

Bringing Cambridge to Consett? Building university-centred entrepreneurial networks in peripheral regions

Case Study Report 2: Twente, the Netherlands.

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Table of Contents

1	INTRODUCTION.....	1
2	SPIN-OUTS IN THE KNOWLEDGE ECONOMY: BUILDING A DENSER INNOVATION AND ENTREPRENEURSHIP ENVIRONMENT	4
2.1	INTRODUCTION.....	4
2.2	SPIN-OFFS OUTSIDE CORE KNOWLEDGE AGGLOMERATIONS	5
2.3	TOWARDS A MODEL FOR USOs CONTRIBUTION TO REGIONAL PERIPHERAL DEVELOPMENT ...	8
2.4	OPENING THE BLACK BOX OF THE REGIONAL TEN: EXPLORING THE SUB-SYSTEMS	11
3	METHODOLOGY	14
4	THE REGION OF TWENTE: TOWARDS A SECOND R&D HOTSPOT	19
4.1	INTRODUCTION AND HISTORICAL BACKGROUND TO THE REGION OF TWENTE (1574-1976) .	20
4.1.1	<i>Twente before the Kingdom of the Netherlands.....</i>	<i>21</i>
4.1.2	<i>The new Twente in the 19th century</i>	<i>24</i>
4.1.3	<i>Innovation vs. stagnation: building strong regional networks</i>	<i>26</i>
4.1.4	<i>Rise and fall: the regional co-operation paradox.....</i>	<i>28</i>
4.2	THE ‘TWENTE WONDER’: REPOSITIONING THE REGION IN A NATIONAL SPACE-ECONOMY ...	32
4.2.1	<i>Regional development in the 1980s: building a regional knowledge economy</i>	<i>33</i>
4.2.2	<i>The 1990s: growth, hyperbole and burst.</i>	<i>34</i>
4.3	A NEW PERSPECTIVE FOR TWENTE: THE REGION INTO THE 21ST CENTURY	38
4.3.1	<i>The national policy framework: the new innovation agenda.....</i>	<i>38</i>
4.3.2	<i>Reinventing Twente through the national policy framework?</i>	<i>41</i>
5	THE HISTORY OF THE UNIVERSITY OF TWENTE.....	44
5.1	RECONSTRUCTION, BEAUTY PARADES AND MINISTER CALS (1945-1961).....	46
5.1.1	<i>The regional response to the post-war expansion of HE.....</i>	<i>49</i>
5.1.2	<i>From a university for the East to “Technische Hogeschool Twente”</i>	<i>51</i>
5.2	HET EXPERIMENT IN DE BOS: THE EARLY YEARS (1961-1975).....	54
5.2.1	<i>The formal fabric of the university; the experiment in the forest.....</i>	<i>54</i>
5.2.2	<i>Expansion of the university: new faculties and glass barriers</i>	<i>56</i>
5.2.3	<i>More general changes and the end of the experiment</i>	<i>57</i>
5.3	A NEW LEASE OF LIFE: GOVERNANCE REFORM, AND THE ENTREPRENEURIAL UNIVERSITY (1975-1988)	58
5.3.1	<i>Reinventing UT as the entrepreneurial university</i>	<i>59</i>
5.3.2	<i>Exploiting the new governance structure: the role of Harry van den Kroonenburg</i>	<i>61</i>
5.3.3	<i>Towards a “Twente model” for regional engagement</i>	<i>63</i>
5.4	FROM AN ENTREPRENEURIAL UNIVERSITY TO THE UNIVERSITY OF ENTREPRENEURS (1989-2004)	65
5.4.1	<i>From Harry van den Kroonenberg to Frits Schutte</i>	<i>66</i>

5.4.2	<i>The evolving regional development environment: maintaining regional leadership?....</i>	68
5.4.3	<i>The regional engagement infrastructure in UT, 2004</i>	71
6	UNIVERSITY SPIN-OUTS BUILDING A TERRITORIAL KNOWLEDGE POOL	74
6.1	THE KEY ACTORS IN THE KNOWLEDGE POOL	74
6.1.1	<i>The managerial and professional technology transfer staff</i>	75
6.1.2	<i>Professors and permanent entrepreneurial staff</i>	78
6.1.3	<i>Temporary entrepreneurial staff (TOP-pers)</i>	80
6.1.4	<i>Third party businesses</i>	82
6.1.5	<i>Business support agencies</i>	84
6.2	PROCESSES OF PARTICIPATION IN THE KNOWLEDGE POOL	85
6.2.1	<i>University management participation in the knowledge pool.....</i>	85
6.2.2	<i>University academic participation in the knowledge pool.....</i>	88
6.2.3	<i>Spin off participation in the knowledge pool.....</i>	91
6.2.4	<i>Other participation in the knowledge pool.....</i>	95
6.3	MECHANISMS FOR THE DEEPENING AND SUSTAINABILITY OF THE REGIONAL KNOWLEDGE POOL	97
6.3.1	<i>The formal spin-off process: “many hands building heterogeneous networks”</i>	98
6.3.2	<i>Regional stickiness: ensuring sustainability in a subdued regional environment</i>	101
6.3.3	<i>The production of a hard infrastructure for promoting innovation.....</i>	104
6.4	PROBLEMS AND ISSUES IN THE CREATION OF TERRITORIAL INNOVATION ASSETS	107
6.4.1	<i>Problems in the creation of territorial assets through spin outs</i>	107
6.4.2	<i>Solutions and learning activities in the Twente techno economic network.....</i>	111
7	UNIVERSITY SPIN-OUTS OPENING UP THE UNIVERSITY	115
7.1	DEFINING THE COMMERCIALISATION COMMUNITY OF PRACTISE AT THE UNIVERSITY OF TWENTE	116
7.1.1	<i>Changing the old university culture: realising the entrepreneurial university.....</i>	118
7.1.2	<i>Configuring a new environment and creating new activities.....</i>	122
7.1.3	<i>Reconceptualising the institutional configuration: the entrepreneurial university as an entrepreneurial field?</i>	126
7.2	THE TOP PROGRAMME IN A HISTORICAL PERSPECTIVE: FROM CORE TO PERIPHERY (AND BACK AGAIN?)	129
7.2.1	<i>The pioneers: reacting to crisis and confluence</i>	130
7.2.2	<i>The user community: TOP-pers experience of participation in the scheme</i>	134
7.2.3	<i>The view from the core: the current key decision-makers</i>	137
7.2.4	<i>Neither in nor out: the work of the knowledge transfer professionals.....</i>	139
7.3	OPENING THE UNIVERSITY TO REGIONAL ENTREPRENEURS?	144
7.3.1	<i>Introduction: the shifting entrepreneurial culture of UT.....</i>	144
7.3.2	<i>The TOP story: towards a synthetic perspective</i>	145
7.3.3	<i>Reconceptualising the technology transfer activities and the cultural changes</i>	148

