

# Pan National Corporations: Exploring the Effects of Information Technologies on Control and Co-ordination Relationships

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**Abstract-** The pan national corporation (PNC) with its inherently complex structure is the organisational form most severely affected by globalisation. It is therefore important for the management of such corporations to improve the control and co-ordination of the corporations' spatially dispersed subsidiaries. IT has been hailed as an important tool in changing traditional control and co-ordination processes in complex environments. This paper presents the results of a study which examined the role of information technology in the control and co-ordination of pan national corporation subsidiaries in Ireland. The findings indicate that IT is being used to change the nature of the relationship between headquarters and subsidiaries in a manner that makes the PNC more global in orientation. This is occurring as operations and decision making processes in subsidiaries are redesigned to improve global management and local responsiveness.

## I. INTRODUCTION

The term multinational corporation encompasses the various forms of corporations that have overseas entities, including the multinational corporation [1], the multi-domestic corporation [2], the global corporation [3], the international corporation [4], and finally the transnational corporation [4] [5]. To reduce the risk of ambiguity, the term "Pan National Corporation (PNC)" will be used to encompass all forms of organisations that have one or more foreign affiliates.

Pan National Corporations are complex organisations facing operational diversity and environmental complexities not faced by other organisations [6]. In addition, the world's economies are being shaken by the forces of globalisation with no organisational form being more effected by increased global competition than pan national corporations [1] [7]. These new pressures have transformed the global competitive game, forcing the pan national corporation to rethink world-wide strategic approaches [4] [5] [6]. These new strategies, in turn, have raised questions about the adequacy of organisational structures and processes used to control and co-ordinate these world-wide operations [1] [8]. It has become apparent that in the current environment, global survival is constrained by the ability of the pan national corporation to set up an effective information processing network as well as leveraging new information technologies to integrate its highly complex activities [9]. Information technology has been hailed as the mechanism that will enable pan national corporations to rethink their traditional control and co-ordination mechanisms [4] [6].

This paper argues that pan national corporations are using information technology to become more global in their operations. It illustrates that PNCs are reducing the independence of individual subsidiaries and increasing the level of integration between entities that comprise the group. Information is seen to be at the core of both control and co-ordination processes. IT's primary role is to help the PNC overcome the barriers against the exchange of information among spatially and temporally separated entities. To achieve this, the telecommunications network, electronic mail, and corporate-wide databases were found to be particularly effective. Technology was found to facilitate tighter control by redesigning subsidiary processes thereby enabling headquarters make decisions that have traditionally been delegated to subsidiaries in order to ensure local responsiveness. In addition, an emerging form of co-ordination in pan nationals was identified. IT is seen to make traditional co-ordination mechanisms more personal, but also enables a new, more impersonal, co-ordination mechanism.

## II. CONTROL, CO-ORDINATION AND PAN NATIONAL CORPORATIONS

Control refers to "the process by which one entity influences to varying degrees, the behaviour and output of another entity [10], through the use of power authority [11] and a wide range of bureaucratic, cultural, and informal mechanisms [12]" [13]. The complex nature of pan national corporations intuitively suggests the need for control of the entities that comprise the group. This is compounded by organisational complexities that arise when trading across political and cultural borders [14]. More specifically the factors indicating the need for control within a pan national corporation are shown in table 1.

TABLE I  
THE NEED FOR CONTROL IN PAN NATIONAL CORPORATIONS

1. Multidimensional products and processes
2. Dispersed or concentrated value chain activities
3. Agency theory
4. Subsidiary unaware or unwilling to follow corporate objectives
5. Increased global competition
6. Geographical dispersion, linguistic differences, cultural diversity, which may shape subsidiary managers decisions.
7. Various host governments, inflicting different pressures
8. Instability of the international financial system

An examination of this table illustrates that the forces necessitating control can be categorised as being related to the operating conditions of the PNC as well as factors related to the increasingly competitive environment within which it operates.

Computer technology and in particular, telecommunications technology are suitable for control purposes, due to their ability to compute, store, retrieve and communicate data and information very quickly [15]. An examination of the research literature on organisational control reveals that technology facilitates control in three ways; changing decision making structures, formalisation of behaviour, and monitoring activities.

