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A framework for information services: benchmarking for countries and companies

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Abstract

Purpose – The typology developed in this research allows one to compare a variety of information services around the world. A properly built typology ensures a methodologically-valid framework.

Design/methodology/approach – In this research typology-building methodologies developed in social sciences and strategic management are imported to provide an example of how a typology may be built for information services.

Findings – The prescriptive element derived from this framework helps to benchmark countries relative to different information services as a function of their level of development and cultural characteristics.

Originality/value – This research enables managers of multinationals to distribute their information globally by taking advantage of the relative differences among countries.

Keywords Benchmarking, Multinational companies, Information systems

Paper type Research paper

Introduction

In the past few years, multinational organizations have been increasingly trying to configure their information services on a global scale. Today, firms are investing significantly greater amounts of resources internationally through foreign direct investments. In conjunction with the dispersion of the production activity, many of the service/back-office functions are being out-sourced to foreign locales with sufficient skill levels and lower labor costs (*Economist*, 2001). This indicates that multinationals have recently recognized the tremendous potential to not only market services overseas, but also produce/procure such services internationally.

In particular, one of the key type of services a company provides and depends upon is information service. Just as manufacturing can vary in terms of the level of inputs, information services can also differ in the inputs required. Some types of information services require low technology and significant manual labor, whereas other services require a high degree of knowledge component and an advanced technological sophistication. Given that nations differ significantly in terms of culture and developmental characteristics, the type of benefit and support they can provide also varies tremendously. Thus, astute multinationals can disperse their activities globally to leverage the comparative advantages offered by countries. Low-tech manual services might be sourced to one country, whereas high-tech knowledge-based services could be developed in another nation. All these trends suggest the impending explosion

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of global information services. To be successful in such endeavors, however, it is crucial that firms benchmark their services to meet the needs of their global operations and ensure that the services reflect the unique environment of the various nations.

To guide such activities, considerable literature exists in the global information management area. This literature suffers from relatively weak methodology; many of the underlying models are unable to explicitly encapsulate the salient information services variables with relevant international dimensions. In this research, we attempt to fill this gap by building a typology that would result in a framework which can predict the relationships between information services complexity and various international variables.

Such a framework, can help practitioners benchmark the utility of various IS services for their unique environments. Numerous benefits can result in using this typology for government officials and industry players. For instance, IS managers would be able to define their services to reflect the country where they operate and determine which countries have an inherent comparative advantage for specific technologies. Government officials can use this methodology to identify specifically what types of investments to make in soft or hard infrastructure in order to allocate and support various types of information services. Researchers can also find this typology of use in that:

- it provides a theoretical framework for global information services; and
- it can be generalizable across variations in technologies and countries.

To ground our research, we will next examine the literature in theory development and benchmarking, information services, and global information services. Following this synthesis, salient dimensions are extracted for the typology. Finally, we discuss the applicability of this framework and provide directions for future research.

Literature review

Benchmarking and theory building

Unlike competitive advantage, benchmarking goes beyond a comparisons of results to include an analysis of organizational processes and methods (Fitz-enz, 1993). Several authors have examined benchmarking information technology/services relative to a number of issues including small firms (Cragg, 2002), quality assessment (Lee *et al.*, 2002), and e-commerce (McGaughey, 2002). However, the literature indicates that academia is lagging behind in terms of providing the necessary framework (Yasin, 2002) and a systems-wide approach (Jackson *et al.*, 1994) for benchmarking. In this research, we discuss how building a typology can provide a relatively more precise method of analysis which supports a systems-wide approach. Since, this typology-building methodology is not very common even in the overall benchmarking and management systems literature, we will next review some of its fundamental aspects.

In this research, we will borrow from the typology-building methodologies established in social science fields. Employing an appropriate theory-building process can help us improve our prediction (precision) and understanding (power) (Dubin, 1969). Both precision and power are important elements for benchmarking. The greater the degree of precision allows for a finer ability to make comparisons. Greater power provides an understanding on the way to improve upon the services.

