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Investigating A Generic Architecture For International Information Systems

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Purpose of the research

Despite their often pivotal importance for the global firm, international applications of information technology are still "largely unreported [and] unstudied" (Cash, McFarlan & McKenney, 1992) if not "..generally ignored." (King & Sethi, 1993). However, while scholarly research into this field is sparse, there is an increasing amount of anecdotal evidence of serious mishaps in the development and implementation of international information systems.

This research projects investigates whether there is a generic architecture common to international systems sui generis. If there is, then this could well have positive ramifications for a more successful development approach.

Definition of 'International Information Systems'

A definition is needed to distinguish international systems from other distributed systems. 'International Information Systems' are defined as distributed information systems which support similar business activities in highly diverse environments commonly found across country boundaries. They are thus distinguished from information systems which support different business activities or functions, which are different by definition, whether they are in single or multiple locations, national or international.

Strategies, management structures and information system architectures of the international firm

The architecture of international systems seems directly influenced by the strategy and structure of the international firms which use them (King & Sethi, 1993; Sankar, Apte & Palvia, 1993; Kosynski & Karimi, 1993; Butler Cox, 1991; Ives & Jarvenpaa, 1991).

The major factors shaping an international firm's strategy seem to be the level and intensity of global control versus local autonomy. The framework developed by Bartlett & Goshal (1989) seem to model this best. Kosynski & Karimi (1993) show that corresponding to these global business strategies there are specific organisation structures of firms operating in more than one country. Butler Cox (1991), Kosynski & Karimi (1993) and Sankar, Apte and Palvia (1993) develop a further linkage between information systems architecture and the strategy and structure of the international firm. These relationships are summarised in Table 1 below.
If the replicated structure is discarded as a physically distributed incarnation of the centralised architecture, there are thus three generic architectures outlined, namely centralised, autonomous and integrated.

The centralised architecture ignores local diversity and the autonomous architecture ignores global influence. The integrated structure is the one where a balance of control can be reflected, i.e. it is the information systems equivalent of the heterarchical organisation of the transnational firm.

**An generic architecture model for international information system**

That international systems need to accommodate differing local needs has been established early on by Buss (1982) and Keen et al (1982). However, there has been little further development of this model since and Ives & Jarvenpaa (1991) conclude that "the literature offers little guidance for...local versus common applications", except perhaps Keen's (1991) 'transnational [information technology] platform'.

Not least because of its intrinsic plausibility, further investigation of this common/local notion seems warranted. A 'common-local' architecture could be expressed in a two dimensional topology with a common 'core' and 'local' parts. Conceptually, the 'core' is similar to Weill's (1992) notion of an information technology infrastructure, i.e. "to provide a stable base of reliable services" but exceeds it by also becoming a reflection of the required level of global control. The degree to which applications are included in the core corresponds to Keen's (1991) notion of 'infrastructure range', whereas the extent of the 'local' parts (unique to each site) correlate with his concept of 'reach'.

<table>
<thead>
<tr>
<th>Global Business Strategy</th>
<th>Organisation Structure</th>
<th>Systems Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global: high global control</td>
<td>Centralised</td>
<td>Central systems used globally</td>
</tr>
<tr>
<td>Multi-national: high local autonomy</td>
<td>De-centralised</td>
<td>Autonomous systems in de-central locations</td>
</tr>
<tr>
<td>International: mixed global/local control</td>
<td>Co-ordinasted Federation</td>
<td>Replicated copies of a global system in local sites</td>
</tr>
<tr>
<td>Transnational: high global and high local control</td>
<td>Network or 'Heterarchy' (Hedlund &amp; Rolander, 1990)</td>
<td>Integrated systems in all locations</td>
</tr>
</tbody>
</table>

Table 1: Strategy, structure and systems architecture of the international firm

The two-dimensional topology can accommodate all of the above systems architectures identified in the literature: Centralised architectures have a 'local' content of (near) zero, Decentralised ones have a 'core' of (near) zero and Integrated structures have a varying 'core' to 'local' ratio for each element and/or for each location.
As such a 'common/local' architecture can be made to fit these three architecture models, it may be assumed that there is a generic architecture model for international systems which will fit most/all international information systems. However, before a full research project was set up, three (mini)cases were investigated as a pilot study to obtain an indication whether such a generic architecture can be validated in the real world.

**Comparison of the 'common/local' architecture model with some empirical observations**

Three case vignettes from the author's own experience were used:

1. A leasing firm, where global control over lease set-up and customer exposure was balanced with full autonomy for local systems;
2. A merchant bank which used all local systems in their largely independent international operations, linked only by stringent information standards for central risk management;
3. A commodity board, supported by large central production and marketing systems, connected with message standards to closely directed sales outlets around the world.

The information was obtained in interviews and participant observation. Table 2 overleaf summarises the outcome of the pilot case:

The degree of local autonomy and global control in these three cases seems to be correlated to the topology of international systems, i.e. the 'size' of local and common systems elements respectively. This confirms the influence of strategy on information systems structure mentioned in the literature and also indirectly confirmed by King & Sethi (1993), who in their case study also point to the "overriding role of business strategy".

The fact that the pilot study corroborates the notion of a common and generic systems architecture for international information systems was sufficient encouragement for the establishment of the main research project. As this is investigative, 'theory building' research, a case study methodology has been selected (Lee, 1989, Benbasat et al, 1987, Eisenhardt, 1989). Three case sites have been established in New Zealand, a further two in the USA, one in the UK and one (still under negotiation) in Germany. The fieldwork will be completed by the end of 1995.

<table>
<thead>
<tr>
<th>Architecture and Strategy</th>
<th>LEASING FIRM</th>
<th>MERCHANT BANK</th>
<th>COMMODITY BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common 'Core' information systems</td>
<td>'Medium core'; selective customer database; central leasing application</td>
<td>'Thin core'; data &amp; communication standards</td>
<td>'Large core'; large central system at the production sites and head office</td>
</tr>
<tr>
<td>'Local'</td>
<td>'Medium locals'; local</td>
<td>'Large locals'; all</td>
<td>'Thin locals'; message</td>
</tr>
<tr>
<td>Information systems</td>
<td>Receivables &amp; Marketing systems</td>
<td>Operations systems locally sourced</td>
<td>and file transfers to centre</td>
</tr>
<tr>
<td>---------------------</td>
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<td>-----------------------------</td>
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<tr>
<td>Global Strategy</td>
<td>'Transnational'</td>
<td>'Multinational'</td>
<td>'Global'</td>
</tr>
</tbody>
</table>

Table 2. Summary of the case histories

References


