## APPENDIX A

**Table 4.1(a) : Summary Of The Characteristics Of The Construction Firms**

| Characteristics | | Gamuda | Road Builder | IJM | Gadang |
|---|---|---|---|---|---|
| Construction As core business | | √ | √ | √ | √ |
| Grouped Companies | | √ | √ | √ | √ |
| International Construction Experience | | √ | √ | √ | X |
| Diversification | | √ | √ | √ | √ |
| Number of employees | | N/A | 1700 (year 2004) | 972 (year 2003) | 300 (year 2004) |
| Number of Years in Establishment (As on year 2005) | | 29 | 20 | 21 | 12 |
| Experience of alliance or joint-venture | | YES | YES | YES | YES |
| Group Annual Turnover | 2003 (RM '000) | 1,442,069 | 1,234,694 | 1,363,895 | 138,086 |
| | 2004 (RM'000) | 1,719,032 | 1,159,849 | NA | 133,380 |
| Nature of Business | | -Civil<br>-Structural<br>-Bridges<br>-Highway<br>-Property<br>-Highway concession<br>-Water concession | -Civil<br>-Structural<br>-Bridges<br>-Highway<br>-Property<br>-Highway concession<br>-Port | -Civil<br>-Structural<br>-Bridges<br>-Highway<br>-Property<br>-Highway concession<br>-Quarrying | -Civil<br>-Structural<br>-Property |

**Table 4.1(a) : Summary Of The Characteristics Of The Construction Firms (continued)**

| Characteristics | | WCT | Company X | Pintaras |
|---|---|---|---|---|
| Construction As core business | | √ | √ | √ |
| Grouped Companies | | √ | √ | √ |
| International Construction Experience | | √ | √ | X |
| Diversification | | √ | √ | √ |
| Number of employees | | 300 (year 2004) | 300 (year 2004) | 200 (year 2004) |
| Number of Years in Establishment (As on year 2005) | | 24 | 32 | 16 |
| Experience of alliance or joint-venture | | YES | YES | YES |
| Group Annual Turnover | 2003 (RM '000) | 911,325 | 153,747 | 68,038 |
| | 2004 (RM'000) | NA | 381,907 | 87,358 |
| Nature of Business | | -Civil,<br>-Structural<br>-Bridges<br>-Highway<br>-Dams,<br>-Property<br>-Highway concession | -Civil,<br>-Structural<br>-Electrical<br>-Mechanical<br>-Power generation<br>-Property | -Piling<br>-Civil<br>-Structural |

**Table 4.1(b) : Evidence Of Knowledge Transfer In Construction Firms**

| Directions of Knowledge Transfer | | Gamuda | Road Builder | IJM | Gadang | WCT | Company X | Pintaras |
|---|---|---|---|---|---|---|---|---|
| Individuals to External structure | | Medium | Low | Low | N/A | N/A | N/A | N/A |
| External structure to individuals | | High | High | High | Medium | High | Medium | Medium |
| Competence to internal structure | | Medium | Medium | Medium | Low | Medium | Medium | Medium |
| Internal structure to competence | | Medium | Medium | Medium | Medium | Medium | Medium | Medium |
| External to internal structure | | High | High | High | Medium | High | Medium | Medium |
| Internal to external structure | | Low | Low | Low | N/A | Low | Low | N/A |
| Within internal structure | Between Professional Individuals | High | Medium | Medium | Medium | Medium | Medium | Low |
| | Between managers | Medium | Medium | Medium | Low | Medium | Medium | Low |
| | Between departments | Medium | Medium | Medium | Low | Medium | Low | Low |
| | Within Ad-hoc project teams | High | High | High | Medium | High | High | Medium |

**Table 4.1(c) : Types Of Knowledge Transfer In Construction Firms**

| Types of Knowledge Transfer | Gamuda | Road Builder | IJM | Gadang | WCT | Company X | Pintaras |
|---|---|---|---|---|---|---|---|
| Tacit Knowledge | Medium | Medium | Low | Medium | Medium | Medium | Medium |
| Explicit Knowledge | Medium | Low | Medium | Low | Low | Low | Low |

