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Critical Diversity in Boosting the Role of Universities in the Regional Economy: An International Perspective

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Structure

- Introduction: valorization of knowledge
- Incubation process
 - Determinant factors of incubators' development (focus on diversity)
- Growth of spin-offs in two contrasting cities: Delft and Trondheim
 - Determinant factors of spin-offs' growth (focus on diversity in networks)
- Findings and conclusion

Introduction

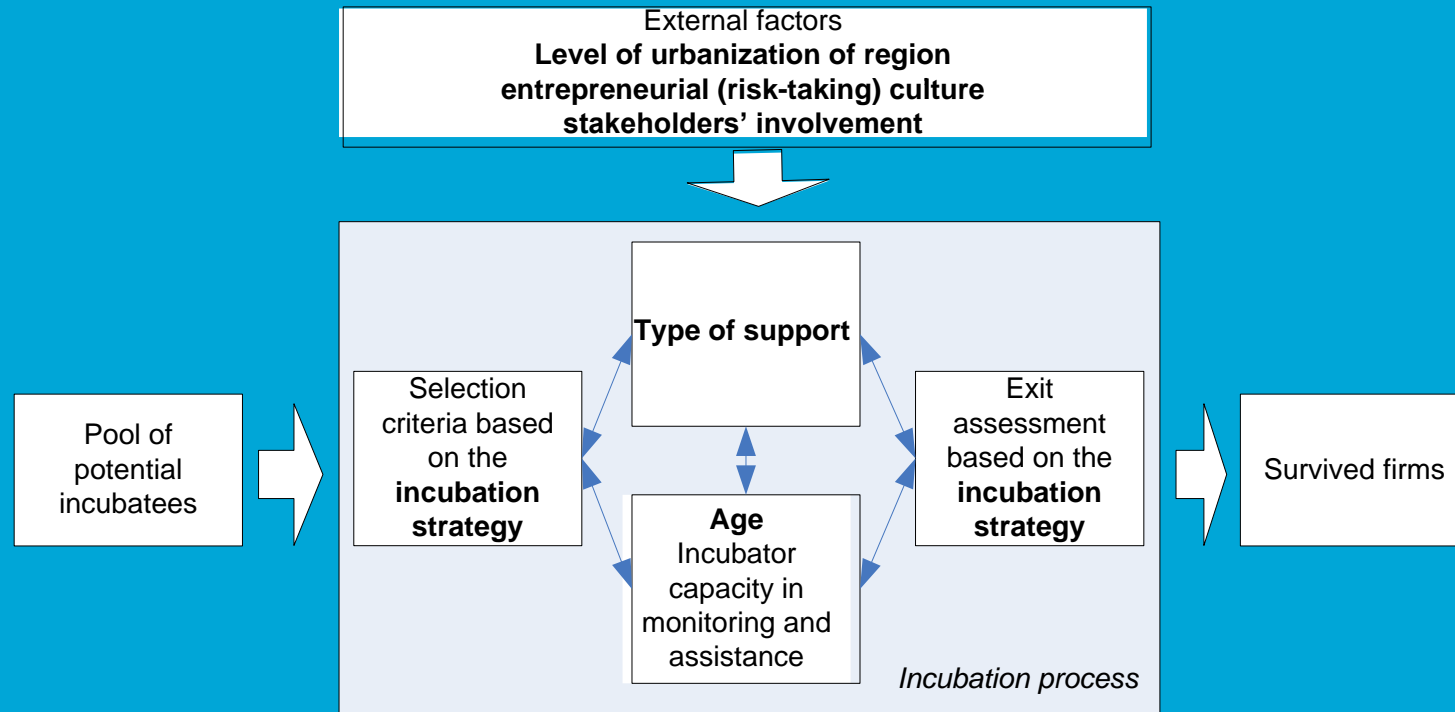
- Universities act increasingly based on their third task: to bring new knowledge to market
- Reasons for this development:
 - shortage of funding from the side of public bodies
 - accountability to policy-making bodies and public
 - insufficient utilization of publicly funded research (EU knowledge paradox)
 - reduction of basic research in large corporate firms (universities are pushed into these vacant positions)
 - need for knowledge institutes to much more strategic spearheads of accelerated economic growth
- University spin-off firms as one 'vehicle' in knowledge valorization

