• Visibility</li> <li>• Uniqueness</li> <li>• Complexity</li> </ul> Implementation Process <ul style="list-style-type: none"> <li>• Complexity</li> <li>• Process Change</li> </ul>
4. <i>Preemption Barrier</i>	Switching costs <ul style="list-style-type: none"> <li>• Tangible co-specialized investments*</li> <li>• Intangible co-specialized investments*</li> <li>• Collective switching costs*</li> </ul> Value System Structural Characteristics <ul style="list-style-type: none"> <li>• Relationship exclusivity</li> <li>• Concentrated links</li> </ul>

\* Response-lag drivers subject to asset stock accumulation processes

<sup>†</sup>Response-lag drivers subject to organizational learning processes.

In using the model, the definitions incorporated from the literature are used as follows:-

- IS and business perceptions of response lag and drivers: from Table 3
- IS and business perception of alignment: from Table 1
- Revolutionary triggers from Table 2.

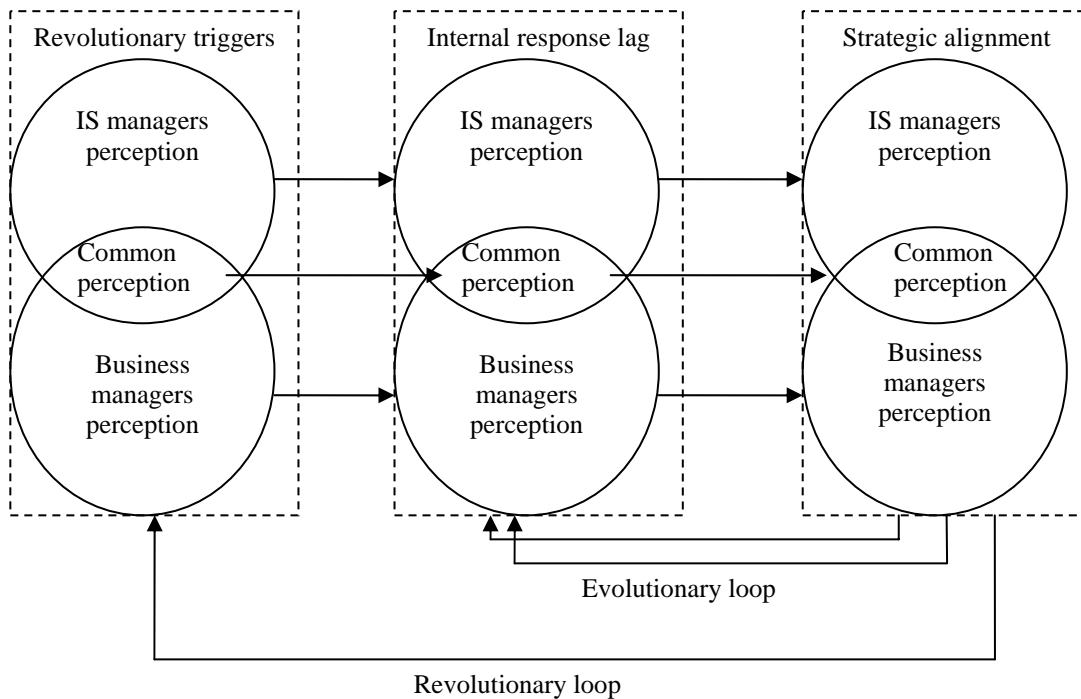


Figure 3: Internal response lag model

### Illustrating the Internal Response Lag Model

The response lag model is illustrated by means of two, complementary investigations. Firstly, a quantitative survey which compares attitudes of business and IS managers to strategic IS and business alignment. Secondly, follow up qualitative interviews which give some indication of IS managers and business managers' perceptions not only of strategic alignment, but also of the dynamics affecting it, including the revolutionary triggers, internal response lag drivers, and barriers to internal response identified in Figure 3.

#### Results of the Quantitative Survey

A survey was conducted using a previously validated survey instrument, which was used with the authors' permission (Preston, Karahanna et al. 2006). It took the form of a postal survey consisting of two parallel questionnaires: one for IS managers, and a similar but shorter one for business managers. The whole mailout package for each organisation was sent to the top IS manager. The package consisted of a questionnaire for the IS manager, and a questionnaire for the business manager, contained in an unsealed envelope. There was a message in the envelope inviting the IS manager to pass it to a senior business manager, and asking them to return the survey sealed in the envelope. The IS manager then forwarded the whole package back to the researchers.