7.3.4	<i>UT fixing global assets for regional entrepreneurship?</i>	149
7.4	CONCLUDING DISCUSSION.....	152
8	UNIVERSITY SPIN OUTS AS ACTIVE TECHNOLOGY TRANSFER.....	155
8.1	INTRODUCTION.....	156
8.2	FORMAL TECHNOLOGY TRANSFER BETWEEN SPIN-OFFS AND OTHER LOCAL FIRMS	159
8.2.1	<i>Direct technology transfer from USOs into local companies</i>	161
8.2.2	<i>Collaborative interaction involving university spin offs</i>	165
8.2.3	<i>Other technology transfer between USOs and regional innovators</i>	168
8.2.4	<i>Spin-offs as active agents for collaborative technology transfer</i>	172
8.3	CREATING COLLABORATIVE INSTITUTIONS AND ACTIVITIES IN TWENTE	174
8.3.1	<i>Direct involvement in establishing new entrepreneurial networks</i>	176
8.3.2	<i>Contributing to institutional thickness: USOs, academic entrepreneurs and the knowledge economy.</i>	181
8.3.3	<i>Concluding discussion</i>	186
8.4	USOs AS INITIATORS OF NEW REGIONAL SEQUENCES OF INNOVATION.....	188
8.4.1	<i>The role of spin-offs in upgrading existing industry</i>	189
8.4.2	<i>Producing the infrastructure for a new innovation sequence</i>	191
8.4.3	<i>UT's spin-offs and the regional 'style' of innovation in Twente</i>	193
9	UNIVERSITY SPIN OUTS AS PARTNERS IN IMPROVING EXTERNAL POLITICAL RELATIONS	195
9.1	INTRODUCTION.....	196
9.2	UNIVERSITY SPIN-OUTS IN BRIDGING THE CITY-REGIONAL GOVERNANCE GAP.....	200
9.2.1	<i>The emergence of the 'Kennispark Twente' agenda</i>	201
9.2.2	<i>Kennispark: national priority or empty concept</i>	206
9.2.3	<i>Kennispark: national priority or empty concept</i>	209
9.3	USOs REPOSITIONING THE REGION IN THE NATIONAL SCIENCE ECONOMY	210
9.3.1	<i>UT as a successful and innovative experimental institute?</i>	211
9.3.2	<i>MESA+ as a successful knowledge institution</i>	217
9.3.3	<i>The hidden national scientific excellence perspective</i>	219
9.4	USOs, TWENTE AND THE BALKENENDE INNOVATION AGENDA	222
10	CONCLUDING DISCUSSION	226
11	BIBLIOGRAPHY	231