First, the effects of using computers is generally to push decisions to a higher level in an organisation [1] [16], as operational data can be transmitted directly into a senior manager's office [17]. In addition, [18] argues that information technology can also facilitate pseudo-decentralisation, as top management creates the appearance of delegating decision making authority downward in the organisation but using information technology for feedback.

Second, decentralisation is usually coupled with increased structuring of behaviour through rules and procedures [19]. IT facilitates formalisation because structured rules and job definitions are easily stored and transmitted using information technology [1]. The scope for idiosyncratic judgement and mystique in the work of subordinate managers is reduced because the ideal of one decision making body with a global mandate is facilitated by information technology [17].

Third, the possibilities for information technology to monitor activities are richly documented. According to [15], the technologies that translate, record, and display human behaviour can provide universal transparency with a high degree of illumination. Information technology can automatically and continuously record almost anything its designers want to capture [20].

Co-ordination is the communication of information and data between geographically dispersed locations in a pan national in order to synchronise management decisions and actions [6]. The primary advantage of global co-ordination is achieving global efficiency [1] [5] [21]. Undesired duplication and overlap are minimised by co-ordinating activities [22]. The second major force driving co-ordination is global integration [23] [24]. The dual demand of responsiveness to local differences while taking advantage of global opportunities results in the co-ordination of the pan national corporation's activities being a strategic necessity [9] [23]. Table 2 summarises the PNCs need to co-ordinate its activities. As with control, it is evident that the need for co-ordination springs from the corporation's operating environment, and pan national environmental factors.

TABLE 2

THE NEED FOR CO-ORDINATION IN PAN NATIONAL CORPORATIONS

1. Requirement to synchronise multidimensional products and processes
2. To synchronise concentrated value chains
3. To minimise undesired duplication and overlap
4. Increased global competition
5. Dual demands of responsiveness to local differences and taking advantage of global opportunities
6. Increase corporations ability to respond to shifting comparative advantage

Co-ordination mechanisms can be categorised into formal and informal methods. Formal tools include centralisation [25], formalisation [26], planning [25] and output controls and behaviour controls [10] Informal tools consist of lateral relations [27], informal communication [28], and the development of an organisational culture through a process of socialisation of individuals [29] Reference [23] argues that over the years there has been a basic increase in the use of these subtler, informal co-ordination mechanisms by pan national corporations.

Much research is required on the effects of information technologies on pan national corporations [6]. There is general agreement among researchers that information technology has a role to play in control. However, the international aspects of the phenomenon have not received the attention they deserve. The majority of studies, including [15] [17] [19], do not mention the pan national corporation in any of its forms. International co-ordination, unlike control, has received substantial attention from researchers. However, [21] have commented on the lack of empirical research in the area of IT facilitating co-ordination in a globally managed business. In general, there is limited understanding as to the role particular information technologies play in control and co-ordination [30]. Such information is vital if IT is to be considered as more than just an automation technology. An important aspect of research in the area is to examine the effects of information technologies on control and co-ordination processes in pan national corporations.

III. DATA COLLECTION

The primary objective of this study was to investigate the role of information technology in the control and co-ordination of pan national subsidiaries. The study was categorised as exploratory due to the scarcity of empirical work in the area. Reference [31] proposes that either a case study or field study research methodology can be used in exploratory research. The researchers decided that a field study would be most appropriate for this study as it would facilitate the collection of data from a larger number of organisations, and would form the basis for more focused research at a later stage. This approach is in line with the thinking of [32].

Field studies are field-oriented, cross sectional case studies that focus on gathering qualitative, anecdotal observations [33] in order to measure dependant variables without any attempt to control independent variables [34]. This methodology enabled the researchers to collect information in a natural setting from a cross-section of organisations, using a combination of qualitative and quantitative research methods. The aim of the study was to explore the experiences of participants in relation to the use of IT for the control and co-ordination of pan national subsidiaries.

