Chapter 2
International Information Systems in the Literature

The following sections first put the research literature on international information systems in the wider context of information systems research in general. The second part will discuss the development of international information systems research literature and set out the 'state-of-the-art' at the end of 1994, when this research project was started. An overview of the literature since then concludes this review.

2.1 Scope and Depth of the Research into International Information Systems

International information systems are still a minority interest in the wider field of information systems research. The ABI/INFORM database lists 32,919 papers (with 'information systems' as a keyword) for the period from the beginning of 1985 to the end of 2005. For the same time period, keywords to do with international information systems occur in 234[1] papers, i.e. in less than 1%. By contrast, a traditional sub-area of information systems research such as Decision Support Systems has 3,607 listings in the last 15 years, or 11% of all IS papers. When the current research was started towards the end of 1994, there were a total of 69 papers listed for the 10-year period 1985–1994 – only 14 of them in '1st Tier' journals.[2] Interest then seems to have increased and over the next 5 years 165

[1] This compares well with Gallupe et al. (1999) who found 314 articles between 1990 and 1998, albeit in the much wider field of 'information management', i.e. in a wider spectrum of journals.

[2] These are defined as: *MIS Quarterly, Information Systems Research, Communications of the ACM* (research articles only), *Journal of Management Information Systems, Decision Sciences, IEEE Transactions on Communications* and *Software Engineering,* and *Management Science*.

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papers were produced – 20 of them 1st Tier. The foundation of two journals for the field (in 1993 and 1998[3]) was indicative of this upturn in attraction.

However, on closer inspection, some of these papers do not qualify as global information technology research, which Palvia (1998, p. 4) defines as being concerned with information systems that are global in scope; operate in different cultures; and offer unique insights in comparison to a uni-cultural environment. About one in four of the 234 papers are studies about 'IS/T in another country…offering no unique insights…' and just because they are 'conducted in a country other than [the researcher's] own does not make it automatically global information technology research'(ibid.).[4]

On the other hand, one in ten papers covers aspects of the nature of international information systems, such as their structure and design, and one paper attempts to set out a framework for their research.

The remaining papers cover a considerable diversity of subjects. Information Technology in developing countries and cases of specific technology applications dominate the literature, as do cross-cultural studies and surveys (of, e.g. key issues in IS/T management) in more than one country. Nineteen further categories formed a large group of 'Other' research topics.

2.2 Research into International Information System Until 1994

A first attempt at identifying transnational IS issues was developed by Mandell et al. (1979) in a survey of European multinationals. They suggested that linkages between parent and subsidiaries could be divided into four types: organizational, data, technology, and communications. Each linkage presents a unique set of issues and problems. Early research into international information systems, however, seemed to focus mainly on issues of trans-border data flows, i.e. 'movements of machine readable data across national boundaries' (Sauvant, 1986). This area (summarized by Hamelink, 1984) was of increasing concern, firstly because of privacy mandates (Maisonrouge, 1981), but increasingly because regulation of trans-border data flows and international communication 'may make or break companies doing business multinationally during the next decade' (Moore, 1984, p. 30).

1982 saw two landmark publications: one was the first case history of an enterprise-wide[5] information system to be implemented in 40 banks globally. In it, Keen et al. (1982) first identified the common/local structure of a global system. The other paper, by Buss (1982), was the first to offer a comprehensive

[3] Journal of Global Information Management and Journal of Global Information Technology Management, respectively.

[4] Gallupe et al (1999) found an even higher percentage: 46.2%, of papers had 'Single Country' studies as their research theme.

[5] Kneitel's (1980) case about Du Pont's polymer sales system covers one application only.

discourse on the managerial and organizational aspects of international information systems. He underscored the need for IS planning and noted the lack of any planning frameworks. He observed that multinationals differ greatly from domestic firms in the arrangement of hardware and software and in the role of their corporate IS. Further, he argued that 'this diversity of approaches is confusing and there are few models to follow.' He recommended that multinationals should plan their IS by creating the right organizational framework and by defining the roles of key players.