In typologies the structural variables are the formal elements of a system. This variable could be made up of two or more properties. It is important that the properties are sufficiently defined, which can analytically be ascertained by meeting the requirements for additivity, synthesis, and consistency. In addition, the properties should exist in terms of a state, rather than a relationship, and they should be conceptually defined so that they are independent of each other (Melcher, 1976). Process variables are characterized by the activities that actually occur and are the results of the interaction of the various structural variables (Melcher and Melcher, 1980).

Once the properties of structural variables are correctly defined, the various process variables can then be derived. To map out the process variables, the structural variables should be cross classified. Hence, a typology with three structural variables with three conditions within each would yield a total 27 cells ($3 \times 3 \times 3$) under which the process variable can be classified. Although this classification is the most comprehensive, it also contributes to a plethora of cells. To simplify the approach it is possible to group the structural variables into clusters, and then cross-classify the clusters themselves. The typology which results provides a basis for benchmarking the necessary precision for prediction and understanding.

IS frameworks

The IS literature provides an extensive array of frameworks, models and classification systems. Some of the IS frameworks have some model building issues that affect their precision and power, while others take a managerial or a strategic orientation (Das *et al.*, 1991; Gorry and Scott-Morton, 1971; Kris *et al.*, 1989; Palvia, 1997; Sambamurthy and Zmud, 1999; Zink, 1993).

Given the nature of benchmarking, our focus has to be at the operational level. In the current literature, many frameworks at the operational level do not have all structural variables specifically defined with corresponding properties affecting the power and precision of the model (Ahituv *et al.*, 1989; Fiedler *et al.*, 1996; Leifer, 1988), while others are not proper typologies (Iivari *et al.*, 2001). In addition, almost all these models were developed based on data in one country or do not explicitly include international variables. Their applicability on a global scale would then be somewhat suspect. A number of existing frameworks lack generalizability to a range of technologies (Hackathorn and Karimi, 1988; Lee and Leifer, 1992; Pant and Ravichandran, 2001) or applications (Choudhury and Sampler, 1997). However, almost all of these frameworks are extremely valuable in developing our typology in that properties, and structural and process variables can be found in this literature. In particular, Meyer and Curley (1991) provide two encompassing structural variables and a number of corresponding properties.

Global information services literature

This literature has historically looked at the effects of regional, national and international variables on the level of development and the use of information technology (Niederman *et al.*, 2002), but lacks a prescriptive element for individual firms. In addition, most of the frameworks have been borrowed from the social sciences rather than from the international management/business literature (Niederman *et al.*, 2002). Many of these frameworks also lack generalizability. The empirical research in

this area, however, can be applied to develop a general framework. For example, single country studies or those replicated in alternative settings allow one to identify additional sources of variation and perhaps test the generalizability of current IS models in international settings. Along these lines, a number of authors have expanded their studies to include a range of regions/cultures to identify interactions between international variables and information system domains. For instance, multi-country studies have been used to examine technology transfer (Hasan and Ditsa, 1999), group decision support systems (Chung and Adams, 1997), and the growth of information technology (Watson and Myers, 2001).

Given the difficulty of data collection these studies have tended to focus on only a few countries and do not represent the true range of countries in terms of the level of development and culture in the world. An overall global theoretical model that provides connections between the type of information services and the salient international factors is missing in the literature. Thus, the earlier research findings are limited to a few countries/regions. For nations that have not been studied as of yet there are not applicable recommendations. Also, many of the earlier studies are not driven by theory. In this research, we borrow from both the IS and international management literature to develop a theory for IS services. In addition, we demonstrate how a range of potential interactions of international variables with information services can be explored and defined. This can then serve as a basis for developing global information systems benchmarks.

Toward a typology of global information services tasks

In this section we develop a framework of global information services tasks that is generalizable to different international environments and technologies. Two structural variables are identified in the international business literature, which are then combined with two structural variables from the IS literature.

International structural variables

Two structural variables relate to international conditions: the level of development and cultural values. We believe that the development level combined with cultural dimensions sufficiently describes most global information services situations without expanding the complexity to such a degree that it becomes difficult to comprehend the interplay among the various structural variables.