The data collection methods used consisted of a questionnaire to measure control and co-ordination, followed by interviews with key personnel. Semi-structured interviews were conducted with executive level financial, management and information technology personnel in 15 subsidiaries of pan national corporations located in Ireland. The fact that the study was conducted in Ireland may raise issues for the relevance of the findings elsewhere. However, due to the openness of the Irish economy and the high proportion of pan national organisations operating there, these subsidiaries were rich sites for the study. Also organisations world-wide are faced with an increasingly global economy and turbulent environmental conditions, and as such are probably similar to their Irish based counterparts in this area.

#### IV. FINDINGS

Each of the subsidiaries researched during the course of this study had a telecommunications network that linked it with at least one other location in the group. In addition a wide area network (WAN) with access to other organisations existed in five subsidiaries. Electronic mail (e-mail) and corporate database systems were the two most pervasive information technologies possessed by the subsidiaries, but a wide range of technologies were found throughout, as shown in table 3. Table 4 shows the types of global systems used in the companies studied. These systems cover a wide range of processes within subsidiaries.

TABLE 3  
IT USAGE IN COMPANIES STUDIED

Technology	No. of companies (max = 15)
Intra-company Network	15
Corporate database	15
E-mail	14
Wide Area Network	5
Video conferencing	4
GroupWare	2
EIS	2
Electronic Data Interchange	0

TABLE 4  
GLOBAL SYSTEMS USED IN COMPANIES STUDIED.

System	No of Companies (Max = 15)
Financial	15
Office Communications	15
Products	10
Production	7
Raw Materials	6
Suppliers	4
Distribution	4
Customers	2
Human Resources	2
Service and Repairs	2

#### A. IT and control

An index based on the work of [35] was used to measure the degree to which subsidiaries were controlled. This index was altered to make it more relevant for control situations involving pan national subsidiaries. This amended index was weighted and covered issues related to budgeting, financial reporting, computer linkages, accounting policies and results, the transfer of funds, hiring policies, promotion policies, transfer pricing policies, sales policies, production plans, purchasing policies, research and development activities, product designs, and advertising policies. For summary purposes, the elements of this index were examined under the headings of general control, control of decision making, and control for monitoring purposes. These headings were consistent with control mechanisms used in pan national subsidiaries, as revealed by pilot tests for the study. An analysis of these results is shown in table 5. The numbers in parenthesis in the top row indicate the maximum score, i.e. the indicator of total control. These results indicate that a high level of control operated between the subsidiaries studied and their headquarters.

TABLE 5  
ANALYSIS OF THE CONTROL OF ORGANISATIONS

	General control (25)	Decision Making (85)	Monitoring (53)
Mean	17.5	57.5	26.5
Minimum	10	33	20
Maximum	25	82	33

The degree to which the subsidiaries were controlled by their headquarters differed depending on the control culture of the organisation. Each subsidiary was wholly owned by its headquarters, and only one subsidiary had a member of its staff on the group's board of directors. Three subsidiaries did not have managing directors. However, the primary

dependence was of a financial nature with subsidiaries dependent on headquarters for operating funds and long-term investment. Some subsidiaries were also dependent on headquarters, or other group entities, for knowledge of the product, and information relating to product development or modification. In addition, sourcing sales was also an important dependency.

The results of the study indicate that information technology is increasingly being used to facilitate the control of subsidiaries. Preliminary analysis indicates that technology is not, in itself, a control mechanism. Rather it is used to make traditional control mechanisms more effective. The key to this synergy lies in the centrality of information to traditional control mechanisms. The speed with which information technology can transfer information from the subsidiary to the headquarters is central to the role of IT in control practices. However, further analysis reveals that the effectiveness of IT for control within pan nationals is strengthened by the traditional dependency relationship of subsidiaries on headquarters. This can result in the redesign of organisational processes to change the nature of how the subsidiary is controlled.