Table of Figures

FIGURE 1 A MODEL OF THE RELATIONSHIPS SUPPORTING THE TERRITORIAL KNOWLEDGE POOL	11
FIGURE 2 A MAP OF THE NETHERLANDS	48
FIGURE 3 BRANDING: “UNIVERSITY OF TWENTE: THE ENTREPRENEURIAL UNIVERSITY”	76
FIGURE 4 THE DATE OF FORMATION OF THE TOP COMPANIES INTERVIEWED	82
FIGURE 5 THE USOs PRE-INCUBATED WITHIN THE MEMS RESEARCH GROUP, 1994-2004	89
FIGURE 6 THROUGH THE YEARS, 3T BV HAS GROWN EN (SIC) TWO NEW PARTNERS ORIGINATED FROM 3T BV	94
FIGURE 7 THE STABILITY AND CONTINUITY PROVIDED BY THE A GROUP OF SPIN-OUT COMPANIES FROM MESA+ AND CMET.....	95
FIGURE 8 THE BUILD-UP AND EMERGENCE OF NEW GROWTH NODES IN TWENTE 1992-2004.....	102
FIGURE 9 THE REPRESENTATION OF THE HISTORY OF C2V FROM ITS WEBSITE.....	103
FIGURE 10 A VISUALISATION OF THE RELATIONSHIPS BETWEEN THE BIOMEDICAL TECHNOLOGY INSTITUTE (BMTI) AND REGIONAL/ WIDER PARTNERS	104
FIGURE 11 A SCHEMATIC REPRESENTATION OF REGIONAL ENGAGEMENT ACTIVITY AT UNIVERSITY OF TWENTE, AUTUMN 2004.....	113
FIGURE 12 HOW NIKOS REPRESENTS ITSELF AS AN INDEPENDENT NEXUS OF COMPLEMENTARY NETWORKS SPANNING THE UNIVERSITY BOUNDARY	125
FIGURE 13 THE BUILDING UP OF A NEW ‘NODE’ WITHIN THE UNIVERSITY FIELD –MESA+	128
FIGURE 14 THE REPRESENTATION OF SPIN-OFF COMPANIES (AND TOP COMPANIES) AS KEY ELEMENTS OF THE MESA+ FAMILY AND AS AN ‘HONOUR’ FOR MESA+	140
FIGURE 15 THE PLACING OF TOP COMPANIES IN THE CTIT ANNUAL REPORT, 2003	141
<i>FIGURE 16 THE ANNOUNCEMENT OF THE TECHNOLOGY EXCHANGE CELL ON THE THALES WEBSITE</i>	<i>171</i>
FIGURE 17 STAATSSECRETARESSE KARIEN VAN GENNIP AT THE LAUNCH OF KENNISPARK WITH CEES EIJKEL (EXTREME LEFT), RONNIE VAN ‘T OEVER, AND JEROEN WISSINK (RIGHT).	205
TABLE 1 THE INTERVIEWS UNDERTAKEN DURING THE RESEARCH PERIOD BY CATEGORY	17
TABLE 2 THE DECLINE OF THE TWENTE TEXTILES INDUSTRY 1955-1985, EMPLOYEE NUMBERS	32
TABLE 3 SOURCE OF THE ENTREPRENEURS BEHIND THE TOP SCHEMES	81
TABLE 4 PARTICIPATION BY THE UNIVERSITY IN TOP COMPANIES.....	86
TABLE 5 THE RATE OF FORMATION OF TOP COMPANIES BY RECTOR MAGNIFICUS.....	111
TABLE 6 THE TKT BOARD MEMBERS WHO ARE ALSO TOP-PERS	143
TABLE 7 SPENDING IN “RESEARCH INSTITUTES” 2003, BY DUTCH CITY, ALL RESEARCH INSTITUTES	198
TABLE 8 DUTCH UNIVERSITY SECTOR INCOME, 2002 OR NEAREST AVAILABLE YEAR, M€.....	199
TABLE 9 THE COMMERCIALISATION INDICATORS FOR NANONED’ S 3 LEAD INSTITUTES, 2004	219
TABLE 10 DUTCH UNIVERSITY THIRD STREAM INCOME, 2002 OR NEAREST AVAILABLE YEAR, M€.....	220

1 Introduction

Innovation is currently a vital part of the contemporary production process, and is increasingly seen as integral to economic competitiveness and success (Porter, 1998). With increasing globalisation of product markets, alongside fragmentation of consumer demands, the ability to differentiate products through innovation, and flexibly respond to new market demands is central to the competitive success of modern businesses. Although there is considerable debate over the broader implications of these economic changes, there is a consensus that “the major source of added value is knowledge” (Stehr, 1994, p. 62), leading to a general acceptance of the idea of a ‘knowledge economy’ in which knowledge as much as capital and labour drive productivity, wealth and ultimately, standards of living.

One issue which arises in the knowledge economy is identifying how less successful regions can participate in this new knowledge economy; these less successful regions face both an absolute shortage of knowledge capital, and barriers to building that capital, because of the importance of agglomeration and critical mass in knowledge work. Innovation potential and capacity is unevenly distributed over space, and this regional dimension broadly matches the regional distribution of economic problems, meaning that poor regions tend to be characterised by low levels of knowledge capital. Knowledge capital is distinct from other forms of capital in that there are no diseconomies of scale (Romer, 1994; Solow, 1994), which means that less successful regions are at a competitive disadvantage to build the necessary critical mass of knowledge activities which can create positive overspills for firms located there. There has been much interest in recent years in trying to promote knowledge activity in less successful regions, because globalisation/ internationalisation has meant that these regions no longer have the option to compete on low costs in the face of extreme cost competition from newly industrialised areas, in Eastern Europe, Latin America and the Far East (Milward, 2003).

This seems to pose a real problem for identifying the place of less successful regions in the new knowledge economy, where they are at a competitive disadvantage to both knowledge rich and low cost locations. A consensus has emerged that the only rational course for these places to pursue is the ‘high road’ approach, to attempt knowledge accumulation and competition. However, they face two barriers to

building a critical mass of knowledge capital, firstly that their regional environments discourage innovation by offering low levels of return to knowledge investments, and secondly, through the outflow of knowledge capital that has been witnessed from peripheral regions in recent years. In this case study paper, we ask the question “how can university spin-off companies contribute to the accumulation of knowledge capital as an initiator for knowledge-based region development in the periphery?”.

In this working paper, we explore whether USOs do materially improve the environment for other HTSFs through three mechanisms, by opening up the university to outside influences, by actively transferring technology into other firms, and by helping to improve the ‘thickness’ of the regional innovation support infrastructure. Our model is that USOs help with the creation of a ‘territorial knowledge pool’ that firms can draw upon in their own innovation processes, and helps them to achieve more in innovation than would otherwise be possible. We focus on three mechanisms by which USOs support the creation and maintenance of a territorial knowledge pool. From this, we reflect on whether this improvement in regional economic environment is sufficient in magnitude to be considered an economic development.