Such a comprehensive planning framework was suggested by Selig (1982) who compared it with the actual planning practices of 25 US multinationals and found that there were significant differences in structure and detail. He concluded that the differences were attributable to contingency factors such as market and industry diversity and corporate roles.

It then took until 1989 before such 'contingency factors' were identified. Thompson et al. (1989), building on the work of Prahalad et al. (1987) and Bartlett et al. (1989) about business strategy of multinationals, suggested that two factors – degree of market integration and degree of home country rule – be used to categorize firms into one of four globalization stages, with salient IS management concerns for each stage. Reck (1989) took this a step further. Recognizing three fundamental operating strategies for multinational corporations – which he dubbed 'imperialistic, multidomestic, and global' – he posited that they also define IS issues such as technology architecture, data architecture, and communication architecture.

The notion that strategies could influence the information technology supporting them led a number of researchers to look more closely at those 'drivers' for global information systems. Applegate et al. (1996) and Ehrlich (1989) link the business reasons for global expansion to the nature of information technology employed. Ives et al. (1991) defined a set of ten 'business drivers for global information technology'. Whereas most of those are operations oriented, Butler Cox (1991) and Neo (1991) also found the marketing dimension as a significant factor in shaping global information technology. From a more technical angle, Hsu et al. (1991) identified the need to integrate data more stringently across 'heterogeneous, distributed environments' and Vinea (1992) developed an outline of the necessary software and architectures to achieve that.

Uniting most of this early research into global information technology was Palvia's seminal edition of *Global Issues of Information Technology Management* in 1992. In addition to topics on technology diffusion in developing countries and studies of specific industries and applications, for the first time a sizeable section was devoted to issues of managing global information technology and organizing for it. Keen (1992) set out strategic planning issues and Roche (1992b) summarized the lessons learned from seven cases about the development of international information systems. Furthermore, both Sethi et al. (1993) and King et al. (1992) attempted to establish a framework for international information systems, the former addressing the firm-internal environment and the latter also including the external influences on the international firm.

Two years later, Deans et al. (1994) edited *Global Information Systems and Technology: Focus on the Organization and its Functional Areas.* Concentrating on application systems issues, this germinal anthology brought together research from other disciplines, predominantly International Business.

Information systems research in the field, meanwhile, began to concentrate on the structure and architecture of IIS and how these fit with the overall organization of the multinational firm. Jarvenpaa et al. (1993) found distinct differences in the way firms organize their information technology – and that over half of the 109 firms investigated showed significant inconsistencies between the way information technology is structured and the organization of the firm itself. Cummings et al. (1994), in a survey of 67 subsidiaries of US firms in the oil and gas industry confirms a perceived complexity in the relationships between information systems, organizational structure and the environment.

Earl (1989) defined the architecture of an information system as 'the technology framework which guides the organization in satisfying business and management information systems needs'. To this, Keen (1991) and Weill (1992) and Weill et al. (1994) added the concepts of 'reach', i.e. the penetration of global sites, and 'range', i.e. how many of the operations are supported by an 'infrastructure', mostly of common technology.

A number of researchers have compared the architecture of international systems with the business strategy of the international firms that use them, using classifications developed by Prahalad et al. (1987) and Bartlett et al. (1989). Both classify the multinational's business strategy along two dimensions of global control versus local autonomy, as Figure 2.1 shows below.