An examination of control reveals that IT offers a real speed factor that allows headquarters to collect huge amounts of information from subsidiaries in real-time. This information is in a standard form that makes it suitable for rapid manipulation at headquarters. Time is therefore saved when headquarters combine the data from multiple sites. According to the operations manager in one site, which depended on headquarters approval before agreeing to large contracts, "maintaining this type of control relationship without IT would be extremely difficult and probably unsustainable. The amount of data we transfer is huge, and response to the customer must be achieved as swiftly as possible. Previously we sent the information by courier, which took two days. We sometimes lost customers due to slow response times". Corporate wide databases on a network are the most popular option for this type of information processing. These technologies offer a method of standardisation that facilitates the control of subsidiaries. However, as more applications are added to these infrastructures, a newer face of control starts to emerge. According to the financial director in one company "with the implementation of a corporate database, nobody in the subsidiary has any excuses for making a bad decision. The guys at corporate expect us all to keep up to date with the changes indicated in the database and to act accordingly. From corporate management's point of view the technology helps ensure that their rules and policies are adhered to. There are no excuses to say that 'I did not have access to that information' or 'how was I supposed to know that the format of that report had changed'".

Information exchange between independent companies is widespread today [36]. However, real integration occurs when the technology is ingrained into the processes of each organisation [37]. It is this element that illustrates the IT

facilitated changes in the nature of control in pan nationals. Pan national headquarters have in the past allowed subsidiaries a level of local independence because it was necessary for the subsidiaries to be responsive to local conditions. Subsidiaries were allowed to alter their processes to become locally responsive. However, they were required to provide reports that allowed the headquarters to monitor their activities. Time and geographic differences allowed the subsidiary flexibility. Two technological developments have started to change this; e-mail and Executive Information systems (EIS). E-mail was an important aspect of headquarters / subsidiary communication in 14 of the 15 sites studied. While a corporate database was central in all sites, only 2 had added an EIS to this system. However, some interesting trends are evident from these examples.

The spread of e-mail as an accepted communications medium at higher management levels has had important implications for pan national subsidiaries. As many pan national headquarters and subsidiaries operate with low levels of synchronous working times due to time differences, fast information exchange is important. E-mail has eliminated the time delays and expense associated with telephone tag. More importantly, headquarters can now interact with people working in a subsidiary on another continent in much the same manner as they can deal with someone in their own building. According to one functional subsidiary manager "e-mails from HQ arrive at your PC with the same level of urgency as your boss sticking his head around the door. They are difficult to ignore, especially when it is easy to tell if you are logged on". A common issue emerging from all interviewees was the need to be sensitive to cultural differences when sending and receiving e-mails across borders. It was agreed that differences in cultures and understanding could often lead to misinterpretations. Despite the widespread use of e-mail for general control situations, more important decision making in relation to PNC control still requires synchronous interaction. One company that had implemented video-conferencing noted that some 'sensitive' issues between headquarters and the subsidiary could be dealt with using this technology, but that face to face meetings were still best for 'high level management discussions'.

Heightened interest in activities in subsidiaries is evident when an EIS is used at headquarters. Real-time monitoring is again a reality. Non-adherence to the budget or unfavourable operational information arriving at headquarters quickly, or being instantaneously accessible, results in headquarters being able to call for action from the subsidiary almost immediately. The zero information float results in headquarters attention being drawn to unfavourable information very quickly. According to one manager in a subsidiary that had an EIS, "with the old system, they had to go looking for the information. This new one alerts them to anything that they should know before we get to do anything about it. We are much more vulnerable now". This links in with the direct communication provided by e-mail, where managers at headquarters can use EIS-type systems to

monitor activities and trends, and then query people in the subsidiary directly. This means that the structured information exchange provided by EIS and corporate databases can be supplemented by unstructured qualitative information. This is likely to become more prevalent as other forms of technological communication become widespread.

The change in the nature of control comes when, according to one manager “they decide at headquarters that they can do the job better than we can, and directly change the way we do business”. This is really a realisation that IT can be used to facilitate a new way of doing business. This was causing much friction between one subsidiary studied and its headquarters. According to one manager “they started by telling us that they wanted to install a new corporate-wide system, but we quickly discovered that they planned to use it to make more decisions centrally. This will be a major change in the way that we do business”. As this subsidiary discovered, IT gives headquarters the ability to manage day-to-day operations centrally. Instant access to key systems by headquarters results in a different relationship, between headquarters and subsidiaries, than traditional periodic reports. This approach to management is made possible by the power that headquarters exerts over subsidiaries and appears to result in the desire by headquarters to alter operational and decision making processes to become more globally oriented. The managing director of one subsidiary stated “we have benefited from an efficiency perspective by linking into a corporate-wide systems, but we are finding that we are losing more and more of our autonomy”.

