

## REGIONAL FACTORS AND ICT IN UNIVERSITY-INDUSTRY COLLABORATION IN MALAYSIA

Ahmad Fauzi b. Abdul Wahab Phd

Fakulti Alam Bina, Universiti Teknologi Malaysia, UTM Skudai 81310

Johor Bahru, Johor, Malaysia

[kjplfab@yahoo.com](mailto:kjplfab@yahoo.com)

**ABSTRACT:** One of the most documented consequences of ICT is the trend of decentralisation (of workplace), as reflected by teleworking, etc. ICT is connected to decentralisation for its ability to overcome geographical distance, take advantage of time compression, and restructure business relationships. Organisational and spatial forms of activities were becoming less determined by physical locational factors (distance, centrality, time, and costs). While the location of the organisations and the impact of ICT has become a subject of interest to researchers in the manufacturing firms and other service sectors, empirical study and investigation concerning university location is few. This research investigate whether the location of the universities' facilities are still important to university-industry collaboration and users' interaction."

**Keywords:** Location, ICT, university, R&D, inter-organisational collaborations.

### 1. INTRODUCTION

This research is concerned with the understanding of the kind of relationship between the external environment of organisations and their inter-collaboration activities. Although there have been several studies in the field of built environment with reference to communication within the organisation context, but no empirical study has been conducted on communication across an organisation boundary. Therefore, this study has been undertaken to complement other studies.

During the last two decades three inter-related forces - the rising consumer power, new model of organisational management, and *information & communication technology* (ICT) have moulded the new economic environment. Organisations are under pressure to be more adaptable with the accelerating changing environment. Managers that think beyond traditional environments will attempt to create ways of managing effectively or the future will be very frustrating and offer very limited rewards.

Parallel to this development, studies on physical workplaces (e.g. Iadanza, 1997; Raymond & Cunliffe, 1997) have asserted that the workplaces also need to respond to the changing environment. The important issue that has been addressed is that physical workplaces must be reinvented as work patterns changed, and that it can provide a significant contribution to business success. Therefore, it becomes a major challenge to organisational leaders in creating work settings that will address the above issue.

Drawing from these literatures, several characteristics of the new physical workplace have been identified, and the major emphases of these characteristics are on improving communication between the workers. The emphasis on improving communication in the physical workplaces has been synthesised from the fact that communication has been a central to the concept of the organisation. It is the process most central to the success or failure of an organisation (Hunt & Owen, 2000).

The changing environment has also witnessed the emergence of post-bureaucratic forms of organisation, including the 'network' organisation, seen by some as an inter-organisational phenomenon specifically (Podolny & Page, 1998). Workers, especially the professional and managerial levels are also increasingly interacting and communicating across their organisation boundaries. It has been widely seen that the merging of computers and ICT has been seen as the 'essential components' facilitating the drastic changes in how workers communicate with one another and perform the new ways of working (e.g. Rockart, 1998).

One of the most documented consequences of ICT is the trend of decentralisation (*of workplace*), as reflected by teleworking, teleproducing, teleconferencing, teleshopping, and telebanking. ICT is connected to decentralisation for its ability to overcome geographical distance, take advantage of time compression, and restructure business relationships. As such, organisational and spatial forms of activities were becoming less determined by physical locational factors (distance, centrality, time, and costs). On similar note some literatures (Stocks, 1998) have also viewed that, ICT is among the major factor that has been seen as liberating influences on workplace location. This time-space compression was seen as a revolutionary trend that offers insight into the capabilities of ICT to alter traditional location theory and may offer to organisations and peripheral regions on economic development opportunities. However, one should be cautious in their acceptance of the proclaimed shift. Despite widespread recognition of the potential and the popularity of ICT, there are several criticisms on the strategic use and application of ICT.