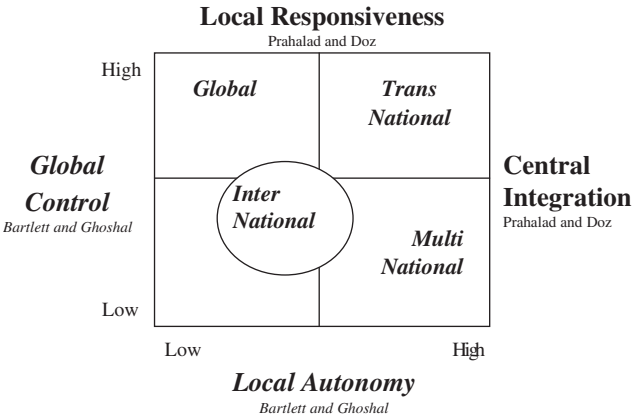

Figure 2.1 Global business strategies of multinational firms: the *Bartlett* and *Ghoshal* and Prahalad and Doz's integration-responsiveness models

Bartlett and Ghoshal's model, which integrates both global business strategy and organizational forces, has proved to be the most often selected framework by

researchers into the linkage between international information systems' architectures and the strategic stance a multinational firm takes. Its four strategy archetypes are:

The '*global*' business strategy shows a high degree of global control at the expense of local autonomy;

Juxtaposed to this is the '*multinational*' strategy with little global guidance and high local control;

'*Transnational*' organizations balance tight global control in certain aspects with a policy of vigorously fostering local autonomy, particularly for the diffusion of innovation. These firms 'think global and act local' (Bartlett and Goshal, 1989). This strategy is considered optimal for many multinational corporations;

Defined as an interim, or transitory stage, the 'international' firm shows considerable variety between global and local control, often with neither control modus dominant.

Butler Cox (1991), furthermore, put a developmental perspective on the Bartlett–Ghoshal framework. While they use a different terminology, companies seem to become active internationally first as 'Exporter' of their goods or services – usually applying a '*Global*' [6] business strategy. Increased activity in any one location encourages autonomy for local operations, taking on the role of 'National Adapter', similar to the '*Multinational*' classification. In the next phase this degree of autonomy is counterbalanced by some global control as 'Central Co-ordinator', i.e. an '*International*' firm. Finally, as global operations mature, firms move towards a status of 'Global Co-ordinator' (equivalent to the '*Transnational*'). This migration does not necessarily follow a set pattern of clear stages, nor does it move synchronously in all locations, or with all products, at the same pace. Figure 2.2 below shows this migration.

Butler Cox (1991) also developed a model of IIS where there is a direct, one-to-one relationship between Bartlett and Ghoshal's global business strategies and these systems architectures. They distinguish between:

'Centralized' systems;
'Replicated', i.e. multiple copies of one central system;
'Autonomous', local systems;
'Integrated' systems, developed at local and central sites.

Other researchers propose similar relationships between information systems structure and global business strategy. Konsynski et al. (1993) describe (in the same sequence as above) 'centralized', 'inter-organizational', 'decentralized' and 'integrated' architectures. Sankar et al. (1993) define three global information architectures by the way their elements are linked, namely:

Integrated (separate elements, logically connected);
Centralized (together and connected);

[6] Italics denote the Bartlett & Goshal classification.

Decentralized (separate and disconnected).

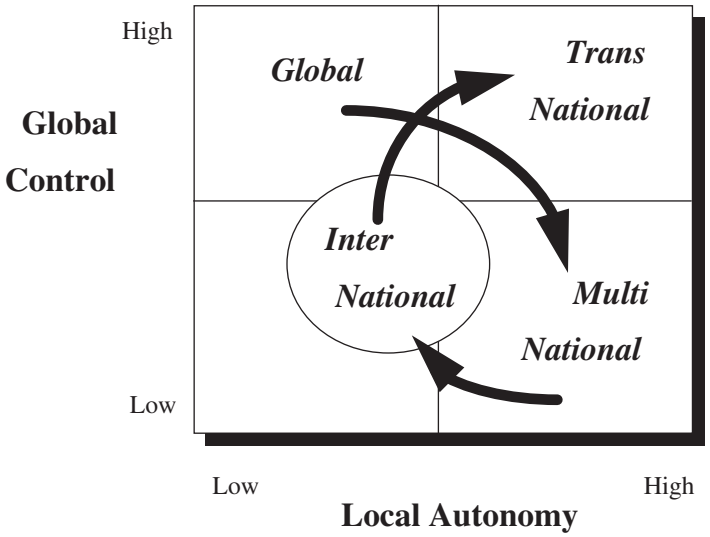

Figure 2.2. Migration through global business strategies

Jarvenpaa et al. (1994), in a study of organizational fit and flexibility in international information systems describe a framework of 'Global Information Technology Configuration' that also maps directly onto the Bartlett Ghoshal typology. That study is also supported by a series of previous case studies (Ives et al., 1991, 1992, 1994).