**Table 4.1(d) : Types of Innovation In Construction Firms**

| Types of Innovation | | Gamuda | Road Builder | IJM | Gadang | WCT | Company X | Pintaras |
|---|---|---|---|---|---|---|---|---|
| Innovation In Business Management | Innovation in management of assets (e.g. factory, warehouse,) | X | X | X | X | X | X | X |
| | Innovation in management of construction machineries | √ | √ | X | X | X | X | √ |
| | Innovation in management of human resources and expertise | √ | X | √ | X | X | X | X |
| | Innovation in business development and marketing | √ | √ | √ | √ | √ | √ | √ |
| Innovation In Construction Operation | Innovation in construction contracts | X | X | X | X | X | X | X |
| | Innovation in construction method | √ | √ | √ | √ | √ | √ | √ |
| | Innovation in engineering design | √ | √ | √ | √ | √ | √ | √ |
| | Innovation in construction logistic | √ | √ | √ | X | √ | √ | √ |
| | Innovation in construction material | √ | √ | √ | X | √ | X | X |

**Table 4.1(e) : Evidence Of Innovation In Construction Firms**

| Type of Innovations | Company | Evidence of Innovations |
|---|---|---|
| Innovation in management of construction machineries | Pintaras | Modified and rent the machineries to other construction companies |
| | Gamuda & Road Builder | Joint venture with counterparts to share the initial cost of expensive machineries such as tunnel coring machines. |
| Innovation in management of human resources and expertise | Gamuda & IJM | Offer Employee Share Options Scheme (ESOS) and special incentives for the project team. |
| Innovation in construction method | Road Builder | Cable-stayed Putrajaya Seri Saujana Bridge. |
| | IJM | Investing in research and development of precast concrete panels and promoting it as an alternative construction method via its wholly owned subsidiary Industrial Concrete Products Berhad. |
| | IJM | Pioneer in utilising shear wall system and system formwork for high rise building construction. |
| | Gamuda | Adopting climbing forming for box-girder elevated bridge construction. |
| | Gamuda | Adopting pre-grout method and utilizing large diameter boring machine for tunnel boring works. |
| | IJM & Company X | Adopting top-down construction method to reduce the construction period. |
| | Pintaras | Adopting alternative design and larger diameter of bored piles. Introducing new type of loop bearing ground anchor that will ease the removal of ground anchor. |

**Table 4.1(e) : Evidence Of Innovation In Construction Firms (continued)**

| Type of Innovations | Company | Evidence of Innovations |
|---|---|---|
| Innovation in construction method | Gadang | Adopting flexible steel formwork system for conventional building structure to reduce construction cycle. |
| | WCT | Adopting rock-fill method for Bakun Dam construction. |
| Innovation in engineering design | Pintaras | Alternative design substituting several small diameter bored piles with large diameter bored pile. |
| | IJM, WCT, Gamuda, Gadang, Company X & Road Buider | Alternative design on highways, building structures and infrastructure with cost effective and reduction of construction period. |
| Innovation in construction logistic | Gamuda, IJM, WCT, Road Builder, Pintaras, Gadang & Company X | Adopting well-planned logistic routing and schedule to avoid heavy traffic for construction in town center. Adopting off-site pre-fabrication to reduce congestion at site. |
| Innovation in construction material | IJM | Utilizing quarry sand and rice hush as an alternative to aggregate in concrete. |
| | Road Builder | Introduction of Jumbo Beam which has higher strength and smaller size as an alternative to conventional steel U-Beam. |
| | WCT | Utilizing black pipe as an alternative to G.I. pipe for inclinometer casing. |
| | Gamuda | Utilizing steel fibre concrete to substitute conventional concrete. |