The survey used a Fairfax Business Research database (Fairfax 2004), which contained the mailing details of the top IS manager for all firms with more than 1,000 employees, and for any particularly IS intensive firm, within Australia. There were 5,386 IS managers so defined, and the survey was sent to all of them. 365 IS managers responded to the survey – a 6.77% response rate. This is within the expected response rate where such senior executives are concerned (Chan, Huff et al. 1997; Pervan 1998; Enns, Huff et al. 2003; Fairfax 2004). The full survey, which investigated the relationship between IS managers and business managers, has been reported elsewhere.

Levels of shared understanding of the role of IS in the organisation were investigated. Scales were rated from strongly agree (5) to strongly disagree (1). Results are shown in Table 4 below.

Table 4: levels of shared understanding of business and IS

Perceptions of level of shared understanding	Source of survey	
	IS manager	Business manager
(A) The IS manager/ business manager and I have a shared understanding of the role of IS in our organisation	3.5	4.3
(B) The IS manager/business manager and I have a shared understanding of how IS can be used to increase productivity in our organisation's operations	3.6	4.1
(C) The IS manager/ business manager and I have a shared role of IS as a competitive weapon in our organisation.	3.3	4.0

These results show that IS managers do not hold as high a view as business managers regarding levels of shared understanding. It also showed internal differences, in that IS managers appear to view the potential of IS to enhance productivity and competitiveness in a different way from business managers. These results were therefore investigated further by performing cross tabulation and regression analyses. The results are as follows (A, B, and C as per the definitions in Table 4).

For business managers  $A = 1.06 + 0.43*B + 0.24 * C; R^2 = 0.43$

For IS managers  $A = 0.69 + 0.42*B + 0.39 * C; R^2 = 0.54$

This analysis indicates that IS managers regard a shared understanding of the role of IS to be as much about its potential to enhance productivity as about competitiveness. Business managers, by contrast, see shared understanding of productivity as more significant than their shared understanding of competitiveness. This may reflect a more internally focussed "efficiency" perspective from business managers, as compared with IS managers, who also see an externally oriented, "effectiveness" perspective.

### Results of the Qualitative Analysis: Exploratory Interviews

The qualitative analysis took the form of interviews with survey respondents in five organisations. The first (Org 1) is based in Australia and New Zealand. It distributes plumbing and electrical supplies, and makes plastic pipeline systems. Its operations are divided into four business lines. Interviews were conducted with the Chief Information Officer and the Chief Financial Officer. The second organisation (Org 2) is global, highly dispersed and organised along matrix lines. It operates on approximately 1,000 sites and is divided into 10 regions which are spread through Europe, Africa, America, Asia and Australia. Its headquarters are in Geneva, Switzerland. It specialises in inspection, verification, testing and certification, and its business is divided into ten lines. The CIO for the Asia Pacific region was interviewed. The third organisation (Org 3) was the distribution arm of an Australian publishing company. Interviews were conducted with the IT manager, the marketing manager and the general manager for a subsidiary company specialising in merchandising. The fourth (Org 4) was an Australian public sector organisation, where an interview was conducted with a senior director of operations. The fifth (Org 5) was an American bank, where an interview was conducted with an IT manager. The interviews were designed to explore the dynamics of strategic alignment, and therefore all respondents were asked to trace the "story" of one or more strategic activities which they considered significant, with minimal prompts from the interviewer. In addition, they were asked to comment on the relationship between themselves and their counterpart (IS managers were asked about their relationships with business managers, and vice versa).

A striking finding from these interviews was that, in each situation where the interviewee specifically identified a highly functional relationship between the IS manager and business manager, the only point of contention was that of the timing of strategic initiatives:-

"He's generally supportive but ... he's impatient for the pace at which we can do things. I don't think we've ever had a major disagreement to be honest, but where we certainly have some disagreements is around the pace of change" (Org 1 CIO describing relationship with CEO)

"He wants to fix a bunch of things and he's frustrated with the pace of change because I've got the classic CIO dilemma of I've got unlimited demand limited supply of resource and cost. The view is these guys are doing a great job but it's just too slow" (Org 1 CIO describing relationship with line manager)

"Because of (the IT manager's) insistence, we actually prepared a very, very good document. However, the downside is that it's taken a long time to do it" (Org 3's marketing manager)

"She was a great mentor... she helped enormously by being able to understand that the business was the prime reason for having a system, rather than the system being the prime reason for having the business. ....Now there

were conflicts between her and me...and that is where something was happening at the business interface which was creating strife and causing all sorts of negative feedback. My requirement of those people was to fix it. ...if there was a bad problem which they said would only take six weeks to fix and I said it had to be done in two days” (Org 4’s operations manager describing relationship with IS manager).