At the organisational level, it has been argued that ICT is merely a tool and, in itself, is incapable of producing significant benefit to the organisation. Benefits do not flow from the mere use of ICT but from human and organisation innovations (Morton, 1991). Some other organisational writers (e.g. Kotter and Heskett, 1992) have attributed to culture as a major determinant of organisational performance and effectiveness. With regards to the new form of location advantage (accessibility), several scholars (e.g. Lemberg, 1996) noted that one of the initiative for change is more to socio-cultural related factors. At the users level, it has been observed that what influences an individual's choice of communication medium has been the subject to the task that they wanted to accomplish (Daft and Lengel, 1986). These criticisms reflect that organisational and user's factor can become a strong determinant to the greater utilisation of ICT in order to promote decentralisation. Therefore, whether ICT actually leads to more flexibility in working practices for employees is a debated issue.

With respect to the above criticisms, it is precarious to generalise that ICT may alter the concept of traditional location advantages especially under different socio-cultural contexts; places and organisation settings. As most of the view presented in the current literatures represent the business organisation's perspective and in the context of the industrialised countries, it is important to have a greater understanding on whether location still has a significant impact or not to users' interaction in different socio-cultural contexts. This would provide an in-depth knowledge on the function of location and ICT to various kinds of organisations and to various socio-cultural contexts.

## **2. BACKGROUND AND CONTEXT OF THE STUDY**

Traditionally, the relationship between people interaction (communication) and location can be seen through the concept of *accessibility*. The definition of accessibility in the spatial context are in relation to the opportunity of interaction and contact, and in its relation to opportunity to utilise a place or attribute of a place for activities (Helling 1998). Fundamentally, as accessibility increases, the overall trip (or interaction) rises. As

the spatial and non-spatial network infrastructures (ICT) are increasingly developed, network connectivity and measures of accessibility are now represented by both the spatial infrastructure and the non-spatial network infrastructure. It has been viewed that as telecommunications costs are becoming elastic over greater distances, the traditional geography-economic model of location advantages break down because the spatial dimension (distance, centrality, time, and costs) is essentially lost.

In the context of inter-organisation collaboration, the earlier literatures have shown that location characteristics and proximity affect R&D facilities location. It has been shown that R&D is strongly concentrated in the metropolitan centres located in traditional innovative core regions (e.g. Malecki and Bradbury, 1992). First, it is usually argued that, due to specific agglomeration advantages, large agglomerations and core regions have greater opportunities for innovation, as interaction between closely located firms promotes the sharing of new knowledge and ideas. Secondly, it is also argued that the availability, cost and quality of labour are important locational determinants for high-technology firms. Most of the early studies have shown that highly skilled labour in scientific and engineering occupations for R&D of products and processes themselves have a strong locational preference for large urban areas ( Dicken and Lloyd, 1990).

However, the later literatures (e.g. SuarezVilla and Walrod, 1997), has found contradicting evidence on some of the most common assumptions on the benefits of agglomeration advantages. It has been observed that there is little evident that firms in more favourable regions engage more often in R&D or undertake relatively more R&D than is done by similar firms in other regions, and that proximity with other research establishments also do not show significantly higher levels of technology diffusion. It is seen that the after effect of the changing environment (including that of ICT) directly and indirectly has contributed to the new understanding of R&D location. Two inter-related factors: the changing business environment and the pervasive diffusion of information technology are seen as the catalysts to the decentralisation and the shift of population growth from metropolitan to non-metropolitan (Cheshire, 1995). With respects to this development, some literatures (e.g. Malecki and Bradbury, 1992) have noted that the present trend toward R&D decentralisation are often in responds to a need for labour and technical information that may be available elsewhere.

While the location and the external environment of the organisations has become a subject of interest to researchers in the manufacturing firms and other service sectors, empirical study and investigation concerning university location is few. This is more so with regards to the relationship between the location and university's inter-organisation collaboration. The available studies on university location (e.g. Hoare, 1989) have focused around the same theme: accessibility for the academic community especially to the traditional post-secondary students. These studies are inadequate to provide meaningful information on the university's location or its relocation decision in the present context.