**Table 4.1(f) : Factors Affecting Innovation In Construction Firms**

| Factors | Gamuda | Road Builder | IJM | Gadang | WCT | Company X | Pintaras |
|---|---|---|---|---|---|---|---|
| Effective exchange of knowledge within organization | √ | √ | √ | √ | √ | √ | √ |
| Effective transfer of knowledge from external sources | √ | √ | √ | √ | √ | √ | √ |
| Research and Development | √ | √ | √ | X | √ | X | X |
| Short term planning of the organization | √ | √ | √ | √ | √ | √ | √ |
| Long-term strategy of the organization | √ | √ | √ | √ | √ | √ | √ |
| Adjust to environment | √ | X | X | X | √ | X | X |
| Absorptive capacity of the organization | √ | √ | √ | √ | √ | √ | √ |
| Government regulations and legislations | √ | X | X | X | X | X | X |
| Coordination with external knowledge sources | √ | √ | √ | √ | √ | √ | √ |
| Details contractual in temporary network of the organization | √ | √ | √ | √ | X | √ | X |

**Table 4.1(f) : Factors Affecting Innovation In Construction Firms (continued)**

| Factors | Gamuda | Road Builder | IJM | Gadang | WCT | Company X | Pintaras |
|---|---|---|---|---|---|---|---|
| Building long-term relationship with permanent network of the organization | √ | √ | √ | √ | √ | √ | √ |
| Mutual trust and respect with permanent network of the organization | √ | √ | √ | √ | √ | √ | √ |
| Openness with permanent network of the organization | X | X | √ | X | X | X | X |
| Development of social ties | √ | √ | X | X | X | X | X |
| Understanding of social values and norms | √ | √ | X | X | X | X | X |
| Matching culture | √ | √ | X | X | X | X | X |
| Joint ventures or forming alliances | √ | √ | √ | √ | √ | √ | √ |

**Table 4.2 : Summary Of The Research Results**

| Propositions | Status |
|---|---|
| **Proposition 1:** More efficient and effective exchange of knowledge between external and internal parties of construction firms leads to higher innovation performance. | √ |
| **Proposition 2 :** A long-term view in construction firms enhances the firm to adjust to changes in the environment and increase innovation performance. | √ |
| **Proposition 3 :** The better developed the absorptive capacity of the construction firm, the higher the innovation performance. | √ |
| **Proposition 4 :** A context with less strict regulations and restrictions has a positive impact on the development of new knowledge for innovation within construction firms. | X |
| **Proposition 5 :** Coordination between construction firm and its external knowledge resources can help to gain competitive advantage. | √ |
| **Proposition 6 :** Coordination of temporary network, in the form of detailed contracts, has a negative impact on exchange of knowledge for competitive advantage between internal and external knowledge resources in construction industry. | X |
| **Proposition 7 :** Coordination of permanent network, in the form of trust, has a positive impact on exchange of knowledge for competitive advantage between internal and external knowledge resources in construction industry. | √ |