For many subsidiaries studied, pricing and production decisions used to be within their range of activities as long as they stayed within corporate policies. This approach facilitated a level of local responsiveness. However, six subsidiaries now use enterprise resource planning (ERP) systems located at headquarters. This results in the elimination of subsidiary management's input to pricing decisions. Corporate management also use the ERP system to draw up a rolling, over-all production plan for the subsidiary to identify resource requirements and check them against available manpower and machine capacity. IT was also found to play a similar role in selecting suppliers, engaging in research and development, and devising the group's strategy. Many managers commented on their belief that without the facilities of information technology to enable corporate management to gather, analyse, manipulate and consolidate data in such an effective and speedy manner, more of the subsidiary's expertise would be required. Information technology therefore, facilitates the ability of corporate management to exclude subsidiary managers from these types of decisions. Due to traditional dependency relationships, headquarters can directly implement a change in subsidiary processes to facilitate this new way of working. Table 6 shows the number of subsidiaries studied affected by changes in processes as a result of new operations and decision making structures imposed by headquarters.

TABLE 6  
PROCESSES AFFECTED BY IT FACILITATED CONTROL STRATEGIES

Process affected	No of companies (Max = 15)
Marketing and advertising	15
Budgeting	10
Transfer / selling price	8
Sales and production plans	8
Purchase of supplies and materials	4
Research and development	3

To summarise, pan national subsidiaries are increasingly experiencing a tighter control environment via their headquarters. This has manifested itself in three ways. First, headquarters now have real-time access to operational data using corporate databases. Second, e-mail has become an important instrument for query purposes, as headquarters can immediately react to incoming data. In addition, more advanced communications technology, e.g. videoconferencing, can be used for decision making that requires synchronous interaction. This type of interaction is normally only used where the issue is more important or sensitive than the type of everyday issues that can be dealt with using e-mail. Third, a change in the nature of control of subsidiaries is evident in some circumstances, where IT is used to facilitate a change in the business processes of the subsidiary in such a way as to change the operational and decision making relationship between headquarters and subsidiary.

#### B. IT and Co-ordination in the PNC

The previous section documented evidence of a changing control environment within pan nationals resulting from an increasing application of information technology to control mechanisms. Independent of changes in control relationships, pan nationals are required to co-ordinate their activities across time and space boundaries. This section examines how IT has been used within PNCs to affect the nature of co-ordination practices. It argues that IT facilitates a more depersonalised co-ordination environment that is based on real-time co-ordination data.

Subsidiaries that are part of an interdependent pan national corporation are situated in a network of reciprocal obligations. These obligations require the subsidiary to work with other affiliates and to integrate its activities to achieve world-wide efficiency. This level of co-ordination is not required between independent organisations. The traditional, and most widespread, type of co-ordination is based on prerequisite interdependence and involves people working together on a daily basis, ordering activities, sharing information and entering into joint decision making, as shown in table 7. This is the traditional type of co-ordination referred to by researchers e.g. [35].

A second type of co-ordination was identified while analysing the pan national corporations in this study, and is also illustrated in table 7. For the purpose of differentiation, these separate types of co-ordination are referred to a type 1 and type 2. Type 2 co-ordination is co-ordination without direct communication that leads to the synchronisation of activities as opposed to joint decision making. It is apparent more at an operational rather than a strategic level, and based on the findings of this study, would be impossible to operate in a pan national without the aid of information technology. An example of type 2 co-ordination identified during the study was where two subsidiaries were obliged to consult a real-time database to ensure that no two subsidiaries were quoting for the same business. In many ways this type of co-ordination is based on the control relationship that is typical of pan national corporations rather than other types of organisations.