Introduction

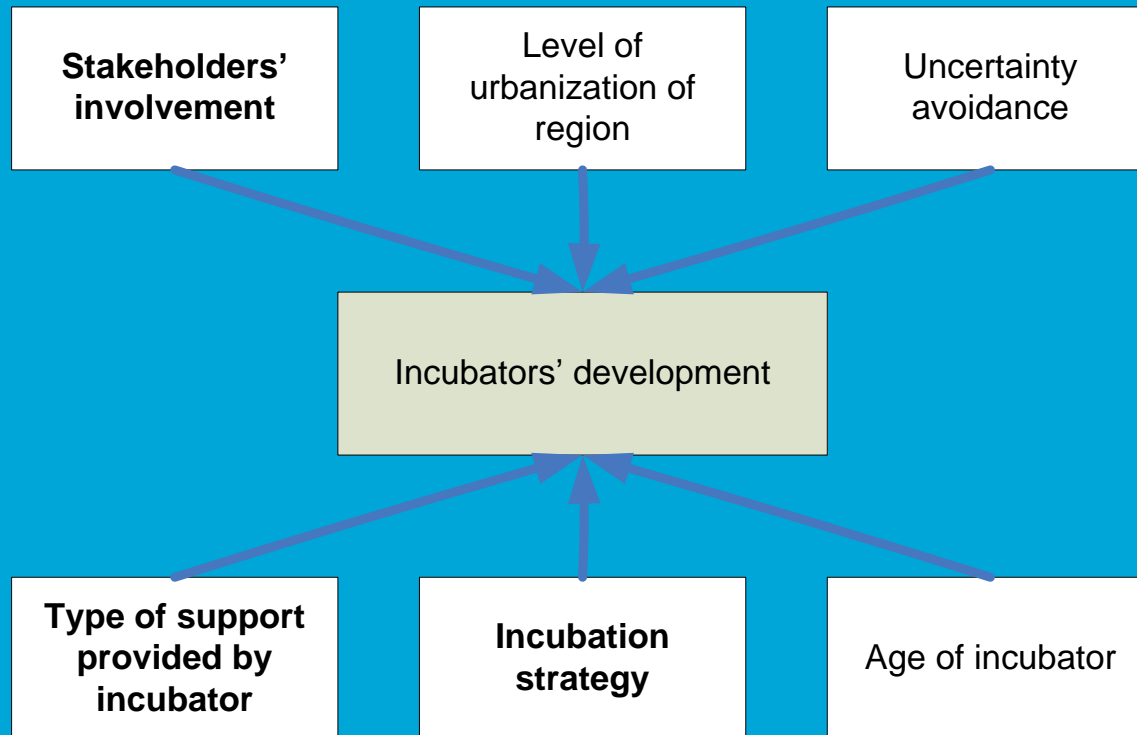
Reasons for universities and local/regional governments to foster spin-offs (Shane , 2004):

- Creation of local high-tech economic development
- Creation of employment (skilled labor) but also indirect labor market effects
- Attraction of private investment in university technologies
- Creation of a breeding ground for young talent
- Improvement of university image (social responsibility)
- Etc.

Simplified Model of Incubation Process



Determinant Factors of Incubators' Development



Variables

Independent variables: regional external factors

C1 : Stakeholders' involvement

C2 : Level of urbanization of region

C3 : Uncertainty avoidance

Independent variables: incubator internal factors

C4 : Type of support provided by incubator

C5 : Incubation strategy

C6 : Age of incubator

Dependent variable: performance indicator

D : Average annual growth of entrants of incubator

Rough Set Analysis

- Aims to disentangle causal relations
- Uses an information table: a case-based matrix containing scores of the dependent and independent variables
- Identifies under which conditions certain features (or attributes) of the independent variables are necessary to 'explain' a feature of the dependent variable
- Presents the results as deterministic rules of an 'if... then...' character (so-called decision rules)
- Is based on a computer software named Rough Set Data Explorer (ROSE).