√ - Proposition accepted
X - Proposition rejected

## APPENDIX B

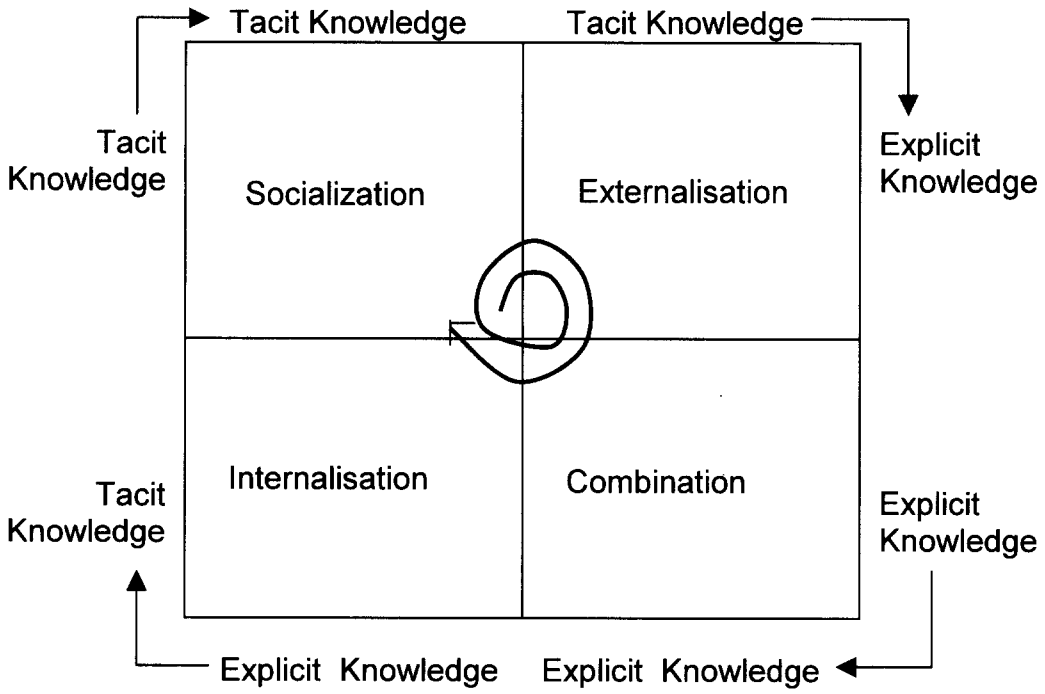


**Figure 2.1 : SECI As Process Of Self-transcendence**
Source : (Nonaka,1994)

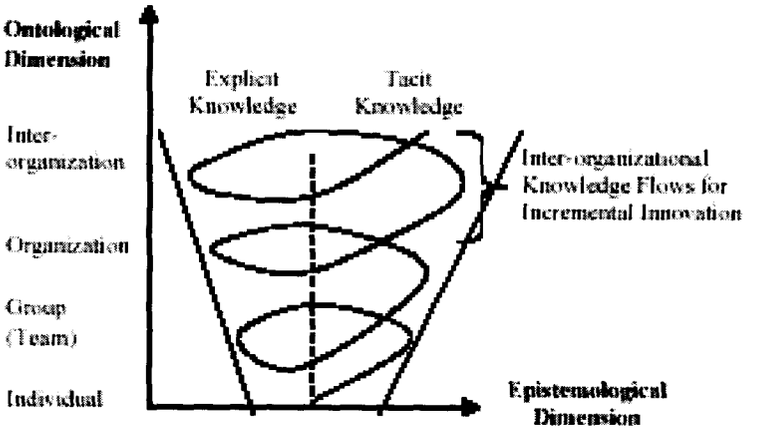


**Figure 2.2 : Inter-organizational knowledge flow for localized innovations in project-based industries**

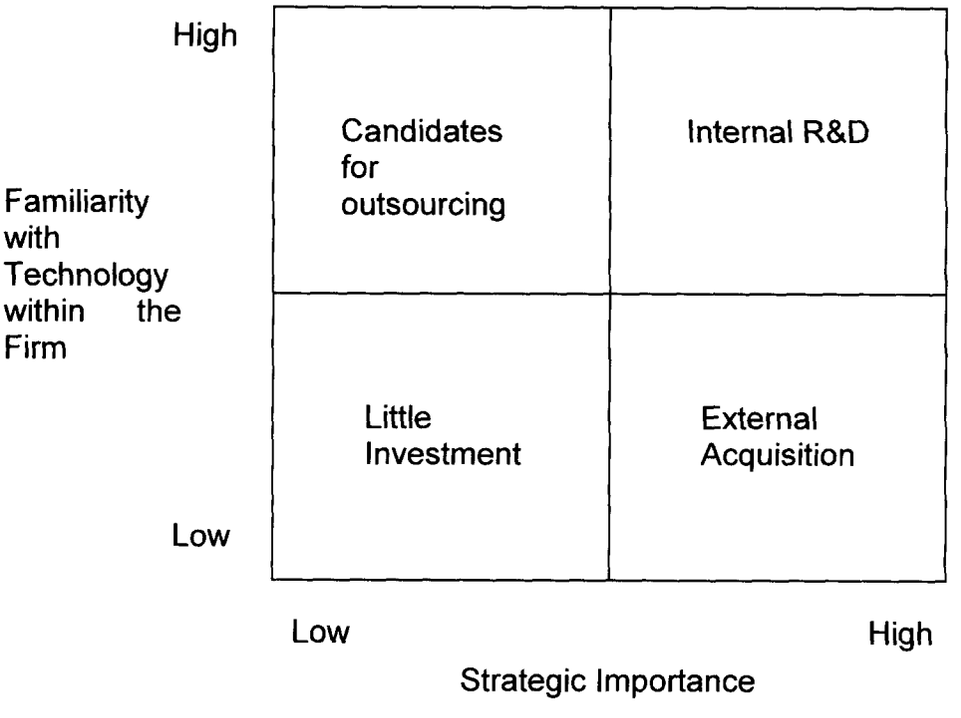


**Figure 2.3 : Need For External Sourcing Of Technology And Knowledge**
Source : (Leonard, D. ,1998)