The level of development can be defined by a number of process variables. Some of the process variables include the legal traditions, treaties with other nations, patents, trademark laws, laws affecting business firms, level of economic development, gross domestic product, per capita income, literacy levels, social infrastructure, natural resources, membership in economic blocks, monetary and fiscal policies, degree of competition, currency convertibility, inflation, taxation systems, interest rates, wages, form of government, political ideology, administration's stability, strength of opposition parties, social discord, political strife, foreign policy, and governmental attitudes towards MNCs.

Based upon similarities and characteristics of the process variables, countries can be classified as industrialized, newly industrialized, and developing on the level of development continuum. Generally, industrialized countries (e.g. USA, Germany) tend to share a more established legal system, with laws on trademarks and businesses in

force. They tend to also have higher per capita income, full literacy, excellent infrastructure, convertible currencies, a competitive environment, high wages, low inflation rates and stable monetary and fiscal policies. On the other end of the continuum, developing countries usually have a poorly developed legal system, lower per capita income, low literacy rates, poor infrastructure, restrictions on foreign exchange transactions, low wages, high inflation rates, and variable monetary and fiscal policies. Developing nations include countries such as India, China, and Mexico. We recognize that large countries such as India and China exhibit variations in development. Approximately, in the middle of this continuum lie countries which are commonly referred to as newly industrialized. These countries tend to posses moderate levels of per capita income, good levels of literacy, adequate infrastructure, some restrictions on foreign exchange and the business environment, moderate wages, and some degree of environmental uncertainty with inflation rates, monetary and fiscal policies. In addition, we recognize that not all countries will neatly fall within these three categories; rather, countries exist anywhere along the continuum. However, in our desire to have a relatively manageable parsimonious model we restrict our analysis to only three types of countries. A greater degree of precision can be had by increasing the type of countries from three to five. If significant variations do exist, it is possible that two locations within a country might operate at different levels in the development continuum. Cultural effects of customs, languages, attitudes, motivation, social institutions, status symbols, and religious beliefs have all been documented in the international literature (Phatak, 1995). Cultural variables can affect the management of technology and information services. Several theory-based schemas have been suggested for dimensionalizing the modal concept of national culture; examples of such schemas include Kluckhohn and Strodtbeck's (1961) five value orientations, Inkeles and Levinson's (1969) three dimensions, and Hofstede's (1980) five dimensions. There is considerable convergence among the various schemas.

One dimension of cultural values that has been used in the context of IS (Hasan and Ditsa, 1999) is individualism-collectivism. Several cross-cultural studies have empirically established the importance of this cultural dimension; Hofstede (1980) found that individualism-collectivism accounted for the greatest variance in work-goal priorities in 40 countries. Schwartz (1990, p. 143) describes individualism-collectivism as follows:

> [In individualistic cultures] achievement, self-direction, social power, and stimulation values all serve self-interests of the individual .... [In collectivistic cultures] conformity, security, and tradition all focus on promoting the interests of others.

Collectivistic cultures can be defined by "we" consciousness, identity based on the social system, emotional dependence of the individual on organizations and institutions, friendships determined by stable social relationships, belief in group decisions, and particularism (Hofstede, 1980). Although the degree of collectivism exists on a continuum, in this research we categorize it with two levels: low and high. If additional cultural dimensions are deemed to exert a significant impact on information tasks, they can be included within the framework.

The two structural variables (level of development and degree of collectivism) are combined to define international dimensions. Given that the two structural variables exist at two and three levels, respectively, by combining them we yield a total of six

(3 × 2) cells (Table I). This then defines the international process variable. If needed in the benchmarking process, a greater degree of precision is possible by simply dividing the various structural variables into more segments. In additional, it is possible to include other cultural dimensions such as power distance and uncertainty avoidance – expanding the classification of countries to 24 (3 × 2 × 2 × 2) cells. However, to keep the framework manageable, we will retain only six cells for country classification.