In this report, we focus on one particular such peripheral region; we use the concept of ‘peripherality’ to refer to a place within a broader political-economy, that is to say a region which is dominated by externally controlled activities, rather than geographical or cartographic remoteness. The region we focus on is the Twente, in the east of the Netherlands. The Twente region has been undergoing half a century of decline in its dominant industry, textiles, and restructuring has created severe economic problems for the region. Although the university was created relatively recently, it established close links with industry from its inception, and from the 1970s, has been targeting increasing its regional impact. The University at Twente is globally renowned for its record of spinning off companies in the last 20 years, and has created probably the most famous formal spin-off support programme, the “TOP” system (*qv*).

This research is part of a larger comparative study also involving the region of Newcastle in the North East England, another peripheral region with an equally regionally engaged university. That report has already been published as the first working paper in this series. The two case studies set out the empirical evidence base from the research project, which will be elaborated in a further series of working

papers in 2005-07. The first of these working papers is currently under preparation, and provides a basic comparative overview of the two case study areas. An early version of this working paper was presented at the 5th Triple Helix Conference, 18th-21st May 2005 (Benneworth *et al.*, 2005) and it is anticipated that the comparative paper will be ready by early autumn 2005. A policy brief is also under preparation, and will be published in *Regions*, the newsletter of the Regional Studies Association in October 2005.

This report sets out research undertaken in the Twente, in the East of the Netherlands, from July to September 2004; this research was funded by the UK's Economic and Social Research Council, under grant RES-000-22-0659, and we are extremely grateful for ESRC for their support in this regard. The authors also gratefully acknowledge the support of the Dutch Institute for Knowledge Intensive Entrepreneurship (NIKOS) who hosted the researcher (Paul Benneworth) during his period of fieldwork in the Netherlands. The authors also thank the Department of Geography at the Radboud University Nijmegen granting Paul a research fellowship from October to December 2004 which enabled additional work to be undertaken on the Twente case study. The authors are also grateful to Dr. Gert-Jan Hospers, of the Faculty of Public Administration, University of Twente, for his help in developing a more historical perspective to the University of Twente, and in navigating the minefield of regional development agencies, strategies and partnerships in the region. The authors are also exceptionally grateful to those interviewees who gave their time and spoke most candidly, and were essential in allowing this report to be written. However, the authors have prepared this in a professional capacity, do not speak on behalf of their respective institutions, remain responsible for any errors, omissions and the interpretations presented in this report.

2 Spin-outs in the knowledge economy: building a denser innovation and entrepreneurship environment¹

2.1 Introduction

Although it has long been recognised that human capital is critical to economic development, central to notions such as the Schumpeterian entrepreneur (Schumpeter, 1941), the notion that knowledge capital differs from other factors of production has emerged only comparatively recently. At a macro-economic scale, Romer (1994) and Solow (1994) both identified that knowledge, at least in the sense of intangible forms of investment, could account for potentially half the productivity growth in the long post-war growth period. Temple (1998) terms the theories subsequently developed as the “new growth theory”, and notes that it is predicated on the notion that productivity growth is driven by investments in knowledge capital which differs from other forms of capital in not suffering from diseconomies of scale. Consequently, further investment in knowledge always brings marginal improvements in productivity. Coupled with increasingly globalised production systems where advanced producer economies no longer have the capability to compete purely on cost, this produces a neat conceptual framework for the idea of the ‘knowledge economy’ as one driven by investments in innovation, research and design activities.

Consequently, there is a clear geographical dimension to the new economy: knowledge capital stocks are extremely unevenly distributed, with competitiveness, productivity and ultimately wealth dependent on those unevenly distributed stocks. This unevenness seems to be a barrier for less successful places to develop economically. Consequently, knowledge production has become increasingly centralised and we have seen the emergence in recent years of a knowledge production hierarchy. This creates significant problems for those less successful places which lie at the bottom of these global ‘command-and-control’ networks

¹ This chapter summarises the conceptual framework for the research project, and has been published in a slightly extended form as Benneworth & Charles (2005). This chapter was written in conjunction with Professor David Charles

(Yeung *et al.*, 2002). The macro-economic knowledge economies, or the new growth theory, emerged at a time when there was also interest in a number of very successful regions, such as Emilia-Romagna who appeared to have succeeded precisely because they had territorial production systems well-organised to deal with a competitive global environment.

Although many argue that the case of the Italian industrial districts are so specific to their context that more general lessons cannot be derived from them, a number of case studies were developed in other regions which began to support the theorisation of those successful places in terms removed from their more general context. As Hassink & Lagendijk argued (2001), theories were developed in ways that allowed them to be easily transferred between places, without necessarily considering whether the contextual factors were sufficiently similar between those places to justify that transfer. Massey *et al.* (1992) noted that this led to perverse policy outcomes, where knowledge economy economic development policies brought the greatest benefits to those most successful regions. More generally, this all comes together to suggest that as a consequence of this, less successful regions have difficulties in ‘finding a place’ in this new knowledge economy. They have difficulties in accumulating sufficient knowledge capital to create economies of scale which offer a sufficiently favourable environment for regional economic development, and appear to suffer from perpetually being ‘held’ in subaltern positions in the knowledge production hierarchy. This raises a problem in understanding how knowledge activities can promote economic development in less successful places. To explore this more general conceptual issue, we focus on one such new economy activity, university spin-outs, which have been an important part of the stories that people tell about this new economy.

