APPENDIX 1

GUIDING DIAGRAM

Chapter 2: a theoretical chapter
"Explaining mixed results on Science Parks performance: Bright and dark sides of the effects of inter-organizational knowledge transfer relationships"
Variables identified in the paper are shown below:

Direct ties	Formal ties
	Informal ties
	Social ties
Trust	Organizational trust
	Personal trust
Proximities	Geographical proximity
	Technological proximity
	Organizational proximity
Knowledge quality	Knowledge usability DV
	Frequency of transfer
Diversity of actors	
Unintended knowledge flows	
Absorptive capacity	
Innovative performance DV	

DV: Dependent Variable

Chapter 3: an empirical chapter "Knowledge exchange behaviours of science park firms: The Innovation Hub case"

Chapter 4: an empirical chapter "A relational view of knowledge transfer effectiveness in small new technology- based firms: An empirical view from South Africa"

Chapter 5: an empirical chapter "Knowledge transfers between and innovative performances of NTBFs in South Africa: An attempt to explain mixed findings in science park research from South Africa"

APPENDIX 2

Evaluation of SCIENCE PARKS in literature

WITH THE FOCUS ON A COMPARISON BETWEEN ON- AND OFF-PARK FIRMS

Author(s)	Country and period	Research focus	Research methodology		Key results
			Sampling approach	Data collection and analysis techniques	
Felsenstein (1994)	Israel (period of study not known)	To examine the role of science parks as "seedbeds" of innovation by looking at the effects of seedbed (as indicated by level of interaction with a local university and the entrepreneur's educational background) on a firm's innovation level	stratified sampling On-park: 72 Off-park: 90	Questionnaire survey at firm level Log-linear modelling	(1) The level of interaction between on-park firms and local universities is generally low, however, it is higher than the level of interaction exhibited by off-park firms; (2) Seedbed effects are not necessarily related to a firm's innovative level; (3) Science park location has only a weak and indirect relationship with innovation level
Westhead and Cowling (1995)	UK (1986-992)	• To assess the employment growth in the "surviving" firms located on- and off-park • To identify factors that are associated with employment growth	Matched sampling On-park: 49 Off-park: 44	Questionnaire survey at firm level Longitudinal data set (1986-1992) Bivariate and multiple correlation and regression	No difference in the employment growth of on- and off-park firms; (2) Education and technical experience and financial sources are associated with employment growth
Westhead (1997)	UK (1986-1992)	To assess the R&D inputs and outputs between firms located on- and off-park	Matched sampling On-park: 41 Off-park: 40	Questionnaire survey at firm level Chi-square test	• No significance differences in the R&D inputs (R&D expenditure and percentage of qualified scientists and engineers) of on- and off-park firms • No significance differences in the R&D outputs (patents, copyrights, new products/services) between on- and off-park firms

Author(s)	Country and period	Research focus	Research methodology		Key results
			Sampling approach	Data collection and analysis techniques	
Löfsten and Lindelöf (2002)	Sweden (1996-1998)	To assess the performance (sales, employment and profitability) of firms located on- and off-park	Matched sampling On-park: 134 Off-park: 139	Questionnaire survey at firm level Chi-square test, Independent t-test	• On-park firms cooperate more with universities • On-park firms have higher employment and sales growth • No significant difference in the profitability of on- and off-park firms
Colombo and Delmastro (2002)	Italy (2000)	To determine if SPs are successful in fostering the establishment and growth of NTBFs by comparing on- and off-park firms in terms of: • Characteristics of founder • Growth and innovativeness of firms • Access to public subsidies	Matched sampling On-park: 45 Off-park: 45	Questionnaire survey at firm level Chi-square test, Independent t-test	• On-park founders are mainly motivated by innovation-related factors • No differences in the innovative inputs • No difference in the innovative outcomes (patents) • On-park firms have higher employee growth and easier access to public subsidies
Siegel, Westhead and Wright (2003)	UK (1986-1992)	To study the impact of SP on research productivity by comparing on- and off-park firms	Matched sampling On-park: 89 Off-park: 88	Questionnaire survey at firm level Independent t-test	• For two of the three R&D outputs measured (new products and patents), the output elasticity is positive and statistically significant for on-park firms • On-park firms have slightly higher research productivity

Author(s)	Country and period	Research focus	Research methodology		Key results
			Sampling approach	Data collection and analysis techniques	
Lindelöf and Löfsten (2003)	Sweden (1996-1998)	To assess the performance of SP by comparing on- and off-park firms in their strategic approaches	Matched sampling On-park: 134 Off-park: 139	Questionnaire survey at firm level Independent t-test	• On-park firms showed significantly greater emphasis on firm characteristics such as innovation ability, competitor- and market-orientation, sales and employment growth, high profits, etc. • Off-park firms reported proximity to other firms to be of higher importance than the on-park sample in their choice of location • No significant difference in new products (before competitors) and patents
Lindelöf and Löfsten (2004)	Sweden (1996-1998)	To examine the level of interactions with local universities during innovation process	Matched sampling On-park: 134 Off-park: 139	Questionnaire survey at firm level Independent t-test, correlation, factor analysis	• On-park firms have higher technological innovation (product development) than off-park firms • Off-park firms have higher R&D outputs (patents) • On-park firms have low level of interactions with universities, but it is still higher than off-park firms