Gibson (1994) used statistical analysis (factor analysis, etc.) to arrive at seven-element definition of information technology architectures. Investigating them in the context of multinational companies, he found that they grouped into four distinct patterns as generic architectures, which, again, corresponded to Bartlett & Ghoshal's categories. Table 2.1 summarizes the results from the five studies:

Table 2.1. Comparison of architecture styles/configurations identified in the literature

Bartlett & Ghoshal	Butler Cox	Kosynski & Karimi	Sankar et al.	Ives & Jarvenpaa	Gibson
Global	Centralized	Centralization	Centralized	Headquarter driven	Centralized
Multi-national	Autonomous	De-centralization	De-centralized	Independent	De-centralized
Inter-national	Replicated	Inter-organizational	(Undefined)	Intellectual Synergy	Co-ordinated
Trans-national	Integrated	Integrated	Integrated	Integrated	Integrated

It seems that just as the 'international' business strategy is an intermediary stage, so are the corresponding global information technology configurations. If these replicated/inter-organizational/intellectually-synergized and co-ordinated structures are regarded as embryonic 'integrated' architectures, then just three generic architectures (*centralized, decentralized* and *integrated*) could suffice, as Figure 2.3 below shows.

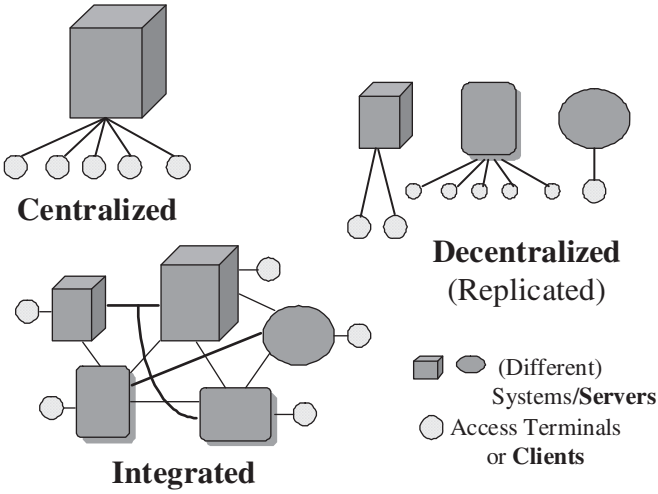

Figure 2.3. The three generic architectures of international information systems

Gordon (1994) analyzed the difficulties with centralized and globally standardized international information systems with a specific focus on telecommunications. The role of decentralized systems and the nature of the 'integrated' structure/architecture in an international context, however, had not yet been an object of rigorous empirical study.

By the end of 1994 international information systems research was well into what Palvia (1998) termed the 'first generation' of global information technology research. He characterizes the research in this phase as predominantly

- Descriptive studies, sharpening the understanding that international information systems are different from domestic systems, and perhaps significantly so;
- Exploratory studies, where first conjectural theses about the nature of these global/international information systems were formed, the major one being the connection between Global Business Strategy and the structure/architecture of the international information systems supporting them; research was, however, still mainly;
- Opportunistic, because of an absence of guiding frameworks that were specific enough to be useful: the first ones developed by then were – by necessity – either very broad [Deans et al.'s. (1994) embraced all of MIS research, just as

King et al.'s (1992) incorporated all of the multinational firm's global external environment] or too narrowly focused on just one aspect of global information technology, such as Ein-Dor et al. (1993) and Nelson et al. (1992) who concentrated solely on cross-cultural issues.