This finding was one of the key reasons for the development of the internal response lag model. The data from organisation 1 has allowed a more comprehensive analysis of the relationship between the CIO and several managers, and is given below.

#### Organisation 1

The strategic initiative discussed was the rollout and consolidation of an ERP system, which was problematic. Costs were escalating, the technical platform was unstable, business processes had not been reengineered to gain value from the system, and there was a silo mentality in most of the business lines. The CFO moved into his role after the initial ERP implementation and found that he was spending a considerable amount of his time working on the project. He subsequently recruited the CIO, who reported to him. Both agreed that they had a very close working relationship and saw things similarly. Both showed a detailed understanding of the business, and a detailed understanding of the requirements for ERP implementation and process change. Soon after the CIO was recruited, a new CEO was appointed, whose vision included making full use of the ERP as a platform for organisational change. The CIO believed that his knowledge of the organisation and his project management skills were key to his being able to fulfil the brief of the CEO; namely, to fix up problems with the initial implementation and “work with executive general managers of each of the business units to try to reengineer certain aspects of this group, in particular the fact that we are in four silos.” (CIO) The comparison between the perceptions of the CIO and of other business executives could be summarised as follows.

- With the CFO – common understanding
- With the CEO and Line Manager 1. A common understanding of technological possibilities. Differences in perceptions regarding timing. Both parties wanted to make change more quickly than the CIO, who had two concerns: firstly that changes in personnel needed to be done in such a way as to preserve organisational knowledge, and secondly that business requirements needed to be accurately ascertained. Both the CEO and the line manager were “IT savvy”: the CIO interpreted that in terms of the managers’ broader backgrounds “we’ve all grown up in the same IT age”.
- With the two other line managers (Line Managers 2 and 3): difference of opinion of the importance of IT, with the line managers seeing it as “keeping some hardware running”. (CIO). Here there were problems with understanding IS, again expressed in terms of broader background: “When ..[he]... started working that was the punch card era, you know... there were no PCs for 20 years of his working life”.
- With one line manager (Line Manager 4): a political issue in that he wants to retain power over his own part of the organisation.

Seen from the perspective of the internal response lag model, the CIO perception was that when he joined the organisation it had low levels of alignment. Both types of cross dimensional alignment were low: business structures, including processes, were poorly aligned with the IS strategy of an implemented, integrated ERP system, and IS structures were poorly aligned with the business strategy of an efficient integrated system, as the technology was unstable. A silo mentality meant that business alignment – between business strategy and structure, was also problematic. The technical problems meant that IS structures did not allow IS strategies to be effectively implemented, and hence IS alignment was also poor. The combination of silo mentalities and technical problems also meant that structural alignment – between business and IS structures – was also a problem. Arguably, IS and business strategies were fairly well aligned.

Taken together, the level of alignment was so poor as to cause severe problems for the business “.. seriously had the potential to sink (the organisation)” , and so could be taken to be a revolutionary trigger of sustained low performance. Soon after that a second revolutionary trigger occurred – that of new leadership in the form of a “technically savvy” CEO.

The CEO, the CFO, and line manager 1 shared the CIO’s view. Line managers 2 and 3 did not have a clear perception of the need for revolutionary change, as they saw the role of IS to be a limited, infrastructural one. Line manager 4 did not see the need for revolutionary change as he was keen to retain political control.

The CIO was working to achieve better alignment by first stabilising the technology, and then improving business processes. He saw internal response lags as arising from the IT assets (technological underpinnings needed to be changed); complementary resources in terms of organisational learning (a silo mentality in some lines of business, and a lack of IT understanding, particularly from older line managers); and the complexity of



the implementation process (innovation required a detailed analysis of business requirements) . The CFO shared his views. The CEO did not perceive the same response lag in terms of organisational learning – he did not share the CIO’s view regarding the necessity to retain staff with key business knowledge. Manager 1 did not perceive the same response lag as the CIO in terms of the complexity of the implementation process – he expected change to be made without a detailed analysis of business need.