Information services structural variables

Two structural variables are identified from the IS literature: the degree of knowledge and the degree of technological complexity. These two variables encompass a wide range of technologies and information environments. The various properties for both structural variables allow for additivity, synthesis, consistency, and exist in terms of a state rather than a relationship; the properties are conceptually defined so that they are independent of each other.

The knowledge complexity structural variable has been defined by Prasad *et al.* (2006) and consists of the following properties: breadth of domain (single vs multiple), rate of change of domain(s) (low vs high), depth of domain (common vs expert), comprehensiveness of systems outputs (limited vs extensive), breadth of information inputs (limited vs range), ambiguity of information inputs (low vs high), degree of information interdependence with outside organizations (limited to extensive), and uncertainty of information inputs (none vs extensive). These properties emanate from the works of Meyer and Curley (1991) and Hackathorn and Karimi (1988).

The technological complexity structural variable has also been defined by Prasad *et al.* (2006) and has the following properties: diversity of platforms (single vs multiple), diversity of technology (limited vs extensive), database intensity (low vs high), database location (centralized vs distributed), diversity of information sources (few vs multiple), and processor location (centralized vs distributed). These properties emanate from the works of Meyer and Curley (1991), Fiedler *et al.* (1996) and Lee and Leifer (1992).

The two structural variables (knowledge and technological complexity) can then be combined to define the information services complexity process variable. In this research we divide knowledge complexity into three regions (low, medium, and high), and technological complexity into three regions (low, medium, and high), yielding a total of nine (3 × 3) cells. A greater degree of sensitivity is possible by simply dividing the various structural variables into a larger number of regions. The cells emanating from the two IS structural variables can be clustered for simplification and ease of understanding. In Table II we look at the combination of the knowledge complexity variable with the technological complexity variable. By taking the diagonal combinations we generate a continuum for the information services complexity variable: low (low knowledge complexity × low technological complexity), moderate (medium knowledge complexity × moderate technological complexity), and high

Table I.
Combination of cultural and level of development variables

Collectivism	Level of development: Developing	NIC/transitional	Industrialized
High	a,a Columbia	a,b Taiwan	a,c Japan
Low	b,a South Africa	b,b	b,c, US

(high knowledge complexity × high technological complexity). If a greater detail in the framework is required, other cells can be combined with the respective IS structural variables.

Next, we will combine the information services complexity variable with the international variable.

Process variables for global information services tasks

By combining the information services complexity variable with the international variable, we are able to define the process variable for global information services tasks. Given the nine conditions for information services and six international country categories, 54 cells (9×6) can be defined for the domain of the global information services task variable. This typology allows one to clearly define the entire space of global information services tasks.

Once the system space has been defined, the properties of structural and process variables can be used for frameworks, and hence benchmarking. The typology allows one to clearly define variables and build interactions. In this research, we will look at the interactions between international variables and information services to develop a model.

For example, if the literature indicates that as the level of development rises within a country it is more capable of handling complex knowledge tasks, this can be specified in the framework. In Table III, we specify the relationship between level of development and knowledge complexity, with larger numbers indicating greater effectiveness. Similarly, in Table V we indicate that as the level of development increases, a country is more capable of handling technologically complex information tasks.

Knowledge complexity	Technological complexity Low	Medium	High
High	(3,1), e.g. human expert	(3,2), e.g. artificial intelligence	(3,3) High information services complexity., e.g. Intelligent distributed system to be developed
Medium	(2,1), e.g. human analyst	(2,2) Moderate information services complexity, e.g. management information services	(2,3), e.g. distributed processing and storage
Low	(1,1) Low information services complexity, e.g. manual tabulation	(1,2), e.g. centralized transactional processing	(1,3), e.g. distributed transactions

Table II. Grouping of knowledge and technological complexity into information services complexity variable

Level of development	Knowledge complexity Low	Medium	High
Developed	0	10	20
NIC	10	20	10
Developing	20	10	0

Table III. Hypothesized relationship between the level of development and knowledge complexity *f*1

Other than linear functions, other types of relationships can be prescribed. For example, in Table IV we indicate no correlation between the degree of collectivism and knowledge complexity. Also, in Table VI, a negative relationship between the degree of collectivism and technological complexity is specified. This assumes that countries which are more individualistic are relatively better at working with distributed systems as found with highly technologically complex tasks, perhaps because technologies developed in Western, individualistic settings more or less presume an individualistic mentality in managers and employees (Triandis, 1995). Thus, the USA with a more individualistic society (Hofstede, 1980) would have an edge over Japan.