2.2 Spin-offs outside core knowledge agglomerations

In this research report, we focus on one element of the knowledge economy, University Spin-Offs (USOs). By USOs, we begin from Pirnay *et al.*’s (2003) generic definition as “[n]ew firms created to exploit commercially some knowledge, technology or research results developed within a university” (p. 356). USOs therefore embody knowledge capital in a relatively pure form, and there has been increasing interest in policy-makers in promoting spin-off companies to generate

stocks of knowledge capital in less successful regions. The policy promotion of USOs has certainly produced results in terms of numbers of new firms created (AUTM, 2001; HEFCE, 2002; ARC, 2003). Association of University Technology Managers (AUTM) figures suggest that US universities created around 500 new firms in 2001 (AUTM, 2003). Other countries have also followed American practise; in 2000, 199 spin-offs were formed in the UK whilst 47 spin-offs were formed in Australia (HEFCE, 2002; ARC, 2000).

However, it has not been established that USOs are ubiquitously beneficial, and frequently valuations of USOs rely more on faith than fact. The past experience of science parks (cf. Massey et al., 1992) suggests the success of knowledge-based economic development policies are much more dependent on the underlying strength of the regional economy rather than an intrinsic quality of the policy. Given that knowledge capital has a tendency to accumulate in successful places, this suggests that USOs might have fewer benefits for less successful places than the discourse of the new economy intuitively suggests. The general problems with the knowledge economy paradigm take on a particular form with regard to spin-off companies.

Firstly, in less successful regions, where economic conditions are less prosperous, and entrepreneurial environments tend to be less munificent (Dubini, 1989), one would expect USOs to more difficult to generate, and require greater effort, government support and subsidy to produce a lesser effect. This assumes that a USO in a less successful region will be less profitable and hence less competitive/ productive than had the same resources been deployed in a more successful region which has an agglomeration of knowledge capital. Because knowledge-based firms access local networks and spill-over effects to cut the costs of innovating, in less successful environments those firms perform less well than firms which have easy and regular access to knowledge resources which exist in knowledge agglomerations. Indeed, there is much disagreement in the role and significant of USOs in the Cambridge phenomenon, between those who regard them as a by-product of an already strong R&D base against those who argue that they have become an integral part of the science base driving the economic success.

“In a developed environment there is already an entrepreneurial community with the capability to select the best projects and allocate resources to them ... In contrast, in environments with less demand for innovation, characterised by a weak

entrepreneurial community and a lack of other resources, [research institutions] may need to play a more pro-active incubation role” (Claryss et al., 2004, p. 1-2).

The second issue is that as USOs emerge in less successful regions, it would be expected that they would move away from those regions, either through direct relocation or through take-over and rationalisation by more competitive businesses in more successful places. Lycos is a famous example of a spin-off company which formed in Boston despite being a spin-off from – and partly owned by – Carnegie Mellon University in the rustbelt city of Pittsburgh. More generally, Elgen *et al.* (2004) have highlighted the fact that many university spin-outs – particularly knowledge-intensive business services (KIBS) – have a tendency to relocate to larger cities in core areas rather than making a positive contribution to the area around their parent institution. This is particularly worrisome given that these KIBS firms are seen as being an important constituent of those knowledge economies which USOs are supposed to build.

These two issues together might reduce any capacity that USOs had to improve the economic performance of less successful regions, much less to reduce the agglomeration advantages that core regions have over LFRs. The archetypal places where USOs have succeeded (e.g. Route 128, Silicon Valley, and Silicon Fen) already have agglomerations of knowledge capital; further knowledge activity adds to the concentration of knowledge, a ‘win-win’ situation. However, the economic development benefits of USOs depends on existing stocks of capital meaning that USOs in those regions benefit from the multiplier effect of the USOs. Although USOs might appear to be beneficial to less successful regions, this seems to imply what those regions really need is to begin to accumulate knowledge capital stocks to drive regional economic growth. However, this particular analysis is based on an over-socialised reading of peripheral places as lacking any kind of capacity to challenge the relationships by which they are held in their subaltern positions. In this research project, and this report, we are interested in identifying mechanisms by which regions can tangibly improve their position within a broader political-economy. Consequently, we not turn to develop a model for considering how spin-offs can make such a contribution to their regional economies.

2.3 Towards a model for USOs contribution to regional peripheral development

Deducing that there is no role for university spin-off firms in supporting economic development in less successful places is intuitively problematic, because it does seem to run counter to broad swathes of recent analyses which have demonstrated that USOs do act as drivers of economic development in ‘ordinary’ places (Asheim & Coenen, 2003). This is a fundamental tension in conceptualising the territorial economic development of less successful places, what Cooke (2004) calls the ‘scalar envelope’. The issue is the mutual irreconcilability between perspectives which focus on the apparent value of local activities and initiatives, and analyses which look at the subaltern ‘place’ of less successful regions in the global knowledge hierarchy. As Cooke notes...

“As a consequence ... economic geography tends to be dominated by (ideographic) case studies, broad (and untestable) stylised statements on what propels regional economic development, or, even less productive, high-level theory discussions that remain uncoupled to real-world experience.” (p. 8).

This idea of a scalar envelope leads directly to the main research question we explore within our research, namely

“how can university spin-offs rework political-economic relationships in ways that improve the situation of their host regions in wider knowledge-based economies”?