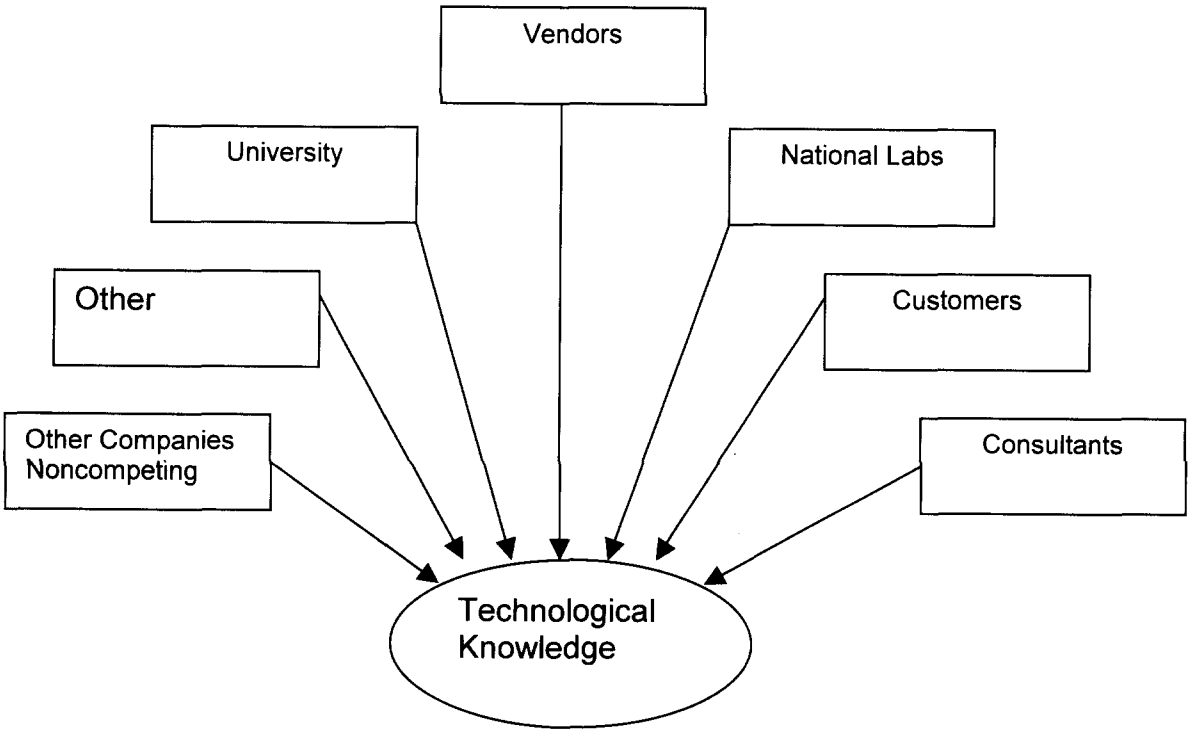


**Figure 2.4 : External Sources Of Technological Knowledge**
Source : (Leonard, D. ,1998)

## APPENDIX C

### Sample Guidelines for Semi-structured Interview

# University Malaya

The Faculty of Business and Accountancy

Master of Business Administration

This survey is conducted as part of the academic research project, which shall be submitted in partial fulfilment of the requirements for the Degree of Master of Business Administration from the University of Malaya.