University environment has changed tremendously since the last two decades. Many universities have to embrace business and market approaches in facing budgetary and other pressures. Industrial relationships have become growing important to universities as a source of finance from research royalties and licensing fees. Many governments strongly encourages universities to facilitate the practical application of research results by participating in academic-industry relationships (Blumenthal, 1994) and have become an object of strong interest among the international community of policy makers and university leaders including those in the developing countries. Malaysia, for example have fostering stronger co-operation in R&D and technology development amongst and between industry, universities and research institutes as a thrust to meet the objectives of productivity-driven growth and competitiveness (Seven Malaysian Plan, 1996).

In order to meet the growing demand for educated and skilled workforce in tandem with the country's rapid industrialisation, a considerable effort has been undertaken to increase the intake into local public institutions of higher learning. Among the step taken is by expanding the physical facilities in the existing campuses and by establishing new universities.

Several questions will become an interest to Malaysian policy makers and facilities planners, viz

- Where should the new universities or the branches of the existing universities be located in response to the changing environment, and in order to encourage greater university-industry collaboration?
- To what extent that the present universities' locations have the impact to, or affected by the changing environment, particularly in university-industry collaboration?
- To what extent the location affects users' interaction by face-to-face (FTF) and by using the new telecommunication media?

Generally, all these questions can be simplified into a major question "whether the geographical location of the universities' facilities are important (or having a significant impact) to university-industry collaboration and users' interaction."

### 3. OBJECTIVES AND HYPOTHESES

Based on the earlier locational theory, the importance of location can be seen as by the function of accessibility (the opportunity for interaction). In R&D inter-collaboration context, the opportunity for interaction between organisations depending on two major factors; the richness of the locational environment, and the proximity between the collaborating organisations. By the same time, it is also important to recognise the impact of the new technologies on the locational advantages. Therefore, the primary objectives of this research are:

1. To investigate the locational environment at which university-industry collaborations take place.
2. To investigate the effects of the geographical location of the university's to users' FTF interaction in the inter-organisation collaboration.
3. To investigate the relationship between users' interaction by ICT and FTF interaction.

This research has constructed two interrelated hypotheses to determine whether location is still important or not to inter-organisation collaboration, and if ICT has significant impact or not to inter-organisation collaboration. Based on the argument that location in terms of proximity and the richness of the place has a significant impact to users FTF interaction, this research construct the following hypotheses:

- University-industry collaboration is associated to the richness of the locational environment.
- Users' FTF interaction is inversely correlated to distance.

### 4. RESEARCH METHOD

This research chooses case studies of three science and technology based universities in Peninsular Malaysia. The selection of the universities is based on their location attributes that meet the study requirements. Universities located at the urban, suburban and relatively rural areas have been chosen to meet the objective of study. From the case

studies, the research will try to uncover related issues on the location of the university affecting their collaboration with the industry. Although this research uses multiple sources of evidence, the chief means of data collection is through surveys. Other instrument used in this research is interview. Multiple sources of evidence are one of the characteristics in case study (Yin, 1984).

The data collected will be analysed through a series of statistical techniques ranging from descriptive statistic of using mean, median, and standard deviation to one-way ANOVA (or the non-parametric equivalent) to determine whether the physical attributes (location and the provision of facilities) affect the interaction between the university and industry. This study will also use Pearson Correlation Coefficient (or the non-parametric equivalent) to measure the correlation between two variables. The correlation coefficient test will enable this research to discover the relationships between users' FTF interaction and user's interaction by ICTs, distance between the universities and the industrial firms, and other variables.

## 5. RESEARCH FINDINGS AND DISCUSSION

The findings have shown that location is important in university and industry collaboration in a developing country, namely, Malaysia. The importance of location in this context can be described in three interrelated aspects:

1. the strong relationship between regional factor with the science and technology (S&T) based collaborations,
2. the importance of FTF interaction and its strong relationship with distance, and
3. the small impact of telecommunication technology in replacing FTF interaction.