TABLE 7  
FORMS OF CO-ORDINATION

Characteristics	Type 1 Co-ordination	Type 2 Co-ordination
Nature of Co-ordination	Interactive	Non-interactive/automated
Activity co-ordinated	Decision making & operations	Operations
Co-ordination involves	Transfer and sharing of information, discussion	Placing data in a central location, making data available to prospective users
Destination	Destination of data & information known	Destination of data unknown
Time frame	Real-time distributed Asynchronous distributed	Asynchronous distributed
Level of Communication	High	No communication
Objective	Global efficiency Transfer of learning Local responsiveness	Global efficiency Transfer of learning Local responsiveness

Information, and particularly, communications technologies were utilised for the transmission of information enabling type 1 co-ordination of decision making and activities. Communication was principally of a synchronous, distributed nature, where the message has a pre-set destination and served a particular purpose. E-mail facilitated this sharing of information on a real-time basis to make decisions. To achieve this type of co-ordination, structured and unstructured information, are transferred by the Irish subsidiary to sister subsidiaries, and on occasion, to headquarters. All interviewees emphasised the main advantage of using e-mail is its ease of use as a superior method of communicating over space and time boundaries. According to one manager “e-mail has created more of a sense of personalised co-ordination, which our standard

reports systems didn't. We communicate a lot more now. It really helps you get a global perspective”. Such technology enabled a decrease in the communication cycle to be achieved, created time zone independence for decision making, removed geographical constraints, created workable reports on arrival, and eliminated telephone tag. Four of the subsidiaries had video conferencing facilities and two had other GroupWare technology. In general, this type of technology had not gained general acceptance, but those interviewed believed that in time GroupWare technology would enhance co-ordination in as tangible a way that e-mail had. One company was trying to use a well-known GroupWare product to improve general input to co-ordination decisions. It was hoped that the anonymity created by the product would eliminate barriers created by differences in subsidiary location and management level. However, this had not gained widespread acceptance as most involved were uncomfortable with the approach and the technology.

Overall, the general theme emerging from the application of information technology to type 1 co-ordination has been the creation of a more personalised form of co-ordination. Despite claims that IT depersonalises interaction, those interviewed for this study believed that they had a more personal view of what other subsidiaries in their group did when they began to use e-mail to help them leverage the expertise available in their sister organisations. More advanced information technology has yet to deliver this, but this may be that many have yet to become comfortable with its everyday use.

Type 2 co-ordination observed during the study was non-interactive co-ordination, where information technology depersonalised the process. This is where the creator or supplier of the information did not know who would subsequently use the information and for what purpose. Corporate wide databases emerged as the technology that was predominantly used to achieve this type of co-ordination. Another example of information technology facilitating type 2 co-ordination is a bulletin board used as a trouble shooting system.

The role of information technology in enabling type 1 co-ordination and type 2 co-ordination differed. In type 1 co-ordination, information technology enabled participants to exchange data and information efficiently and effectively. In this case information technology is a co-ordination tool used for direct communication between the parties involved. A relationship, enabled by information technology, is consequently built between the parties. Conversely, in type 2 co-ordination, information technology functions as a tool for centrally inputting, storing and extracting data needed by the participants involved. No relationship is constructed between the participants, yet the sharing of valuable data is enabled by information technology. Table 8 illustrates the different roles played by information technology in type 1 and type 2 co-ordination. To summarise, the application of information to pan national co-ordination is resulting in a more impersonal operating environment, despite evidence that early attempts

by the organisations studied to introduce IT facilitated co-ordination actually resulted in more personal interaction.

TABLE 8  
IT AND CO-ORDINATION

*Type 1 Co-ordination*

1. IT enables rapid data and information sharing for decision making
2. Data and information transferred is reliable and concise
3. IT can be many-many, enables streamlined decision-making to be achieved
4. IT reduces time and spatial dependence
5. IT reduces the need for people to travel for joint decision-making
6. Reduced data redundancy
7. Information for decision-making from multiple locations is comparable

*Type 2 Co-ordination*

1. IT functions as a central pool of information
2. IT automates certain co-ordination activities
3. IT renders certain activities transparent to subsidiaries which act on the data or information originating in other affiliates
4. Enables subsidiaries to synchronise activities and making group level decisions