The general purpose of this study is to examine knowledge-based approach to innovation among construction firms in Malaysia.

Please answer all questions provided in all sections. All information shall be treated with the strictest confidentiality and only aggregated data shall be analysed. Please also enclose a business card for reference.

Shall you have any further enquiries, please do not hesitate to contact the undersigned via e-mail taijh@yahoo.com

Thank you in advance for your kind assistance.

Yours sincerely,

Mr. Tai Jiunn Hong

## GENERAL INFORMATION

Please fill the answer.

1. Name of organization :
2. Nature of business :
3. Year of establishment :
4. Year of listing on Bursa Malaysia :
5. Paid up capital :
6. Interviewee particulars:

   Name :

   Designation :

   Tel (Office) :

   E-mail address :

**Part 1 : Knowledge Transfer and Innovation**

1. Knowledge and company personnel are two resources for construction firms in competitive environment. Do you agree with the statement? Why?
2. Has your organization put in place procedures for continuous learning and training programme for your staffs?
3. Do your organization emphasis on knowledge transfer to your organisation from external source via continuous learning and training programme for your staffs?
4. Do your organization encourage exchange of knowledge within your organisation? If yes, where do the knowledge exchange take place?
   a) Individual professionals
   b) Between managers
   c) Inter-department, or others?
5. What form of knowledge transfer that take place? Tacit knowledge[1] or explicit knowledge[2] ?

*1. **Explicit** knowledge - the obvious knowledge found in manuals, documentation, files and other accessible sources.*
*2. **Tacit** Knowledge - functions as a tool (background knowledge) which assists in accomplishing a task which is in focus*

6. Do your organization provide impressive reward systems to attract talented professionals?
7. Do your organization taking steps to transfer the individually held competence and expertise to the organisation and vice versa?
8. Do your organisation invest in continuous upgrading of technical capability?
9. Do your organization invest in any engineering research and development programme?
10. Management of a construction firm is basically management of change. What is your view to this statement?

11. Is your organization adopting technology and businesses innovativeness in your operation? To what extent can your accept changes and innovativeness in your organisation?
12. Do you agree that the more efficient and effective exchange of knowledge internally and externally, the higher the innovation performance of an organisation.

**Part 2: Coordination between Knowledge-based Networks**

1. Has your organization developed a mission statement?
2. Has your organization developed short-term objective and long-term strategies to achieve the stated visions and missions?
3. Have you incorporated the concept of core competencies in your organization?
4. Do you agree that long term planning is important to adjust to environment as well as to increase innovation performance of your organisation.
5. Do you think that coordination on project and firm level is important?
6. Do you think that the following factors are important in coordinating a construction project and help your organisation gain competitive advantage in the industry?
   a. building long-term relationship
   b. development of mutual trust and respect
   c. increasing openness between different parties
   d. development of social ties
   e. understanding of each other's values and norms

7. Do you think the coordination between your organisation and these external knowledge resources can help gain competitive advantage?

8. Do your organization have any experience of forming an alliance or joint venture with other construction firms in construction projects?
9. To your opinion, do these alliances or joint ventures provide knowledge transfer or conversion to your organisation?
10. Do you agree that coordination of temporary network, in the form of detailed contracts, has a negative impact on exchange of knowledge between internal and external knowledge resource in construction industry?
11. Do you agree that coordination of permanent network, in the form of trust, has a positive impact on exchange of knowledge between internal and external knowledge resource in construction industry?

**Part 3 : Impact of Government Regulations and Culture**

1. Do you think that less stringent regulations and restrictions will help to encourage development of new knowledge for innovation in construction? How?
2. Do you think that a matching culture will have a positive impact on innovation in construction and encourage knowledge transfer in the industry? Why and How?