Our approach is rooted one step back from the political-economic model, noting that as a consequence of peripherality, less successful regions have fewer resources available for innovation, which in turn makes them less attractive places for external actors. We assume that improving the position in the political economy will take place if the regional environment becomes more attractive for external actors, which gives local actors more leverage in their relationships with external agents, which increases the stickiness of particular forms of knowledge, and also contributes to placing the region more centrally within the spatial imaginaries of policy makers allocating state resources which play a significant role in shaping regional innovation systems (Saxenian, 1999; Charles & Benneworth, 2001).

To operationalise these ideas, we consequently begin from a resource-based model to the geographies of innovation. If an innovative firm has a problem, and it does not have the internal resources to solve that problem fully, then external resources can be accessed if they are locally situated and do spill-over. Munificent environments like Cambridge have these in abundance, whilst in less successful regions, there is not ready access to these assets (Johannisson, 1993), and consequently there is a correlation between the geographies of innovation, and the geographies of economic success. A simple resource-based model of the innovation process might be that USOs work with universities and other innovative firms in creating collective innovation assets (cf. Klein Woolthuis, 1999). The heuristic model is that the environment is improved if a USO creates an asset which spills over, and that those collective innovation assets are what improve the environment. This means they create resources which other actors are able to access more easily, at a lower direct cost. Although this is a pleasing heuristic, it requires a degree of rationalisation to explain what precisely is regionalised in this process.

Muller & Zenker (2001) have developed a model of the mutual interdependence of high-technology consultancy activities which they conceptualise in terms of a co-evolution process, in which consultants and high technology firms both innovate together, but build a shared knowledge pool between them. This shared knowledge pool facilitates future collaboration, but also gives each of them an advantage in the wider KIBS process, which they can exploit in working with other firms. Wood (2002) gives examples of how these activities have been territorialised into the kinds of arrangements that Lundvall (1998) sees as being national 'styles' of innovation. Our argument is that one overspill mechanism that such a shared knowledge pool builds up between university and USO, and that other firms are able to draw on this as an asset in solving their innovation problems. Thus, although a peripheral region may lack many free-floating innovation assets, this knowledge pool – between university and USO - is available to other firms to augment their resources. This allows those firms to achieve better innovation outcomes than their internal resources alone would permit, in the absence of other external innovation resources due to their location in a peripheral, sparse innovation environment.

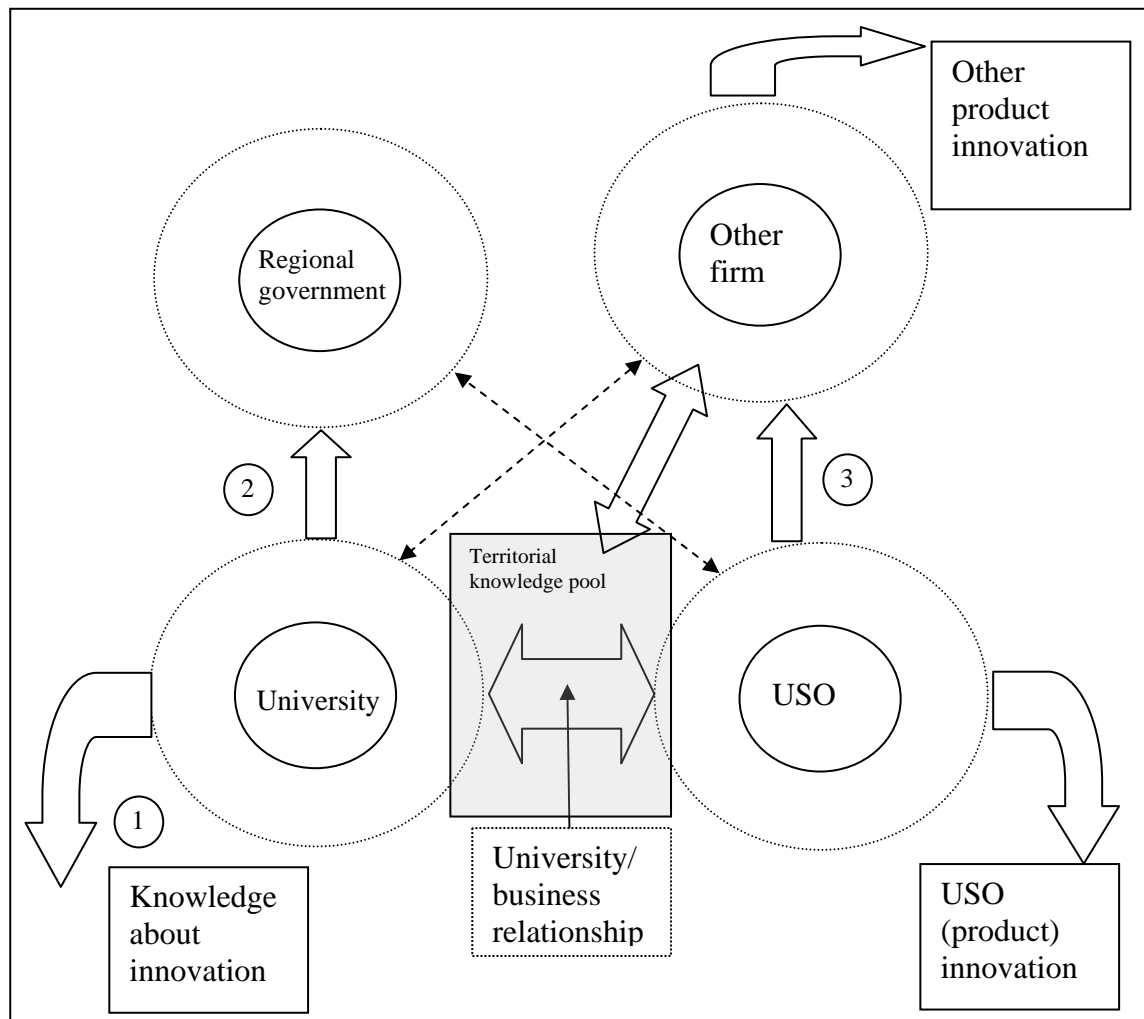
The concept is that an iterative accrual of these assets over time corresponds to an improvement in the entrepreneurial environment. Event-specific outcomes are