Strength of Rough Set Analysis

- Non-parametric (no statistical requirements)
- Enables the transformation of an imprecise or incomplete collection of data (quantitative and qualitative) into structured knowledge
- Matches with a small sample and qualitative data
- As a result: an integrated review of findings that is more objective and exact than a narrative review

Research Design

- Selection of 40 incubators across the developed world
- Specific requirements
 - Technology incubators
 - Particular characteristics in one (or more) of the six determinant factors
 - One time frame (1998-2002)
- Data sources: paper journals, conference proceedings, annual reports, websites.

Frequency of the Strongest Rules (Combinations of Attributes)

Strongest rules	Frequency in 10 samples	Strong growth	Weak growth	
C1 & C2	60.0 (6/10)	3	3	X
C4 & C5	40.0 (4/10)	2	2	
C1 & C5	30.0 (3/10)	1	2	
C1 & C6	20.0 (2/10)	0	2	
C2 & C5	20.0 (2/20)	2	0	

C1 : Stakeholders' involvement, C2 : Level of urbanization, C3 : Uncertainty avoidance, C4 : Types of support provided by incubator, C5 : Incubation strategy, C6 : Age of incubator.

Frequency of Condition Attributes in Strongest Rules

Condition attributes		Weak growth	Strong growth
C1	Stakeholders involvement	43.0 (3/7)	60.0 (3/5)
C2	Level of urbanization	29.0 (2/7)	60.0 (3/5)
C3	Uncertainty avoidance attitude	43.0 (3/7)	20.0 (1/5)
C4	Types of support provided by incubator	57.0 (4/7)	0
C5	Incubation strategy	43.0 (3/7)	40.0 (2/5)
C6	Age of incubator	14.0 (1/7)	20.0 (1/5)

Summary of results

- The more stakeholders involved, the more often a dynamic incubator development.

Apparently, incubators that follow the modern Triple Helix model, being placed in a web of different networking organizations besides the university, tend to be more vital and dynamic.

- The strongest explanation for growth is given by the combination of multiple stakeholder involvement and regions facing a low level of urbanization.

Summary of results (2)

- Incubators that employ a profit-focused incubation strategy grow more actively than those merely dealing with research commercialization.

Apparently, incubators that introduce more commercial principles and open doors to entrants from outside, tend to develop more dynamically, thus supporting the modern Triple Helix Model.

Remaining Study on Incubated Spin-offs

Selection of spin-offs in a contrasting environment:

Delft (NL) : highly urbanized, single stakeholder involvement (at start of study 2004)

Trondheim (Norge): weakly urbanized (single, isolated city), multiple stakeholder involvement

Economic structure of city/region is similar due to large share of knowledge-based activity and attitude towards new entrepreneurship is similar (GEM, 2006).

University Spin-off Firms (USO's)

A particular type of spin-off firms, created for the purpose of commercially exploiting knowledge, technology or research results developed within a university (Pirnay et al., 2003).

Aim of the Study

To explore whether social networks are different (in terms of diversity) and play a different role in growth of university spin-offs.

Social Network Theory

Benefits for growth are connected with:

- Tight or loose networks (not conclusive).
- Strong or weak networks (not conclusive).
- Heterogeneous partners (conclusive).

- External orientation versus a local orientation (not conclusive).

Much of the ideas behind are related to the **level of diversity** of the knowledge that flows through the networks.

Approach

- Comparative analysis of the social network profile of spin-offs in Delft and in Trondheim
- Estimation of a regression model of growth including the social network profile for Delft and for Trondheim separately.

Variables used

Age (control variable)

Set 2: Strategy/resources/capabilities (risk-taking profile of strategy/resource deficiency, network capability, support received)

Set 3: Network profile (tightness, strength, heterogeneity, external orientation)

Characteristics of the Empirical Study

- Sample: USOs established in 1996-2005 (survived in 2005) in Delft and Trondheim
- Estimated coverage of population of 70% (based on informal statistical sources, like incubator lists, lists kept at university, etc.)
- Data collection: in-depth interviews; number of valid cases: 100 (59 in Delft and 41 in Trondheim).

Social Networks

- Networks of “important” partners that provide knowledge and information on survival/growth and business matter.
- These connect initially through social relationships while covering business matter later on, or arise later on as business networks including a large social (informal) component.