2.3 Relevant Research Since 1994

Following the establishment of a number of conjectures, a number of researchers set about trying to verify some of them. Significant examples concerning the nature, structure or architecture of international information systems are:

- Tractinsky et al. (1996), using Q-methodology (33 items on 18 project managers of multinational firms), confirmed empirically that a global context contributes significant variability and complexity to IS design and established that global systems need a design approach different from other large, distributed systems;
- Grover et al. (1996) found no such confirmation when they tried to validate the previously posited link between global business strategy and architecture of the global IS. Their data (from 344 respondents in the US, France and Korea) supported only minimal consistency between the organization of firms and the configuration of their information systems;
- Similarly, Burn et al. (1996) found that the concept of alignment or 'fit' between organizational and technology management structure does not work well in a global firm. Their results showed that problems with global information technology stem predominantly from 'social' issues – whereas information systems management is often aligned along technical lines.

1996 also saw Palvia et al. issue a follow-on collection of research papers, *Global Information Technology and Systems Management – Key issues and Trends*. Building on the previous anthology's foundations, this collection staked out specific concerns such as the technology environment, issues of national infrastructure, technology architectures and themes of systems planning, development and management. Of specific interest is Roche's (1996) analysis of the internet's likely impact on global information technology – one of the first acknowledgement of border-less electronic commerce. In the same spirit of more concrete, predictive, research, Targowski (1996) provided a detailed analysis of the technology infrastructure for global systems. Deans et al. (1996) put together the first textbook on international information systems for use by post-graduate students of International Business.

Detailed issues of international information systems design were taken up by Simon (1996) with the introduction of 'control' versus 'co-ordination' as determinants for the centre-subsidiary division in the configuration of information systems. His work builds on foundations already laid by Palvia's (1995) distinction of a global versus a domestic dimension. This topic had also been

addressed by Apte et al. (1995), who re-affirmed that global systems have a local and a global component, corresponding to the dis-aggregation of the underlying information services of the multinational firm. Nelson (1996), further underscoring the distinction of global/international information systems, established a comprehensive set of quality dimensions for global information systems.

Christmann (1998) and van den Berg et al. (1999) carried on the emergent tradition of research into the development of international information systems. The former emphasizes the importance of developing a vision, specific for global information technology. Van den Berg et al., investigating four systems in operation across European borders, concluded that the key issues with such systems are with people, not with technology; the design and implementation, not the actual building, are the danger points in their development; and internal, political issues are of greater import in the life-cycle of their creation than external, cultural issues.

Three important frameworks were created:

- Gallupe et al. (1999) analyzed the research literature on information management over the last 10 years and distilled a comprehensive framework and taxonomy for research in this field. This now provides a detailed and practical guide for selecting and classifying areas of research;
- King et al. (1999) revisited their 1992 framework and in a large research project (150 multinational firms from 25 industries, represented in 20 countries) established an empirical base for an authoritative model of the organization of transnational systems. Their model confirms a link between the firm's organization and the configuration of its global technology – but they also found the relationship to be of considerably higher complexity than postulated in previous research;
- In a similar vein, Peppard (1999) extended the two domains (business organization and information systems architecture) to propose a higher level of sophistication for models of the interaction between business and information technology in the multinational firm.

In the last 10 years, research into international information systems has become a more accepted branch of IS research. This is visible in the quantity – and often the quality – of publications. There are also a larger number of discussion forums for researchers in this field: a number of first tier conferences now have tracks dealing with global information technology. 'Informatics in Multinational Enterprises' is the focus of the Working Group 8.7 within the International Federation of Information Processing (IFIP). The group holds regular working conferences in conjunction with the International Conference on Information Systems (ICIS). Last, but not least, popular undergraduate textbooks on information systems, such as Laudon et al. (1995) and O'Brien (editions since 1998), now contain chapters on international information systems.

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