broadened to become territorial collective competences more open to others in that particular territory (Lawson, 1999; Maskell & Malmberg, 1999). Storper's (1995) example of the creation of a 'regional specialised labour market' is beneficial because it allows others to benefit directly from the recruitment effort originally expended, without incurring that expenditure. Fontes & Coombes' (2001) offered the notion of 'densification of the techno-economic network' (p. 84), in referring to the process of universities and firms working together to create new innovation assets. This idea of 'densification' provides a means to bridge between micro-scale activities and meso-level developments in particular regional economies.

We have elsewhere worked through this idea and highlighted three sets of key relationships which influence this collective asset creation process (Benneworth & Charles, 2005). Central to the model is the notion of a 'regional knowledge pool' which exists between universities and their spin-offs (cf. Muller & Zenker, 2001). However, the regional knowledge pool – as a technological transfer between universities and firms – is sustained by various other systems of relationships that support and regulate access to the pool. We have developed a model which endeavours to show all these relationships, how the knowledge pool between university and USO is sustained by other relationships. The model is shown in figure 1 below, and in particular, we highlight three important networks and sets of relationships which have to be explored in order to make sense of the regional impact of USOs:-

- Spinning off firms can make universities more open to other commercial collaboration activity, helping SMEs to access their knowledge resources,
- USOs can interact with other HTSFs and partnerships and helping them solve their innovation problems, and
- USOs can work with policy-makers and development agencies to help them to be better at working with HTSFs.

Figure 1 A model of the relationships involved in supporting the territorial knowledge pool



Source: Benneworth & Charles (2004) after Muller & Zenker (2001)

2.4 Opening the black box of the regional TEN: exploring the sub-systems

‘Densification’ is not a singular process, and it possible to think of a number of different dimensions along which network densification can vary. Within any network, some densification involves actions on nodes, whilst some may involve actions on linkages. The second variant in densification is whether the densification involves creating new elements (nodes or linkages) or increasing the strength of those that already exist. Within a territorial entrepreneurial network, for example, a new joint venture represents a new node, whilst a new profit centre within an existing firm strengthens the existing node. Likewise, in terms of linkages, a novel collaboration

represents a new linkage, whilst changing the collaboration with a partner from product supply to co-development is a strengthening of that linkage. This 2x2 scheme ({node, linkage}; {more, stronger}) provides a means to explore the extent of densification activity involved in particular entrepreneurial networks.

The framework we use is that the central asset is the territorial knowledge pool in which experiences and relationships build up, and become habituated into routines, and cultures, which are more general innovation resources as is seen in entrepreneurial cultures elsewhere. This can be conceived of as a knowledge pool into which other local actors can dip to supplement their internal resources. We assume that this knowledge pool is territorial in the sense of Lorenz (1999) because although the assets in the knowledge pool can be accessed by those outside the region, they are dependent on relationships between people. Consequently, they embody significant elements of what Lundvall calls “know-who” (1992), the least codifiable and stickiest form of knowledge. The territorial knowledge pool is held in place by further regional specificities, contexts and relationships which contribute to that stickiness, as outlined in figure 1 above. We highlight in particular three sets of relationships, the university’s internal culture of commercialisation (which tie the assets to university-based actors), with relationships with other firms (which further anchor the knowledge in the region) and with policy-makers that regulate the policy-environment and shape the other, complementary territorial innovation assets available.

The first network and set of relationships, (1) is largely internal to the university, and that is the formation of the commercialisation activity within the university. To answer the main research question, it is necessary to explore how these changes in policies affect the overall knowledge pool; whilst it has been assumed that professionalisation of the technology transfer community is largely beneficial, when the impacts on the knowledge pool are considered, professionalisation can be a problem as much as a benefit. Professionalisation seeks to ensure that firms do not rent-seek on university knowledge, but the difference is that knowledge can have greatly differing value to universities and to firms. In particular, policies which stop MNCs free riding on university research programmes also have the potential to stop low-selectivity entrepreneurs dipping into the tacit knowledge pool at universities and exploiting discrete bits of know-how. This is an intriguing tension for universities to

manage because even at a heavy discount, the potential future value of bits of unknown technology are very high, whilst indeterminacy makes their value to SMEs very low. How universities manage this relationship will clearly play a significant role on the openness of the university to local businesses, and hence the accessibility of the regional knowledge pool

The second relationship (2) is between the university and the business support organisations. To some extent, this relationship is traditionally regarded as unproblematic, that universities transfer their technologies in ways that are coherent with other partners' regional development strategies. In this perspective, the university has the capacity to be a much more active partner in regional development, and to improve the regional innovation environment. However, when universities start producing USOs (and those USOs are the result of university strategies) then this creates a new market for business support services in which universities have interests because those services contribute to equity growth in their companies and also create a beneficial environment in which other companies can form. Again, the model suggests that the key research interest in these relationships is how they sustain the knowledge pool, encourage SMEs to access it and ensure that there is a high level of exchange between actors. However, as Cooke found, it is not enough just to create new regional organisations, these organisations themselves have to produce tangible outcomes and sustain themselves productively.