Table 5 below summarises the discussion regarding the application of the internal response lag model to Org 1.

Table 5: Summary of application of the response lag model to Org 1

Perspectives	Revolutionary Triggers	Internal response lag drivers	Strategic alignment
CIO	<ul style="list-style-type: none"> <li>Sustained low performance</li> <li>New leadership</li> </ul>	<ul style="list-style-type: none"> <li>IT Assets</li> <li>Complementary resources – organisational learning</li> <li>Implementation process - complexity</li> </ul>	<ul style="list-style-type: none"> <li>Alignment low across all dimensions except for strategic alignment</li> </ul>
CFO	<ul style="list-style-type: none"> <li>Common perception</li> </ul>	<ul style="list-style-type: none"> <li>Common perception</li> </ul>	<ul style="list-style-type: none"> <li>Common perception</li> </ul>
CEO	<ul style="list-style-type: none"> <li>Common perception</li> </ul>	<ul style="list-style-type: none"> <li>Complementary resources – organisational learning: Saw requirement to retain business knowledge in key staff as less of a barrier</li> </ul>	<ul style="list-style-type: none"> <li>Common perception</li> </ul>
Line manager 1	<ul style="list-style-type: none"> <li>Common perception</li> </ul>	<ul style="list-style-type: none"> <li>Implementation process – complexity: Wanted implementation with less business analysis</li> </ul>	<ul style="list-style-type: none"> <li>Common perception</li> </ul>
Line managers 2 and 3	<ul style="list-style-type: none"> <li>Less perception of problem</li> </ul>	<ul style="list-style-type: none"> <li>Less perception of problem</li> </ul>	<ul style="list-style-type: none"> <li>IT seen as infrastructural only</li> </ul>
Line manager 4	<ul style="list-style-type: none"> <li>Politically motivated lack of interest in problem</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>

From Organisation 1, three viewpoints were derived:-

- Some business managers are so heavily involved in IS strategic project that there are no key areas of difference in perceptions between them and the IS manager
- Some business managers have a similar vision to the IS manager of IS strategic possibilities, but view the barrier to internal response as lower than does the IS manager, because they take different account of the response lag drivers. They therefore expect results more quickly than does the IS manager.
- Some business managers do not share the IS managers view of the strategic possibilities of IS, seeing it rather as an infrastructure.

This analysis compares well with the quantitative finding, that business managers see shared understanding of productivity as more significant than their shared understanding of competitiveness

## Conclusions

Initial explorations confirm the value of looking at an internal response lag model to further our understanding of IS managers’ and business managers’ perceptions of strategic alignment. Both the qualitative and quantitative data suggest that there may be a difference in some business managers’ and IS managers’ views on the nature of strategic alignment. Further investigation in the interviews suggests that some managers do not share the IS managers’ vision of the potential for strategic IS systems to provide competitive advantage, seeing IS as a cost cutting, infrastructural tool. However, some business managers do share the IS managers’ vision. In that case, however, there can be differences of perceptions of the internal barriers to achieving that vision, and in particular the time it will take to do so. Set against the backdrop of very fast change, these timing issues have the potential to be an important factor in maintaining or hindering IS alignment with the business.

The investigations in this paper have been exploratory. In order to validate the model further, it is suggested that a comprehensive study be executed. This would involve several in depth case studies. A number of executives, both IS based and business based, should be interviewed within each organisation. While the interviews should, as described here, consist of asking interviewees to describe the "story" of strategic initiatives, they should be semi-structured to take into account all areas of questioning in the internal response lag model, namely:-

1. How do IS managers and business managers view the business benefits of strategic information systems, particularly in terms of efficiency (productivity) and effectiveness (competitiveness)?
2. How do IS managers and business managers view the alignment of IS and the business?
3. What are IS managers and business managers' perceptions of response lags in improving alignment?
4. How do IS managers and business managers view the dynamics of the external environment in which their business is operating?
5. How do IS managers and business managers view the changes that have occurred, both externally and internally driven over the life time of the strategic?

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