### 5.1 The Regional factor

The results drawn from the collaboration surveys and the structured interview have shown that the science and technology based university-industry collaborations in Malaysia are largely concentrated in the more urbanised regions and around the larger urban concentrations. Among the main reasons that have been discussed is due to the agglomeration of major industrial and main administrative centres. This finding is consistent with the earlier studies (1980's) conducted in developed countries (e.g. Howells, 1990) which show that R&D corporations are attracted to large urban regions for the same reasons. However, it disagrees with some of the latter literatures (SuarezVilla & Walrod, 1997) that there are no significant differences in R&D performance between the more advantageous and the less advantageous regions. This suggests that R&D progress in Malaysia is more akin with the earlier R&D locational preference in the industrialised countries. It is important to note that during the early period, most of R&D facilities in the industrialised countries are concentrated in the large urban areas in order to obtain and retain individuals in specific technical, scientific and engineering occupations. Consistent with the 1980's findings (Herzog & Schlottmann, 1989) that high-tech migrants are attracted to large metropolitan areas, the R&D professionals in Malaysian are also centred around the big cities such as in the Klang Valley and Penang. This may explain why these larger urban areas have greater university-industry collaborations.

This research scheme shows that users from the larger urban area found to be more satisfied in most of the location related factors when compared to the other universities. The urban university's satisfactory score of 3.45 from 5-Likert scale for residential environment indicates the urban condition is acceptable. This suggests that large urban centre in Malaysia remained attractive places of residences. This is

probably because the urban problems in these areas have not reached to such undesirable levels as prevalent in the larger cities. As such, it is credible to view that the condition in the urban concentrations in Malaysia is tolerable. The argument of quality-of-life considerations for the migration of skilled and highly qualified entrepreneurs to small towns and rural areas (e.g. Keeble et. al., 1992) does not appear to be a serious consideration in Malaysia.

Based on infrastructure development consideration, the quality-of-life argument might be true in the industrialised countries due to the more widespread development and most of the basic amenities are equally distinctive between regions. On the other hand, the infrastructure developments in Malaysia and in other developing countries are uneven geographically and centred on few cities and regions. It is in these areas where most of the best amenities are available. Based on such conditions, it is unlikely professionals in Malaysia are attracted to rural areas.

It is important to note that the present locational implication to many businesses and R&D development in the industrialised countries are the results of major economic, education and research restructuring, the changing social and business environment and the impact of telecommunication technologies which mostly began in 1960's. However, changes are still at the early stages in Malaysia, and the scale of changes appears to be concentrating on smaller proportion of the population and centred on few selected sectors. Changes in Malaysia are more apparent in economic development that also led to accelerate physical expansion especially around the economic led regions (e.g. Klang Valley and Penang). The small and fragmented changes may have not reach the level that might have impact on the existing location establishment.

Based on the contextual arguments presented, it can be concluded that the richer arger urban environment provides a greater opportunity for universities to collaborate with industrial firms than those in the non-urban areas.

## 5.2 The Importance of FTF Interaction

With regards to collaboration performance, most studies in technology transfer often used the amount of grants received by the universities as an indicator of collaboration success and seldom used users interaction as a basis for collaboration indicator. Nevertheless, some sociologist used communicative acts or the number of contacts per unit of time among scientists as one measure of R&D output and performance indicator (e.g. Chakrabarti, 1991 and Bach, 1989).

In this research, the frequencies of using telecommunication technologies are two times higher than by FTF contact. However, it does not necessarily mean the technologies are more important kind of communication medium. In all the types of collaboration, FTF interaction has been perceived as more important communication medium. Although the score varies between the types of collaboration and between the three universities, there are no significant differences in both occasions. This implies that FTF interaction has been considered as important communication medium in all kinds of collaboration and at all universities at any location.