Author(s)	Country and period	Research focus	Research methodology		Key results
			Sampling approach	Data collection and analysis techniques	
Ferguson and Olofsson (2004)	Sweden (1991-2000)	To investigate the survival and growth of NTBFs located on and off two Swedish science parks	Stratified sampling Total on- and off-park firms: 66	Questionnaire survey at firm-level Longitudinal data set (1991-2000) Correlations	• On-park firms have a higher survival rate than off-park firms • No differences in the sales of on- and off-park firms • No differences in the employment growth of on- and off-park firms • On-park firms reported higher image benefits and benefits in cooperation with universities
Akçomak and Taymaz (2004)	Turkey (2000-2002)	To assess the effectiveness of incubators in Turkey	Matched sampling On-park: 48 Off-park: 41	Questionnaire survey at firm level Chi-square test, Independent t-test	• On-park firms have higher economic performance (employment growth) than off-park firms • No differences in the innovative output (new product/service development) of on- and off-park firms • On-park firms give more importance to interaction with universities as opposed to their off-park counterparts

Author(s)	Country and period	Research focus	Research methodology		Key results
			Sampling approach	Data collection and analysis techniques	
Dettwiler, Lindelöf and Löfsten (2006)	Sweden (1999)	To relate location to facilities management and how it can affect the growth and performance of NTBFs.	Stratified sampling On-park: 134 Off-park: 139	Questionnaire survey at firm-level Descriptive analysis	• On-park firms rank proximity to university to be important as compared with off-park firms • Facilities management indirectly contributes to interactions, inter-firm relations and networks in on-park firms
Malairaja and Zawdie (2008)	Malaysia (period of study unknown)	To examine the effectiveness of science parks as a strategy to promote university-industry collaboration	Matched sampling On-park: 101 Off-park: unknown	Questionnaire survey at firm-level Chi-square test, Independent t- test	On-park firms have (not at statistically significant level) more links with universities than off-park firms
Yang et al. (2009)	Taiwan (1998-2003)	To compare the R&D productivity of NTBFs located within and outside of science parks by measuring the elasticity of R&D with respect to output	Matched sampling On-park: 57 Off-park: 190	Panel data from databank of the Taiwan Economic Journal & Taiwan Intellectual Property Office Independent t-test, regression analysis	On-park firms have significantly higher R&D spending, R&D intensity and patents than off-park firms On-park firms have higher elasticity of R&D with respect to outputs (as the indicator of R&D productivity) than off-park firms, i.e. on-park firms invest more efficiently in innovations

References

Akçomak, I.S. and Taymaz, E., 2004. Assessing the effectiveness of incubators: The case of Turkey. ERC Working Papers 0412, ERC – Economic Research Center, Middle East: Technical University.

Colombo, M.G. and Delmastro, M., 2002. How effective are technology incubators? Evidence from Italy. *Research Policy*, 31(7), 1103-1122.

Dettwiler, P., Lindelöf, P. and Löfsten, H., 2006. Utility of location: A comparative survey between small new technology-based firms located on and off science parks – implications for facilities management. *Technovation*, 26(4), 506-517.

Felsenstein, D., 1994. University-related science parks – 'seedbeds' or 'enclaves' of innovation?. *Technovation*, 14(2), 93-110.

Ferguson, R. and Olofsson, C., 2004. Science parks and the development of NTBFs – location, survival and growth. *Journal of Technology Transfer*, 29(1), 5-17.

Lindelöf, P. and Löfsten, H., 2003. Science park location and new technology-based firms in Sweden – implications for strategy and performance. Small *Business Economics*, 20(3), 245-258.

Lindelöf, P. and Löfsten, H., 2004. Proximity as a resource base for competitive advantage: university-industry links for technology transfer. *Journal of Technology Transfer*, 29(3-4), 311-326.

Löfsten, H. and Lindelöf, P., 2002. Science parks and the growth of new technology-based firms – academic-industry links, innovation and markets. *Research Policy*, 31(6), 859-876.

Malairaja, C. and Zawdie, G., 2008. Science parks and university-industry collaboration in Malaysia. *Technology Analysis and Strategic Management*, 20(6), 727-739.

Siegel, D.S., Westhead, P. and Wright, M., 2003. Assessing the impact of university science parks on research productivity: exploratory firm-level evidence from the United Kingdom. *International Journal of Industrial Organisation*, 21(9), 1357-1369.

Westhead, P. and Cowling, M., 1995. Employment change in independent owner-managed high-technology firms in Great Britain. *Small Business Economics*, 7(2), 111-140.

Westhead, P., 1997. R&D 'inputs' and 'outputs' of technology-based firms located on and off science parks. *R&D Management*, 27(1), 45-62.

Yang, C., Motohashi, K. and Chen, J., 2009. Are new technology-based firms located on science parks really more innovative? Evidence from Taiwan. *Research Policy*, 38(1), 77-85.

APPENDIX 3

QUESTIOINNAIRE FOR ON-PARK FIRMS

Impacts of networks [illegible] **nology-based firms**

GENERAL INFORMATION

A. Contact information	*Please provide an answer where applicable*
Name of your firm:	
Name of parent and/or daughter firm:	Parent firm: Daughter firm(s):
Name of contact person in your firm:	
Contact telephone number:	
Email address:	

B. Type of firm and main activities	
B.1 Your firm is: *When answering this question, use as the criterion the activity in which the highest percentage of sales was realised in 2007.*	*Please tick only one answer, or provide an answer where applicable* □ A manufacturing firm □ A service provider □ Other type of firm ----------
B.2 What is the main activity of your firm?	*Please tick (can be more than one answer) or provide an answer where applicable* □ Production of consumer goods □ Development of consumer goods □ Production of raw and refined materials □ Development of raw and refined materials □ Production of product parts and components □ Development of product parts and components □ Production of product equipment □ Development of product equipment □ Transport (services) □ Communication (services) □ Financial services □ Business services (engineering, IT) □ Other ----------

C. Firm age and size	*Please provide an answer where applicable*
In which year was your firm established?	Year: ----------
In which year did your firm locate to The Innovation Hub?	Year: ----------
Have you participated in the Maxum Business Incubator programme?	□ Yes, I am **currently** joining the programme □ Yes, I have **graduated** from the programme □ No, I have not been to this programme before
Total number of employees (including directors/managers) in your firm in 2005 (if applicable) and 2007?	**2005** --------- **2007** ---------
Total sales (if any) of your firm in 2005 (if applicable) and 2007? (if sales volume is 1 million, please write 1,000,000)	**2005** R--------- **2007** R---------

D. Services provided by your science pa

Please tick where appropriate

To what extent are you satisfied with the following services provided by your science park?