## V. CONCLUSIONS

This study examined the effect of information technology on the relationship between headquarters and subsidiaries in pan national corporations. Specifically, the study was concerned with how IT influenced the control relationship between subsidiaries and headquarters, and with how IT affected the co-ordination of activities within a pan national. The results revealed that, as expected, IT is being used to leverage the information elements of many control and co-ordination mechanisms to create more efficient relationships. In addition, the study documented emerging forms of control and co-ordination that, in essence, create a basis for a new relationship between headquarters and subsidiaries. This new relationship uses information technology to redesign business processes to increase the power of headquarters, while also keeping a level of local responsiveness in markets worldwide. In this way PNCs are using information technology to become more global in their orientation.

Information technology has the power to improve the efficiency and effectiveness of many activities that rely on the transfer of information for their application. It is clear from this study that PNCs are applying IT to both their control and co-ordination mechanisms in this way. IT is facilitating more centralisation of control and a depersonalisation of co-ordination mechanisms. This is occurring in pan nationals where headquarters are modifying the operations and decision making environments within subsidiaries to reflect a more 'hands-on' approach by headquarters. This is occurring because of the growing acceptance of IT as an interaction medium by senior

management. Interestingly, it is relatively simple technology such as e-mail that is facilitating much of this change. However, as more advanced technology becomes widespread, it is clear that the traditional control and co-ordination relationships between headquarters and subsidiaries will change further.

Overall, this study has indicated a change in the operation of pan national corporations as evidenced by the relationship between headquarters and subsidiaries. Within those sites studied, it is evident that pan nationals are moving towards more centralised control, with a consequential change in the nature of co-ordination required. Information technology has facilitated more direct monitoring of day-to-day operations, while communication technology has vastly improved responsive query operations. This has enabled headquarters to take over direct responsibility of many operations that were previously left to individual subsidiaries in order to ensure local responsiveness. These corporations are moving towards situations where co-ordination can therefore be directed from headquarters. This is evident in relation to the way in which IT is being used to implement a new form of co-ordination. To conclude, IT is being used by pan nationals as more than an automation tool. It is changing the way that such organisations do business within a global market.

## BIBLIOGRAPHY

- [1] L. Hagstrom, *The 'wired' MNC - the role of information systems for structural change in complex organisations* Akademisk, Avahandling, Stockholm, 1991
- [2] R.H. Reck, "The shock of going global," *Datamation*, August 1, pp. 67-69, 1989.
- [3] J. Rourke, J.L. Alvarez, C. Garcia-Pont and J. Neuno, "Managing internationally: International dimensions of the managerial task", *European Management Journal* vol. 11 no.4, pp.485-492, 1993.
- [4] J. Karimi and B R Konsynski, "Globalisation and information management strategies", *Journal of Management Information Systems* vol. 7, no. 4, pp. 7-26, 1991.
- [5] C. A. Bartlett and S. Ghoshal, *Managing Across Borders: The Transnational Solution*. Hutchinson Business Books, London, 1989.
- [6] E. M. Roche, "Multinational corporations – the emerging research agenda," *Journal of Strategic Information Systems*, vol. 5, no. 2, pp.129-147, 1996.
- [7] L Chidambaram and W.G. Chismar, "Managing global communication networks: Key challenges for the 1990's", *International Journal of Information Management*. Vol. 13, no. 3, pp.167-182, 1993
- [8] P.C. Deans and M.J. Kane, *International dimensions of information systems and information technology*. PWS, Kent, 1992.