Independent variables dealing with social networks (ego-networks)(1)

- *Tightness (density)*: indicator measured as the quotient of the total number of ties of the network relation and the total number of partners per spin-off. A high value indicates relatively tight (dense) networks.
- *Strength of relationships*: a composite indicator based on scores on three aspects (frequency of interaction, duration of relationship, and founders' evaluation of quality of the relationship, as suggested by Burt, 1994). A high value indicates a relatively strong relationship.

Independent variables dealing with social networks (ego-networks)(2)

- *Heterogeneity in partners background*: composite variable derived from the proportion of heterogeneous partners among all partners (six social backgrounds). A high value indicates a relatively high level of heterogeneity.
- *External orientation*: quotient of the number of external (non-local) partners (> 30 minutes car driving) and number of local partners (shorter travel time), given a maximum of five partners. A high value indicates a relatively strong external orientation.

Growth of Spin-offs in Delft and Trondheim

A similar pattern of employment growth (1996-2005):

- almost 60% faces a small growth or no growth (1 fte or less per year)
- A slightly higher share of quickly growers in Trondheim.

An slightly higher average annual growth in Trondheim (0.90 fte versus 0.87 fte in Delft)

Social Networks in Delft and Trondheim

	TU Delft		NTNU Trondheim		Mann-Whitney or Chi ² test
	Mean	SD	Mean	SD	
<i>Social characteristics</i>					
Tightness (network)	0.51	0.30	0.67	0.31	-2.50*
Strength (relationships)	2.29	0.33	1.92	0.38	5.08**
Heterogeneity (partners)	0.49	0.16	0.48	0.19	0.39
<i>Spatial characteristics</i>					
External (non-local) orientation	-0.21	0.55	-0.47	0.39	-2.72**

Interpretation

In Delft social networks tend to be (relative to Trondheim):

- more loose (more diversity in knowledge)
- stronger (less diversity in knowledge)
- equally heterogeneous
- a stronger external orientation ... (more diversity)

Thus, the slower growth of the Delft incubator and spin-offs goes along with relatively diversified knowledge flows (contradictory). Reason to estimate the influence of network profile on growth!!

	TU Delft	NTNU
Age	0.11 (0.14)	-0.01 (0.09)
Located in Delft (dummy)		
<i>Resources/capabilities/strategy</i>		
Risk profile of strategy (dummy)	-0.02 (0.09)	0.14 (0.07)
Capability level (dummy)	0.07 (0.09)	0.29**(0.08)
Resource deficiency	-0.14*(0.16)	-0.19* (0.16)
Richness of incubation support	0.09 (0.05)	0.24* (0.05)
<i>Social network profile</i>		
Tightness	-0.18* (0.12)	-0.08 (0.13)
Strength	-0.31**(0.24)	0.20* (0.27)
Heterogeneity of partners	0.19* (0.25)	0.28**(0.20)
External orientation	0.20* (0.07)	0.01 (0.13)
N	59	41
F	28.54**	33.79**
R ²	0.77	0.84
Root MSE	0.21	0.19

Results on networks

Strength of relationships: strength tends to hamper growth in Delft but tends to enhance growth in Trondheim.

Spatial orientation: employing more external relationships tends to enhance growth in Delft, but not in Trondheim (not significant)

Heterogeneity in the social background of partners tends to work the same in Delft and Trondheim: a stronger heterogeneity tends to enhance growth

Results on strategy/resources/capabilities

Networks seem to have a smaller impact on growth in Trondheim compared to Delft (lower level of significance of beta-coefficients).

There seems to be a stronger influence of own capabilities and of support on growth in Trondheim. This may point to stronger efforts in Trondheim to build entrepreneurship through internal capacities (maybe as a compensation for lower diversity in the urban environment and in the networks).

Conclusions on Trends

Diversity in networks connected with social background of partners matters under different urban conditions and different stakeholder involvement.

In Delft – in a highly urbanized region - the networks are such that they capture diversity (except for strength of relations); in Trondheim the networks are more local and more closed.

The slightly stronger growth of spin-offs in Trondheim seems to be related to stronger entrepreneurial qualities (capabilities and use of better support).

Limitations of the Study and Future Research

- Limitation of the study to two cities and 100 spin-off firms: in future research including more cities we can test our results more rigorously.
- The type of knowledge that flows through the networks has remained beyond the study.
- Mixed networks have remained beyond the study.



Thank you