		Do not use the service	*If you use the service, please indicate the level of satisfaction on a scale of 1 (totally dissatisfied) to 5 (totally satisfied)* 1	2	3	4	5
1.	Overall impression on pleasant environment (e.g. of site security, car parking with space for visitors, self-contained and lockable units with power and heating, possibility to expand into additional/adjacent units)	□	□	□	□	□	□
2.	Sharing office equipment, administrative support (e.g. meeting rooms, library, reception area)	□	□	□	□	□	□
3.	Organising marketing events, exhibitions, press conferences	□	□	□	□	□	□
4.	Provision of legal (by Adams & Adams), accounting, business, technical advice at low cost (or free of charge)	□	□	□	□	□	□
5.	Well-established image due to location on the science park	□	□	□	□	□	□
6.	Access to partnership opportunities with other technology firms located on the science park, knowledge sharing/dissemination	□	□	□	□	□	□
7.	Development of a pool of skilled labour, benefits from logistic arrangements, benefits from support network (e.g. emergence of complementary industries)	□	□	□	□	□	□
8.	Access to market, research centres, universities	□	□	□	□	□	□
9.	Rental subsidies, subsidies on telecom/computer network access, other subsidies related to cost reduction (only in Maxum)	□	□	□	□	□	□
10.	Access to venture capital funding, banking facilities, other sources of funding	□	□	□	□	□	□

INNOVATIVE OUTCOMES

1. Innovated product/services

Please tick where appropriate: only one answer is possible

Between 2005 and 2007, has your firm introduced **products** and/or **services** onto the market that were technologically **improved** or **new** to your firm?

Improved: *an existing product/service which has clearly improved technical specifications or increased usability compared to a previous version*

New: *a product/service incomparable with previous products or services of your firm and in which new technology is embodied*

□ Yes, products/services developed mainly **by a third party**

□ Yes, products/services developed together **with a third party**

□ Yes, products/services developed mainly **by my own firm**

□ No. Please go to **Question 4**

2. Product and/or service innovation and sales

Please tick or provide an answer where applicable

A. How many patents did your firm file in 2005 (if applicable) and 2007 respectively?

2005 _____ **2007** _____

B. How many new products and/or services did your firm develop in 2005 (if applicable) and 2007 but did not yet introduce to the market in 2005 and 2007 respectively?

2005 _____ **2007** _____

C. Do you have products and/or services on the market in 2007?

□ Yes. Please continue with **Question D**
□ No. Please go to **Question 3**

D. For 2007, give an indication of the distribution of sales of products and/or services of your firm that:

Distribution of total sales 2007

Did not change ____ %
Were technologically improved ____ %
Were technologically new ____ %

→ Total has to add up to 100%

E. In 2007, did your firm sell products/services that were not only technologically new or improved for your firm, but **also** technologically new or improved in the **market**? (*i.e. your competitors had not already introduced such products/services*)

□ Yes → Share of total sales of *these* products/services in 2007 was approximately: _____ %

□ No

3. Other results of product/service inno	*Please tick where appropriate*				
Please indicate to what extent your firm's product and/or service innovations in 2007 resulted in:	*Please indicate the extent on a scale of 1 (very little), 3 (not little / not much) to 5 (very much)*				
	1	**2**	**3**	**4**	**5**
A. Reduction of development and maintenance costs	□	□	□	□	□
B. Quality improvement of products and/or services	□	□	□	□	□
C. Increases in production capacity	□	□	□	□	□
D. Improvement in delivery times	□	□	□	□	□
E. Increase in sales	□	□	□	□	□
F. Increase in profits	□	□	□	□	□

4. Innovated processes	*Please tick where appropriate: only one answer is possible*
Between 2005 and 2007, did your firm bring production processes into use that were technologically **improved** or **new** to your firm? ***Improved:*** *an existing production process, but with clearly higher performance, less cost or improved production reliability* ***New:*** *a process incomparable with previous processes of your firm and in which new technology is embodied*	□ Yes, processes developed mainly **by a third party** □ Yes, processes developed together **with a third party** □ Yes, processes developed mainly **by my own firm** □ No. Please continue with **Question 6**

5. Other results of process innovations	*Please tick where appropriate*				
Please indicate to what extent your firm's process innovations in 2007 resulted in:	*Please indicate the extent on a scale of 1 (very little), 3 (not little and not much) to 5 (very much)*				
	1	**2**	**3**	**4**	**5**
A. Reduction of development and maintenance costs	□	□	□	□	□
B. Quality improvement of products and/or services	□	□	□	□	□
C. Increases in production capacity	□	□	□	□	□
D. Improvement in delivery times	□	□	□	□	□
E. Increase in sales	□	□	□	□	□
F. Increase in profits	□	□	□	□	□