- [9] L. Neumann-Alkier, "Think globally, act locally – does IT follow the rule in multinational corporations?" *Proceedings of the 5<sup>th</sup> European Conference on Information Systems*, Cork, Ireland, June 19-21, pp. 541-552, 1997.
- [10] W. G. Ouchi, "The relationship between organisational structure and organisational control," *Administrative Science Quarterly* vol. 22, no. 3, 1977.
- [11] A. Etzioni, "Organisational control structures," in *Handbook of organisational structure* J. G. March Ed., pp. 65-77. Rand McNally, Chicago, 1965.
- [12] B. R. Baliga and M. A. Jaeger "Multinational corporations control systems and delegation issues", *Journal of International Business Studies*, vol. 15, no. 3, pp. 25-40, 1984.
- [13] J. M. Geringer and L. Herbert, "Control and performance of international joint venture,". *Journal of International Business Studies*,. Vol. 20, 1989
- [14] A. F. Farhoomand and V. Tuunainen, "Barriers to global electronic commerce: A conceptual framework," *Proceedings of the 4<sup>th</sup> European Conference on Information Systems*, Lisbon Portugal, July 2-4, pp. 1025-1030, 1996
- [15] S. Zuboff, *In the Age of the Smart Machine*. Basic Books, New York NY, 1989.
- [16] T. L. Whistler *The Impact of Computers on Organisations*, Praeger Publishers, New York, NY, 1970.
- [17] J. Child, "New technology and development in management organisatio," *OMEGA International Journal of Management Sciences*, vol. 12 no. 3, pp. 211-223, 1984.
- [18] J. Pfeffer, *Organisational design*. AHM publishing, Carlington Heights Ill, 1978.
- [19] D. Robey, "Computer information systems and organisation structure", *Communications of the ACM*, vol. 24, no. 10, 1981
- [20] M. Hammer and G. E. Mangurian, "The changing value of communications technology", *Sloan Management Review*. Vol. 28, no. 4, pp. 65-71, 1987
- [21] M. J. Earl and D. Feeny, "Information systems in global business: Evidence from European Multinationals," *Oxford Institute for Information Management, Research and discussion paper 92/6*, 1992
- [22] M. L. Manheim, "Global Information Technology: Issues and Strategic Opportunities," *International Information Systems* no. 1, pp. 38-67, 1992
- [23] J. I. Martinez and J. C. Jarillo, "The evolution of research on co-ordination mechanisms in multinational corporations," *Journal of International Business Studies*, vol. 20, 1989.
- [24] J. I. Martinez and J. C. JARILLO, "Co-ordination demands of international strategies," *Journal of International Business Studies*. Vol. 22, no. 3, pp. 529-444, 1991.
- [25] J. Galbraith and R. K. Kazanjian, *Strategy implementation: Structure, systems, and process*. West publishing Co. St Paul, 1986.
- [26] J. Galbraith, *Designing complex organisations*. Addison-Wesley. Reading, Mass, 1973.
- [27] P. R. Lawrence and J. W. Lorsch, *Organisation and environment*. Harvard University Press, Boston MA, 1967.
- [28] J. Kotter, *The general manager*. The Free Press, New York, NY, 1982.
- [29] H. Mintzberg, *Power in and around organisations*. Prentice-Hall, Englewood-Cliffs, N.J, 1983.
- [30] T. J. Allen and O. Hauptman, "The influences of communication technologies on organisational structure." *Communication Research* vol. 14, No. 5, pp.575-587, 1987.
- [31] C. Marshall, and B. G. Rossman, *Designing Qualitative Research*, Sage Publications, CA, 1989.
- [32] R. D. Galliers, "Choosing information systems research approaches," in R. D. Galliers, Ed. *Information Systems Research: Issues, Methods and Practical Guidelines*, Alfred Waller Ltd., Henley-on-Thames pp. 144-162, 1992.
- [33] J. McGrath, "Towards a theory of method for research in organisations," in R. Mowday and R. Steers, Eds. *Research in Organisations: Issues and Controversies*, Goodyear Publishing Inc., California, pp. 4-21, 1979.
- [34] J. Buckley, M. Buckley and C. Hung-Fu, *Research Methodology and Business Decisions*, National Association of Accountants, New York, 1976.
- [35] D. Cray, "Control and co-ordination in multinational corporations," *Journal of International Business*, vol. 15, no. 3, pp. 85-98, 1984.
- [36] P. Finnegan, R. D. Galliers and P. Powell, "Inter-organisational systems planning: Learning from current practices", *International Journal of Technology Management*, vol. 17, no. ½, pp. 129-144, 1999
- [37] P.M.C. Swatman, P.A. Swatman, and D.C. Fowler, "A model of EDI integration and strategic business reengineering," *Journal of Strategic Information Systems*, vol. 3, pp. 141-160, 1994.