The collaborations require a continual interaction and are established in the ongoing organised activities of process and production. The complexity and the uncertainty of the collaboration works have also been cited as one of the main reason for FTF interaction. For example some collaborations have been cited to have loose and vague targets in terms of their scope, achievement, time and expenditure - most

depend on the on going circumstances. In this respect, it is consistent to the understanding (Rice, 1994) that much of R&D research is uncertain, equivocal, difficult to co-ordinate and ambiguous. It also corroborated with Senker and Faulkner (1996) claimed that the know-how transfer is a step-by-step approach and requires personal interaction through secondment, training and so forth. Such understanding strengthened the need for FTF interaction. The results also consistent with Lorentzon (1995) finding on the spatial patterns of communication in different corporate functions in Sweden. The study shows that it is necessary to meet FTF due to the complexity of the projects, including discussions on unstructured problems.

The research also shows that some (37%) of the researchers interviewed have cited the limitation of telecommunication technologies in the communication process of their collaboration works. In this respect, it supports Daft and Langel (1984) media richness theory asserted that ambiguous situations need rich communication, such as FTF interactions. It has very high information richness when compared to other information medium because it reduces uncertainty, clearer or less ambiguous. In other words, the finding suggests that the telecommunication technologies are inferior communication medium in comparison to FTF communication when dealing with complexities and uncertainties such as in S&T collaborations.

The above discussion has shown that two major reasons have been found for the poor exploitation of the telecommunication technologies in the university-industry collaborations. There are; the collaboration works require FTF interaction in order to be more effective, and there are limitations of telecommunication technologies to effective collaboration.

Based on the research finding and supported by the above discussions, it is concluded that FTF interaction is very important and the best communication method in university-industry collaboration in Malaysia. FTF interaction is largely necessary in S&T inter-organisation collaboration mainly due to the complexity and uncertainties of the projects, process-based projects, and users' involvement throughout the process of the projects. There are also limitations in the telecommunication technologies that necessitate FTF interaction. When FTF interaction is necessary, therefore the distances between places and other location factors will affect users' interaction.

### **5.3 Impact of Telecommunication Technology**

Despite this, the frequency of using IT combined with other telecommunication technologies as communication medium is two times more than FTF interaction. However, this does mean the more frequent use of telecommunication technologies has change the spatial interactions pattern. The survey result does not show strong evidence that the technologies are replacing FTF interaction or it compresses distance.

Almost all the findings from this research scheme did not show any significant (negative) correlation between the frequencies in using the telecommunication media with FTF interaction. As such the contention that the extensive diffusion of telecommunication infrastructure and services has spurred a new conception of locational advantages (accessibility) has not been proven.

This finding is credible in the sense that even some studies that have been conducted during the survey period and lately in the industrialised countries have shown that the impact of ICTs on teleworking are not to the expectations (e.g. Lupton & Haynes, 2000). Considering the findings in the industrialised countries is

also not up to the expectation, it is suggested that the idea on the impact of ICT on distance and replacing FTF interaction in Malaysia or anywhere else is still premature. The various reasons given for FTF interactions and the limitation of ICTs suggest that there is no simple solution to overcome the challenges in achieving the greater application of ICT.

In view of the discussion above, it is likely that the trend of decentralisation as reflected by teleworking, teleproducing, teleconferencing, satellite officing, remote telecentres and virtual officing facilitated by telecommunication technologies may be less dependent on FTF communication considerations, or communication related factor is considered as secondary to other factors. It has been observed in the literatures that the decentralisation trend as a product of the society changing way of life (e.g. Leaman & Borden, 1993), responding to the changing business environment (e.g. McDougall, 1993), and others as part of a general suburbanisation process in response to decaying conditions in central cities (e.g. Chesire, 1995), and quest for skilled labour (e.g. Malecki & Bradbury, 1992) rather than as a result of technological change. It is important to note that among the factors leading to university dispersal option in the 1980's are due to limited land, programmatic changes which require new building sites, population changes, and community policy (Fink, 1985) instead of the ICT advancement. Some dispersed universities may even due to the agglomeration of smaller colleges with the major university that based on educational restructuring.