These relationships can then be combined following the typology to define a theoretical model for global information services. For example, in Figure 1, we combine the diagonal elements of the information services complexity process variable with the two international structural variables. We simply use the diagonal conditions to keep the number of cells limited to 18 ($3 \times 3 \times 2$) to ease our understanding. All the 54 permutations can be defined by taking the product of the entire information services complexity space with the international structural variables.

Given the relationships defined in Tables III-VI we can now sum the interactions to benchmark which country would have a distinct edge for a particular information services task. In Figure 1, the higher the score indicates greater the effectiveness. For example, a company seeking to develop new product that requires high level of technology and knowledge complexity would grouped as high information complexity services (Table II). As we see in Figure 1, developed countries such as the USA or Japan would yield higher scores for such a product relative to either NIC or developing countries. A further differentiation by culture indicates that the preferable location would be the USA (50) yielding a higher score than Japan (40). On the other hand a firm

Table IV.
Hypothesized relationship between culture and knowledge complexity *f*2

	Knowledge complexity		
Collectivism	Low	Medium	High
Low	0	0	0
High	0	0	0

Table V.
Hypothesized relationship between the level of development and technological complexity *f*3

	Technological complexity		
Level of development	Low	Medium	High
Developed	0	10	20
NIC	10	20	10
Developing	20	10	0

Table VI.
Hypothesized relationship between culture and technological complexity *f*4

	Technological complexity		
Collectivism	Low	Medium	High
Low	0	5	10
High	10	5	0

Level of Development			
Developed e.g. U.S.	f1 = 0 f2 = 0 f3 = 0 f4 = 0 sum = 0	f1 = 10 f2 = 0 f3 = 10 f4 = 5 sum = 25	f1 = 20 f2 = 0 f3 = 20 f4 = 10 sum = 50
NIC	f1 = 10 f2 = 0 f3 = 10 f4 = 0 sum = 20	f1 = 20 f2 = 0 f3 = 20 f4 = 5 sum = 45	f1 =10 f2 = 0 f3 = 10 f4 = 10 sum = 30
Developing e.g. South Africa	f1 = 20 f2 = 0 f3 = 20 f4 = 0 sum = 40	f1 = 10 f2 = 0 f3 = 10 f4 = 5 sum = 25	f1 =0 f2 = 0 f3 = 0 f4 = 10 sum = 10
	Low	Moderate	High
	Information complexity		

Level of Development			
Developed e.g. Japan	f1 = 0 f2 = 0 f3 = 0 f4 = 10 sum = 10	f1 = 10 f2 = 0 f3 = 10 f4 = 5 sum = 25	f1 = 20 f2 = 0 f3 = 20 f4=0 sum = 40
NIC e.g. Taiwan	f1 = 10 f2 = 0 f3 = 10 f4 = 10 sum = 30	f1 = 20 f2 = 0 f3 = 20 f4 = 5 sum = 45	f1 = 10 f2 = 0 f3 = 10 f4 = 0 sum = 20
Developing e.g. Columbia	f1 =20 f2 = 0 f3 = 20 f4 = 10 sum = 50	f1 =10 f2 = 0 f3 = 10 f4 = 5 sum = 25	f1 =0 f2 = 0 f3 = 0 f4 = 0 sum = 0
	Low	Moderate	High
	Information complexity		