6. Firm's level of knowledge and experience	*Please tick where appropriate*				
To what extent do the following statements apply to your firm?	*Please indicate on a scale of 1 (strongly disagree), 3 (neither agree nor disagree)to 5 (strongly agree)*				
	1	**2**	**3**	**4**	**5**
A. Most of the staff in our firm is highly skilled and qualified	□	□	□	□	□
B. Our firm invests substantially in training	□	□	□	□	□
C. Our firm innovates by improving other firms' products and processes	□	□	□	□	□
D. Most of the time our firm is ahead of our competitors in developing and launching new products	□	□	□	□	□
E. Our firm has the ability to adapt other firms' technologies	□	□	□	□	□
F. Our firm innovates as the result of R&D carried out within our own firm	□	□	□	□	□
G. Our firm has considerable resources and own knowlegde resources for technological development	□	□	□	□	□
H. Our firm is able to introduce into the market innovations that are completely novel on a worldwide scale	□	□	□	□	□

7. Trust

7.1 Interorganisational trust

Please tick where appropriate

To what extent do the following statements apply to your firm?
In general, the **organisations** with which my firm **exchanges knowledge**:

Please indicate on a scale of 1 (strongly disagree) , 4 (neither agree nor disagree) to 7 (strongly agree)

		1	2	3	4	5	6	7
A.	keep promises they make to our firm	□	□	□	□	□	□	□
B.	are always honest with us	□	□	□	□	□	□	□
C.	provide information that we can believe	□	□	□	□	□	□	□
D.	are genuinely concerned that our business should succeed	□	□	□	□	□	□	□
E.	consider our welfare as well as their own when making important decisions	□	□	□	□	□	□	□
F.	keep our best interests in mind	□	□	□	□	□	□	□
G.	are trustworthy	□	□	□	□	□	□	□
H.	it is not necessary to be cautious in dealing with them	□	□	□	□	□	□	□

7.2 Interpersonal trust

Please tick where appropriate

To what extent do the following statements apply to your firm?
In general, **the persons** with whom my firm exchanges knowledge:

Please indicate on a scale of 1 (strongly disagree) , 4 (neither agree nor disagree) to 7 (strongly agree)

		1	2	3	4	5	6	7
A.	have always been impartial in negotiations with us	□	□	□	□	□	□	□
B.	can always be counted on to act as we expect	□	□	□	□	□	□	□
C.	are trustworthy	□	□	□	□	□	□	□
D.	consider our interests even when it is costly to do so	□	□	□	□	□	□	□
E.	if their performance were below our expectations, we would feel a sense of betrayal	□	□	□	□	□	□	□

8. Relationship with firms on your science park

Does your firm exchange knowledge with firms/organisations located at your science park?	□ **Yes**. Please continue with **Question 9 and complete the rest of the questions** □ **No**. Please go to **Question 13 and complete the rest of the questions**

NETWORKING FOR INTENDED KNOWLEDGE FLOWS WITH ON-PARK FIRMS

9. Degree centrality

Please write down the number

	In 2007, with how many **organisations** located on your science park did your firm have **formal/contractual** agreements which were aimed at exchanging knowledge?	In 2007, with how many **organisations** located on your science park did your firm have interactions on a **non-contractual** basis (i.e. informal, social basis) which were aimed at exchanging knowledge?	In 2007, with how many **persons** located on your science park did you (as a manager/director) have social interactions which were aimed at exchanging knowledge? Consider persons working for the organisations under these categories.
Competitors			
Buyers			
Suppliers			
Innovation centres			
Public research labs			
University of Pretoria			
Consultants			
Sector institutes			
Others, namely: ----------			

10. Technological proximity — *Please tick where appropriate*

To what extent is the knowledge your firm receives from the **most important** partners/actors located on your science park under the following categories **similar** to your firm's own knowledge?

Similar: *similarity between your firm's knowledge and the knowledge from your most important partners/actors located on your science park*
Example of "completely similar": your firm possesses knowledge on radar technology and your most important partner exchanges with you the same knowledge in this field

Please indicate the level on a scale of 1 (not similar) to 7 (completely similar)

	1	2	3	4	5	6	7
Most important competitors	□	□	□	□	□	□	□
Most important buyers	□	□	□	□	□	□	□
Most important suppliers	□	□	□	□	□	□	□
Most important innovation centres	□	□	□	□	□	□	□
Most important public research labs	□	□	□	□	□	□	□
University of Pretoria	□	□	□	□	□	□	□
Most important consultants	□	□	□	□	□	□	□
Most important sector institutes	□	□	□	□	□	□	□
Others, namely: _____	□	□	□	□	□	□	□

11. Organisational proximity — *Please tick where appropriate*

To what extent do the following statements apply to the relationship between your firm and the most important partners/actors located on your science park?

Please indicate the level on a scale of 1 (completely disagree), 3 (neither disagree nor agree) to 5 (completely agree)

	1	2	3	4	5
A. Our firm has contacts with the same third parties (i.e. buyers, suppliers, etc.) that our partners have	□	□	□	□	□
B. Our partners have the same organisational routines and values as our firm	□	□	□	□	□
C. Our partners have the same organisational structure as our firm	□	□	□	□	□

12. Frequency of accessing knowledge and the usefulness of knowledge

12.1 Frequency — *Please tick where appropriate*

How often does your firm access knowledge from the most important partners located on your science park?