In conclusion, the argument set in this section concluded that location is important in university and industry collaboration in Malaysia. It is important in terms of the richness of the place particularly in relation to the availability of R&D professionals and proximity with the industrial cluster. Particularly, the larger urban areas offer greater opportunity for universities to collaborate with industrial firms due to its rich environment. Proximity is important due to necessary for FTF interaction. By the same time, the impact of telecommunication technology on distance and FTF interaction if any is rather small. Instead, telecommunication technology is seen more as complementing to FTF interaction rather than replacing it. The impact of advanced telecommunication technology on location is still far from the expectations even in the industrialised countries, and it is unlikely that telecommunication technology have a drastic impact on location in Malaysia in the near future. The success of inter organisation collaboration also depended on other more important factors like the availability of qualified scientists and engineers rather than communication infrastructure alone. As such, location is important in university-industry collaboration in Malaysia.

## 6. CONCLUSION

Based on the discussions presented, this research confirms the hypotheses that locations in terms of the richness of the place and the proximity between places have a strong impact to university-industry collaboration and to user's FTF interaction. In this respect, the university that is located in the larger urban area and in richer region has greater advantages than the university that is located in the rural area. It has been seen that R&D progress in Malaysia is similar with the earlier R&D locational preference in the industrialised countries due to contextual factors; the infrastructural development, socio-economic factors, and that related to the human factors of the country that has been studied. For numerous reasons, the state of art of S&T collaborations particularly in Malaysia largely requires FTF contact require trips from the universities to the industrial firms. The more frequent use of ICTs cannot wholly support the ideals of the network organisation without some form of FTF interaction. The various reasons given to the



needs of personal interactions have contributed to the difficulty in understand a clear relationship between ICTs, alternative working arrangement, and decentralisation trend unless other contextual factors are considered. There is no straightforward link between use of ICTs and new ways of working. In spite of their fascinating potentials and opportunities, ICTs alone cannot be seen as the main source to the trend of decentralisation as reflected by the various virtual activities (e.g. teleworking, virtual office).

It is still premature to give credence that the extensive diffusion of telecommunication infrastructure and services can stimulate a new conception of locational advantages (accessibility). The impact of advanced telecommunication technology on location is still far from the expectations even in the industrialised countries, and it is unlikely that telecommunication technology have a drastic impact on location in Malaysia in the near future. In conclusion, this research finding affirmed that location in terms of the richness of the area and the proximity between places are still important and are affecting university-industry collaboration in Malaysia. University and industry collaboration is more intensified at the larger urban environment and proximity between the universities and industries have important role in affecting users' interaction.

In conclusion, this research finding affirmed that location in terms of the richness of the area and the proximity are still important and are affecting university and industry collaboration in Malaysia.

## 7. REFERENCES

- Ahmad Fauzi A. Wahab (2000), The Impact of Corporate Facilities on Users' Interaction: University-Industry Interaction in Malaysia, PhD Thesis, Strathclyde
- Bach, BW. (1989) The Effect of Multiplex Relationships Upon Innovation Adoption: A Reconsideration of Roger's Model. *Communication Monographs*, No. 56, pp.133-150.
- Blumenthal, D. et al. (1996) Relationships Between Academic Institutions and Industry in The Life Science - An Industry Survey. *New England Journal of Medicine*, Vol. 334, No. 6. pp. 368-373
- Chakrabarti, AK (1991) Industry Characteristics Influencing the Technical Output R&D Management, Vol.21, No. 2 pp.139-152
- Cheshire, P. (1995) A new Phase of Urban Development in Western Europe? The Evidence for the 1980s. *Urban Studies*, Vol. 32, No. 7, pp. 1045-1063
- Daft, RL., and Lengel, RH. (1984) Information richness: A new approach to managerial behavior and organizational design. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior* (pp. 191-233). Greenwich, CT: JAI.
- Dicken, P. and Lloyd, P. (1990) *Location in Space: Theoretical Perspectives in Economic Geography* (3rd edn). Harper and Row Publishers, New York.
- Fink, I. (1985) The Role of Land and Facilities in Fostering Linkages Between Universities and High-Technology Industries. *Planning for Higher Education*, Vol.13, No. 3, pp.1-12
- Helling, A. (1998) Changing Intra-Metropolitan Accessibility in US: Evidence in Atlanta. *Progress in Planning*, Vol. 49, No.2, pp. 57-103
- Herzog, HW and Schlottmann, AM (1989) High-Technology Location and Worker Mobility in *Andersson, A., Batten, DF., and Karlsson, C (Eds.) Knowledge and Industrial Organisation*. Springer Verlag, Berlin.
- Hoare, AG. (1989) Reviewing the Reviews: The Geography of University Rationalisation Higher Education Quarterly, Vol. 45, No.3, Summer, pp. 234-253
- Howells, J. (1996) Industry-academic links in research and Innovation: A National and Regional Perspectives *Regional studies*, Vol.20, pp.472-476
- Hunt, O. and Owen D.W. (2000) The Communication Experiences of Education Managers. *The International Journal of Educational Management*, Vol. 14, Issue 3.