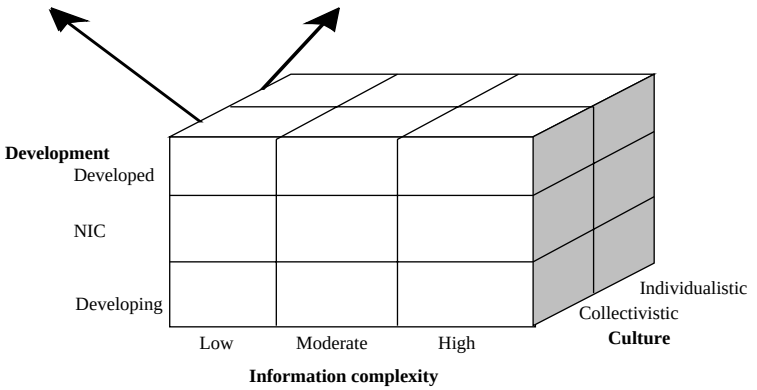

Figure 1.
Benchmarking global information services

seeking to manually tabulate data requiring a low level of knowledge and technological complexity would be classified as low information services complexity (Table II). Thus, for such types of products (Figure 1), developing nations such as South Africa and Columbia would be better suited relative to either developed countries and NIC ones. Finally, the location choice could be narrowed by simply looking at the cultural dimension of the two countries. The collectivistic culture would give an edge to Columbia (50) over South Africa (40).

Next, we will discuss how this framework can be of use to researchers and practitioners.

Discussion and conclusion

The existing literature on global information services is populated with a large number of single or comparative studies of nations (Gallupe and Tan, 1999). However, the relationships between country factors and various IS dimensions are not clearly

identified, and some of this research does not meet the requirements for theory development. This paper attempts to fill this gap in the literature by developing a typology that is a step toward building an integrated theory of global information services tasks; the model specifies the possible relationships between international variance and information services complexity. Providing separate conceptualizations and definitions of knowledge complexity and technological complexity makes it possible to examine combinations and interactions with international variables and to develop more specific predictions about their effect on global information services tasks. The degree of precision and power becomes critical for benchmarking.

The typology presents a systematic approach to coalesce research in global information services. The typology not only provides a mapping of the various information services, but also utilizes a mechanism to provide theoretical predications based upon the salient structural variables. In addition, by extracting out the key basic variables, we are able to develop a relatively parsimonious model of IS services which is generalizable to the global environment. Finally, this research allows us to gain a better understanding (power) of the IS services field and improve upon our prediction (precision) of how the services area will be affected by international factors. With improved understanding and precision, a number of benefits become obvious to practitioners.

The typology developed here has several implications for practitioners benchmarking (both company officials and government agents) who could gain from a relatively simple model that can compare and analyze the effectiveness of information services around the world. Although many countries are attempting to emulate the success of Silicon Valley in their backyards, not all succeed. This paper provides a prescriptive framework by indicating what measures need to be taken to gain a comparative advantage. For example, countries with more individualistic societies will be able to deal with technological complexity better relative to other societies that are more collectivistic. Hence, these countries should focus more on products and services that require more distributed tasks. On the other hand, countries that are less developed need to focus on becoming location hubs of tasks that require low information complexity and low technological complexity. In addition, this typology can also prevent some countries from jumping into new information services without an infrastructure to support the high level of technological and high level of information complexity. For example, countries such as Malaysia have spent resources to develop islands of high-technology infrastructure. Our typology, however, suggests that they lack the soft infrastructure to support the requirements for high levels of information complexity and, hence, are less likely to be successful. Officers at multinational organizations can also use this information for the distribution and out-sourcing of their IT operations. Given the variance in the degree of knowledge complexity and technological complexity for the multitude of information services task activities in organizations, it would be possible to distribute them globally by taking advantage of the relative differences in the level of development and culture.

In this research, we limit ourselves to only two structural variables for both the IS and international dimension. Following up on the IS literature, we believe that the two IS structural variables sufficiently describe the IS services. For the international dimension we restrict the typology to two variables: development and one aspect of culture (individualism-collectivism). The developmental variable is an important one

obtained by collapsing a multitude of process variables (e.g. GNP per capita, infrastructure, etc.). We recognize that the number of structural variables could be expanded to include other dimensions of culture, but limited it to ensure a parsimonious model which would be relatively easy to comprehend. Additional structural variables can be added easily to the typology in a systematic manner in future research.

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