	Never	Rarely	Sometimes	Regularly	Always
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
University of Pretoria	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

12.2 Usefulness	*Please tick where appropriate*				
How useful is the knowledge your firm receives from the most important partners located on your science park with regard to your firm's innovations?	*Please indicate the level on a scale of 1 (not useful) to 5 (completely useful)*				
	1	**2**	**3**	**4**	**5**
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
University of Pretoria	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

13. Use of other knowledge sources	*Please tick where appropriate*				
How often does your firm use the following sources from organisations/actors located on your science park to acquire knowledge for your firm's innovations?	**Never**	**Rarely**	**Sometimes**	**Regularly**	**Always**
1. Employing key scientists and engineers (including poaching key staff) from other firms/organisations located on/related to your science park	□	□	□	□	□
2. Acquiring key information at conferences and workshops organised by the science park management	□	□	□	□	□
3. Reverse engineering of technological knowledge embedded in products developed/produced by other firms/organisations located on/related to your science park	□	□	□	□	□
4. Accessing patent information filed by other firms/organisations located on/related to your science park	□	□	□	□	□
5. Knowledge embedded in organisational processes or routines of firms/organisations located on your science park	□	□	□	□	□
6. Publications in technical and scientific papers by other firms/organisations located on your science park	□	□	□	□	□

Please note that the following questions are targeted at your firm's partners NOT located on science parks

NETWORKING FOR INTENDED KNOWLEDGE FLOWS WITH OFF-PARK FIRMS

14. Degree centrality			*Please write down the number*
	In 2007, with how many **organisations** (**NOT** located on science parks) did your firm have **formal/contractual** agreements which were aimed at exchanging knowledge?	In 2007, with how many **organisations** (**NOT** located on science parks) did your firm have interactions on a **non-contractual** basis (i.e. informal, social basis) which were aimed at exchanging knowledge?	In 2007, with how many **persons** (**NOT** located on science parks) did you (as a manager/director) have social interactions which were aimed at exchanging knowledge? Consider persons working for the organisations under these categories.
Competitors			
Buyers			
Suppliers			
Innovation centres			
Public research labs			
Universities (excluding University of Pretoria)			
Consultants			
Sector institutes			
Others, namely: _____			

15. Geographical proximity — *Please tick only one answer*

What is the location of the most important partner/actor (under the following categories) with whom your firm exchanges knowledge?

With respect to my firm, they are located in:

	Not a partner	Same city	Different city but same province	Other province	Abroad
Most important competitor	□	□	□	□	□
Most important buyer	□	□	□	□	□
Most important supplier	□	□	□	□	□
Most important innovation centre	□	□	□	□	□
Most important public research lab	□	□	□	□	□
Most important university (excluding University of Pretoria)	□	□	□	□	□
Most important consultant	□	□	□	□	□
Most important sector institute	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

16. Technological proximity — *Please tick where appropriate*

To what extent is the knowledge your firm receives from the most important partners/actors (**NOT** located on your science park) under the following categories similar to your firm's own knowledge?

Similar: *similarity between your firm's knowledge and the knowledge from your most important partner/actors (NOT located on your science park)*
Example of "completely similar": your firm innovates on the knowledge base of radar and your most important partner exchanges with you the same knowledge in the field of radar

Please indicate the level on a scale of 1 (not similar) to 7 (completely similar)

	1	2	3	4	5	6	7
Most important competitors	□	□	□	□	□	□	□
Most important buyers	□	□	□	□	□	□	□
Most important suppliers	□	□	□	□	□	□	□
Most important innovation centres	□	□	□	□	□	□	□
Most important public research labs	□	□	□	□	□	□	□
Most important universities (excluding University of Pretoria)	□	□	□	□	□	□	□
Most important consultants	□	□	□	□	□	□	□
Most important sector institutes	□	□	□	□	□	□	□
Others, namely: _____	□	□	□	□	□	□	□

17. Organisational proximity — *Please tick where appropriate*

To what extent do the following statements apply to the relationship between your firm and the most important partners (**NOT** located on science parks)?

Please indicate the level on a scale of 1 (completely disagree), 3 (neither disagree nor agree) to 5 (complete agree)

		1	2	3	4	5
A.	Our firm has contacts with the same third parties (i.e. buyers, suppliers, etc.) that our partners have	□	□	□	□	□
B.	Our partners have the same organisational routines and values as our firm	□	□	□	□	□
C.	Our partners have the same organisational structure as our firm	□	□	□	□	□

18. Frequency of accessing knowledge and the usefulness of knowledge

18.1 Frequency — *Please tick where appropriate*

How often does your firm access knowledge from the most important partners (**NOT** located on your science park)?

	Never	Rarely	Sometimes	Regularly	Always
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
Most important universities (excluding University of Pretoria)	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

18.2 Usefulness — *Please tick where appropriate*

How useful is the knowledge your firm receives from the most important partners (**NOT** located on your science park) with regard to your firm's innovations?

Please indicate the level on a scale of 1 (not useful) to 5 (completely useful)

	1	2	3	4	5
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
Most important universities (excluding University of Pretoria)	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

19. Use of other knowledge sources (with NO relation to science parks) — *Please tick where appropriate*

How often does your firm use the following sources from organisations/actors (**NOT** located on science parks) to acquire knowledge for your firm's innovations?

	Never	Rarely	Sometimes	Regularly	Always
1. Employing key scientists and engineers (including poaching key staff) from other firms/organisations (**NOT** located on your science park)	□	□	□	□	□
2. Acquiring key information at conferences and workshops (**NOT** organised by your science park)	□	□	□	□	□
3. Reverse engineering of technological knowledge embedded in products developed/produced by other firms/organisations (**NOT** located on your science park)	□	□	□	□	□
4. Accessing patent information filed by other firms/organisations (**NOT** located on your science park)	□	□	□	□	□
5. Knowledge embedded in organisational processes or routines of other firms/organisations (**NOT** located on your science park)	□	□	□	□	□
6. Publications in technical and scientific papers by other firms/organisations (**NOT** located on your science park)	□	□	□	□	□