- Iadanza, P. (1997) Workplace Performance Strategies - Why Change? Proceedings From World Workplace 1997), IFMA, Texas, USA, pp. 807-812
- Keeble, D. and Bryson, J. (1993) Small Firm Creation and Growth, Regional Development and the north-south divide, Working Paper 29, Small Business Research Centre, University of Cambridge.
- Kotter, J. & Heskett, J. (1992) Corporate Culture and Performance. Free Press/MacMillan.
- Leaman, A., and Borden, I. (1993) The Responsible Workplace: Users Expectations in Duffy et al. (1993) *The Responsible Workplace*. Butterworth Architecture, Oxford.
- Lemberg, D. (1996) Gentleman Adventurers in the Information Age: Accessibility, Activity, and Urban Futures. National Research for Geographic Information and Analysis Conference, Baltimore, Sept. 9-11.
- Lorentzon, S. (1995) The use of ICT in TNCs. *Regional Studies*. Vol. 29 (27), pp. 673-685.
- Lupton, P. and Haynes, B. (2000) Teleworking - the perception-reality gap. *Facilities*, Vol. 18 Number: 7 Page: 323 – 328.
- Malecki, EJ. and Bradbury, SL (1992) R&D Facilities and Professional labour Force Dynamics in High Technology *Regional Studies*, Vol.26, No.2, pp.123-136.
- McDougall, B. (1993) The Changing Geography of Location. In Duffy et al. (1993) *The Responsible Workplace*. Butterworth Architecture, Oxford.
- Podolny, J., & Page, K. (1998). Network forms of organisation. *Annual Review of Sociology*, 24, 57-76.
- Raymond, S.& Cunliffe, R. (1997) *Tomorrow's Office*. E & FN Spon, London.
- Rice, RE. (1993) Media Appropriateness Using Social Presence Theory to Compare Traditional and New Organisational Media *Human Communication Research*, Vol.19, No.4, pp.451-484
- Rockart, J. (1998) Towards Survivability of Communication-intensive New Organisation Forms. *Journal of Management Studies*, 35, pp. 417-420.
- Senker, J. and Faulkner, W. (1996) Networks, Tacit Knowledge and Innovation., in Coombs et al. (Eds.) *Technological Collaboration*. Edward Elgar, UK.
- Seventh Malaysia Plan (1996-2000) Percetakan Nasional Malaysia Berhad, Kuala Lumpur.
- Stocks, M. (1998) The Virtual Office-Putting management Ahead of Facilities. *Facilities*, Vol. 16, No. 1/2, pp. 29-33
- SuarezVilla, L. and Walrod, W. (1997) Operational strategy, R&D and intra-metropolitan clustering in a polycentric structure: The advanced electronics industries of the Los Angeles basin. *Urban Studies*, Vol.34, No.9, pp.1343-1380
- Yin, RK. (1984) *Case Study Research: Design and Methods*. Sage Publications, California, pp.90-91