APPENDIX 4

QUESTIOINNAIRE FOR OFF-PARK FIRMS

Impacts of networks on innovative performance of new technology-based firms
~ questionnaire for off-park firms

GENERAL INFORMATION

A. Contact information	*Please provide an answer where applicable*
Name of your firm: Name of parent and/or daughter firm: Name of contact person in your firm: Contact telephone number: Email address:	 Parent firm: Daughter firm(s):

B. Type of firm and main activities	
B.1 Your firm is: *When answering this question, use as the criterion the activity in which the highest percentage of sales was realized in 2007.*	*Please tick only one answer, or provide an answer where applicable* □ A manufacturing firm □ A service provider □ Other type of firm ----------
B.2 What is the main activity of your firm?	*Please tick (can be more than one answer) or provide an answer where applicable* □ Production of consumer goods □ Development of consumer goods □ Production of raw and refined materials □ Development of raw and refined materials □ Production of product parts and components □ Development of product parts and components □ Production of product equipment □ Development of product equipment □ Transport (services) □ Communication (services) □ Financial services □ Business services (engineering, IT) □ Other ----------

C. Location	
Please indicate where is your firm located	□ Pretoria □ Other city, namely: ----------

D. Firm age and size	*Please provide an answer where applicable*
In which year was your firm established?	Year: ----------
Total number of employees (including directors/managers) in your firm in 2005 (if applicable) and 2007?	**2005** --------- **2007** ---------
Total sales (if any) of your firm in 2005 (if applicable) and 2007? (if sales volume is 1 million, please write 1,000,000)	**2005** R--------- **2007** R---------

1. Innovated product/services

Please tick where appropriate: only one answer is possible

Between 2005 and 2007, has your firm introduced **products** and/or **services** into the market that were technologically **improved** or **new** to your firm?

Improved: *an existing product/service which has clearly improved technical specifications or increased usability compared to a previous version*

New: *a product/service incomparable with previous products or services of your firm and in which new technology is embodied*

□ Yes, products/services developed mainly **by a third party**

□ Yes, products/services developed together **with a third party**

□ Yes, products/services developed mainly **by my own firm**

□ No. Please go to **Question 4**

2. Product and/or service innovation and sales

Please tick or provide an answer where applicable

F. How many patents did your firm file in 2005 (if applicable) and 2007 respectively?

2005 _____ **2007** _____

G. How many new products and/or services did your firm develop in 2005 (if applicable) and 2007 but did not yet introduce to the market in 2005 and 2007 respectively?

2005 _____ **2007** _____

H. Do you have products on the market in 2007?

□ Yes. Please continue with **Question D**
□ No. Please go to **Question 3**

I. For 2007, give an indication of the distribution of sales of products and/or services of your firm that:

Distribution of total sales 2007

Did not change ____ %
Were technologically improved ____ %
Were technologically new ____ %

→ Total has to add up to 100%

J. In 2007, did your firm sell products/services that were not only technologically new or improved for your firm, but **also** technologically new or improved in the **market**? (*i.e. your competitors had not already introduced such products/services*)

□ Yes → Share of total sales of *these* products/services in 2007 was approximately: _____ %

□ No

3. Other results of product/service innovations

Please tick where appropriate

Please indicate to what extent your firm's product and/or service innovations in 2007 resulted in:

Please indicate the extent on a scale of 1 (very little), 3 (not little / not much) to 5 (very much)

	1	2	3	4	5
G. Reduction of development and maintenance costs	□	□	□	□	□
H. Quality improvement of products and/or services	□	□	□	□	□
I. Increases in production capacity	□	□	□	□	□
J. Improvement in delivery times	□	□	□	□	□
K. Increase in sales	□	□	□	□	□
L. Increase in profits	□	□	□	□	□

4. Innovated processes

Please tick where appropriate: only one answer is possible

Between 2005 and 2007, did your firm bring production processes into use that were technologically **improved** or **new** to your firm?

Improved: *an existing production process, but with clearly higher performance, less cost or improved production reliability*

New: *a process incomparable with previous processes of your firm and in which new technology is embodied*

□ Yes, processes developed mainly **by a third party**

□ Yes, processes developed together **with a third party**

□ Yes, processes developed mainly **by my own firm**

□ No. Please continue with **Question 6**

5. Other results of process innovations	*Please tick where appropriate*

Please indicate to what extent your firm's process innovations in 2007 resulted in:

Please indicate the extent on a scale of 1 (very little), 3 (not little and not much) to 5 (very much)

		1	2	3	4	5
G.	Reduction of development and maintenance costs	□	□	□	□	□
H.	Quality improvement of products and/or services	□	□	□	□	□
I.	Increases in production capacity	□	□	□	□	□
J.	Improvement in delivery times	□	□	□	□	□
K.	Increase in sales	□	□	□	□	□
L.	Increase in profits	□	□	□	□	□

6. Firm's level of knowledge and experience	*Please tick where appropriate*

To what extent do the following statements apply to your firm?

Please indicate on a scale of 1 (strongly disagree), 3 (neither agree nor disagree)to 5 (strongly agree)

		1	2	3	4	5
I.	Most of the staff in our firm is highly skilled and qualified	□	□	□	□	□
J.	Our firm invests substantially in training	□	□	□	□	□
K.	Our firm innovates by improving other firms' products and processes	□	□	□	□	□
L.	Most of the time our firm is ahead of our competitors in developing and launching new products	□	□	□	□	□
M.	Our firm has the ability to adapt other firms' technologies	□	□	□	□	□
N.	Our firm innovates as the result of R&D carried out within our own firm	□	□	□	□	□
O.	Our firm has considerable resources and own knowlegde resources for technological development	□	□	□	□	□
P.	Our firm is able to introduce into the market innovations which are completely novel on a worldwide scale	□	□	□	□	□

7. Trust

7.1 Interorganisational trust	*Please tick where appropriate*

To what extent do the following statements apply to your firm?
In general, the **organisations** with which my firm **exchanges knowledge**:

Please indicate on a scale of 1 (strongly disagree) , 4 (neither agree nor disagree) to 7 (strongly agree)

		1	2	3	4	5	6	7
I.	keep promises they make to our firm	□	□	□	□	□	□	□
J.	are always honest with us	□	□	□	□	□	□	□
K.	provide information that we can believe	□	□	□	□	□	□	□
L.	are genuinely concerned that our business should succeed	□	□	□	□	□	□	□
M.	consider our welfare as well as their own when making important decisions	□	□	□	□	□	□	□
N.	keep our best interests in mind	□	□	□	□	□	□	□
O.	are trustworthy	□	□	□	□	□	□	□
P.	it is not necessary to be cautious in dealing with them	□	□	□	□	□	□	□

7.2 Interpersonal trust	*Please tick where appropriate*

To what extent do the following statements apply to your firm?
In general, **the persons** with whom my firm exchanges knowledge:

...cate on a scale of 1 (strongly disagree) , 4 (neither agree nor disagree) to 7 (strongly agree)

		1	2	3	4	5	6	7
F.	have always been impartial in negotiations with us	□	□	□	□	□	□	□
G.	can always be counted on to act as we expect	□	□	□	□	□	□	□
H.	are trustworthy	□	□	□	□	□	□	□
I.	consider our interests even when it is costly to do so	□	□	□	□	□	□	□
J.	if their performance were below our expectations, we would feel a sense of betrayal	□	□	□	□	□	□	□

8. Relationship with firms on The Innovation Hub

Does your firm exchange knowledge with firms/organisations located at **The Innovation Hub** (which is situated in Pretoria)?

□ **Yes**. Please continue with **Question 9 and complete the rest of the questions**

□ **No**. Please go to **Question 13 and complete the rest of the questions**

NETWORKING FOR INTENDED KNOWLEDGE FLOWS WITH ON-PARK FIRMS

9. Degree centrality — *Please write down the number*

	In 2007, with how many **organisations** located on The Innovation Hub did your firm have **formal/contractual** agreements which were aimed at exchanging knowledge?	In 2007, with how many **organisations** located on The Innovation Hub did your firm have interactions on a **non-contractual** basis (i.e. informal, social basis) which were aimed at exchanging knowledge?	In 2007, with how many **persons** located on The Innovation Hub did you (as a manager/director) have social interactions which were aimed at exchanging knowledge? Consider persons working for the organisations under these categories.
Competitors			
Buyers			
Suppliers			
Innovation centres			
Public research labs			
University of Pretoria			
Consultants			
Sector institutes			
Others, namely: _____			

10. Technological proximity — *Please tick where appropriate*

To what extent is the knowledge your firm receives from the **most important** partners/actors located on The Innovation Hub under the following categories **similar** to your firm's own knowledge?

Similar: *similarity between your firm's knowledge and the knowledge from your most important partners/actors located The Innovation Hub. Example of "completely similar": your firm possesses knowledge on radar technology and your most important partner exchanges with you the same knowledge in this field*

Please indicate the level on a scale of 1 (not similar) to 7 (completely similar)

	1	2	3	4	5	6	7
Most important competitors	□	□	□	□	□	□	□
Most important buyers	□	□	□	□	□	□	□
Most important suppliers	□	□	□	□	□	□	□
Most important innovation centres	□	□	□	□	□	□	□

	4	5	6	7
Most important public research labs	□	□	□	□
University of Pretoria	□	□	□	□
Most important consultants	□	□	□	□
Most important sector institutes	□	□	□	□
Others, namely: _____	□	□	□	□

11. Organisational proximity — *Please tick where appropriate*

To what extent do the following statements apply to the relationship between your firm and the most important partners/actors located on The Innovation Hub?

Please indicate the level on a scale of 1 (completely disagree), 3 (neither disagree nor agree) to 5 (completely agree)

	1	2	3	4	5
D. Our firm has contacts with the same third parties (i.e. buyers, suppliers, etc.) as our partners have	□	□	□	□	□
E. Our partners have the same organisational routines and values as our firm	□	□	□	□	□
F. Our partners have the same organisational structure as our firm	□	□	□	□	□

12. Frequency of accessing knowledge and the usefulness of knowledge

12.1 Frequency — *Please tick where appropriate*

How often does your firm access knowledge from the most important partners located on The Innovation Hub?

	Never	Rarely	Sometimes	Regularly	Always
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
University of Pretoria	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

12.2 Usefulness — *Please tick where appropriate*

How useful is the knowledge your firm receives from the most important partners located on The Innovation Hub with regard to your firm's innovations?

Please indicate the level on a scale of 1 (not useful) to 5 (completely useful)

	1	2	3	4	5
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
University of Pretoria	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

13. Use of other knowledge sources *Please tick where appropriate*

How often does your firm use the following sources from organisations/actors located on The Innovation Hub to acquire knowledge for your firm's innovations?	Never	Rarely	Sometimes	Regularly	Always
7. Employing key scientists and engineers (including poaching key staff) from other firms/organisations located on/related to The Innovation Hub	□	□	□	□	□
8. Acquiring key information at conferences and workshops organised by the science park management of The Innovation Hub	□	□	□	□	□
9. Reverse engineering of technological knowledge embedded in products developed/produced by other firms/organisations located on/related to The Innovation Hub	□	□	□	□	□
10. Accessing patent information filed by other firms/organisations located on/related to The Innovation Hub	□	□	□	□	□
11. Knowledge embedded in organisational processes or routines of firms/organisations located on The Innovation Hub	□	□	□	□	□
12. Publications in technical and scientific papers by other firms/organisations located on The Innovation Hub	□	□	□	□	□

Please note that the following questions are targeted at your firm's partners NOT located in The Innovation Hub

NETWORKING FOR INTENDED KNOWLEDGE FLOWS WITH OFF-PARK FIRMS

14. Degree centrality *Please write down the number*

	In 2007, with how many **organisations** (**NOT** located on The Innovation Hub) did your firm have **formal/contractual** agreements which were aimed at exchanging knowledge?	In 2007, with how many **organisations** (**NOT** located on The Innovation Hub) did your firm have interactions on a **non-contractual** basis (i.e. informal, social basis) which were aimed at exchanging knowledge?	In 2007, with how many **persons** (**NOT** located on The Innovation Hub) did you (as a manager/director) have social interactions which were aimed at exchanging knowledge? Consider persons working for the organisations under these categories.
Competitors			
Buyers			
Suppliers			
Innovation centres			
Public research labs			
Universities (excluding University of Pretoria)			
Consultants			
Sector institutes			
Others, namely: _____			

15. Geographical proximity *Please tick only one answer*

What is the location of the most important partner/actor (under the following categories) with whom your firm exchanges knowledge?	Not a partner	*With respect to my firm, they are located in:* Same city	Different city but same province	Other province	Abroad
Most important competitor	□	□	□	□	□
Most important buyer	□	□	□	□	□
Most important supplier	□	□	□	□	□
Most important innovation centre	□	□	□	□	□
Most important public research lab	□	□	□	□	□
Most important university (excluding University of Pretoria)	□	□	□	□	□
Most important consultant	□	□	□	□	□
Most important sector institute	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

16. Technological proximity *Please tick where appropriate*

To what extent is the knowledge your firm receives from the most important partners/actors (**NOT** located on The Innovation Hub) under the following categories similar to your firm's own knowledge?

Similar: *similarity between your firm's knowledge and the knowledge from your most important partner/actors (NOT located on The Innovation Hub)*
Example of "completely similar": your firm innovates on the knowledge base of radar and your most important partner exchanges with you the same knowledge in the field of radar

Please indicate the level on a scale of 1 (not similar) to 7 (completely similar)

	1	2	3	4	5	6	7
Most important competitors	□	□	□	□	□	□	□
Most important buyers	□	□	□	□	□	□	□
Most important suppliers	□	□	□	□	□	□	□
Most important innovation centres	□	□	□	□	□	□	□
Most important public research labs	□	□	□	□	□	□	□
Most important universities (excluding University of Pretoria)	□	□	□	□	□	□	□
Most important consultants	□	□	□	□	□	□	□
Most important sector institutes	□	□	□	□	□	□	□
Others, namely: _____	□	□	□	□	□	□	□

17. Organisational proximity *Please tick where appropriate*

To what extent do the following statements apply to the relationship between your firm and the most important partners (**NOT** located on The Innovation Hub)?

Please indicate the level on a scale of 1 (completely disagree), 3 (neither disagree nor agree) to 5 (complete agree)

	1	2	3	4	5
D. Our firm has contacts with the same third parties (i.e. buyers, suppliers, etc.) that our partners have	□	□	□	□	□
E. Our partners have the same organisational routines and values as our firm	□	□	□	□	□
F. Our partners have the same organisational structure as our firm	□	□	□	□	□

18. Frequency of accessing knowledge and the usefulness of knowledge

18.1 Frequency *Please tick where appropriate*

How often does your firm access knowledge from the most important partners (**NOT** located The Innovation Hub)?

	Never	Rarely	Sometimes	Regularly	Always
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
Most important universities (excluding University of Pretoria)	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

18.2 Usefulness	*Please tick where appropriate*				
How useful is the knowledge your firm receives from the most important partners (**NOT** located on The Innovation Hub) with regard to your firm's innovations?	*Please indicate the level on a scale of 1 (not useful) to 5 (completely useful)*				
	1	**2**	**3**	**4**	**5**
Most important competitors	□	□	□	□	□
Most important buyers	□	□	□	□	□
Most important suppliers	□	□	□	□	□
Most important innovation centres	□	□	□	□	□
Most important public research labs	□	□	□	□	□
Most important universities (excluding University of Pretoria)	□	□	□	□	□
Most important consultants	□	□	□	□	□
Most important sector institutes	□	□	□	□	□
Others, namely: _____	□	□	□	□	□

19. Use of other knowledge sources (with NO relation to science parks)	*Please tick where appropriate*				
How often does your firm use the following sources from organisations/actors (**NOT** located on The Innovation Hub) to acquire knowledge for your firm's innovations?	**Never**	**Rarely**	**Sometimes**	**Regularly**	**Always**
7. Employing key scientists and engineers (including poaching key staff) from other firms/organisations (**NOT** located on The Innovation Hub)	□	□	□	□	□
8. Acquiring key information at conferences and workshops (**NOT** organized by The Innovation Hub)	□	□	□	□	□
9. Reverse engineering of technological knowledge embedded in products developed/produced by other firms/organisations (**NOT** located on The Innovation Hub)	□	□	□	□	□
10. Accessing patent information filed by other firms/organisations (**NOT** located on The Innovation Hub)	□	□	□	□	□
11. Knowledge embedded in organisational processes or routines of other firms/organisations (**NOT** located on The Innovation Hub)	□	□	□	□	□
12. Publications in technical and scientific papers by other firms/organisations (**NOT** located on The Innovation Hub)	□	□	□	□	□