The third relationship (3) is between USOs and other businesses, supporting access to and participation in the knowledge pool. Part of this activity might be thought of as clustering, working collaboratively to solve innovation projects, and more generally from benefiting from proximity. USOs may play a role in shaping the regional trajectory of a place, and potentially its local style of innovation, if they come to play a big role in working with other firms. Wicksteed's (2000) and Lawton Smith et al.'s family trees from spin-off firms in Cambridge and Oxford respectively are interesting illustrations of how this can happen in more successful regions. Equally, deeper webs of relationships between USOs, their spin-offs and other firms may improve the innovation environment in those places.

3 Methodology²

In this study, we are interested in the evolution of four sub-networks within the regional innovation environment, in which we have identified actors in four main fields. The thesis is that the experience of spinning off companies, and the development of regional specific experience in spin-off commercialisation has positively co-evolved with these three networks, namely the connection of the university to other businesses, the connection of university to other innovation providers and the impact of USOs on other firms innovation. This question is one of a family of lines of inquiry in regional development theory which are seeking to explore whether a particular set of local changes constitute an improvement of the situation in a particular region (*cf.* Hassink, 1992; Yeung *et al.*, 2002; Chapman *et al.*, 2004; Hospers, 2004). Our focus is on a less successful region, because of the problems associated with demonstrating convincingly that such changes have overcome the problems that less successful regions face in beginning an accumulation of knowledge capital, which Cooke (2004) refers to as the scalar envelope.

We undertook this research in one peripheral industrial region, Twente, a former textiles industrial region in the east of the Netherlands (*cf.* chapter 5). There is already a huge literature surrounding spin-off activity around the university of Twente, but our concern is that the literature from Twente tends to be largely descriptive rather than analytical (*cf.* van der Sijde *et al.*, 2002). In particular, there has been little concerted effort to understand the regional impacts of the university activity beyond a formal output analysis from particular projects. Indeed, when one now-eminent Twente professor did undertake a comprehensive analysis, he was hard-pushed to demonstrate that – using formal econometric models – the university really was a benefit to the region (Florax, 1989). In this research, we are using a network-building model to look at the contribution which spin-offs can make to densifying a regional entrepreneurial and innovation environment; although we cannot prove that the improved regional network is a ‘regional improvement’, we are attempting to consider how the whole may add to more than the sum of the parts. In this study, we have drawn on some of the previous literature written about the

² This chapter was written in conjunction with Professor Aard Groen.

University of Twente where it contains factual material of value to this study. Some of the stylised facts we have presented in Chapter 2 are derived from this previous body of research. In chapters 6 and 7, we analyse one particular project in some depth, the temporary entrepreneurs programme, or TOP, and this, the *paradepaard* or prize pupil of UT, has been extensively written about, and we used some of this background material in our analysis.

The research team involved in this project had already been involved in a number of research projects looking at the relationships between universities and regional development. These previous research projects had suggested that spin-out companies might represent an important mechanism through which spin-offs realised their regional benefits. By the time this research was undertaken, we had already completed a parallel study of Newcastle University (*cf.* “Bringing Cambridge to Consett” *Working Paper 1*, “University of Newcastle Case study”). Just as in the Newcastle case study we integrated material from previous work into the overview of Newcastle University, in this report we have integrated previous work undertaken by NIKOS, including the rather famous Karnebeek *et al.* (2001) report, into chapter 5, the history of the University of Twente.

The main research question we have posed in Chapter 2 was:-

“how can university spin-offs rework political-economic relationships in ways that improve the situation of their host regions in wider knowledge-based economies”?

We operationalise this to ask to what extent is USO activity contributing to strengthening three kinds of network, and so the approach in the research focused on exploring the dynamics and evolution of the networks in the North East of England, and ultimately how they cohered into elements of a strengthened regional innovation system. In the literature review above, we have set out what we wished to explore, whether particular sub-systems had become stronger and better connected, along two dimensions, with regard to their situation within global knowledge hierarchies, and in terms of the breadth of the activities covered in the network, namely, to what extent they have become more generally accessible as a territorial innovation asset.

Such a research project is inevitably grounded in realist methodologies, recognising that places containing similar underlying causal relations and structures will in

practise appear different (Scott, 2000). Our approach was also informed by critiques of unselfconscious realism embedded in a number of 'new regionalist' analyses, in which empirical findings have been overly structured by theoretical frameworks, ignoring significant differences between places (Lovering, 1999; Hudson, 2003; Legendijk, 2003). In this working paper, we have attempted to establish a single - if partial - history for the evolution of the three networks, to try to identify similarities in structures of relationships. From this, the analysis argues that such structural similarities may constitute the kinds of regularities which warrant regarding as place-specific assets. We have assumed that similar phenomena are linked through similar underlying causes and structures, which then allows the answering of the questions about whether the set of activities has *in toto* constituted a change in the regional innovation environment.

The research was undertaken through a set of interviews with key actors within the Twente (and one physically located in Gelderland but with close links to and part-time offices at UT). NIKOS have already undertaken much research into spin-off activity around UT, and we used this expertise to identify an initial cohort of key interviewees within the university, including the senior management and the directors of the Research Institutes. We followed a snowball methodology (cf. Yin, 1994) in which we identified who were the key partners of prior interviewees, and then interviewed them, to build up a picture of the university network. The interviews were undertaken in an intensive period of fieldwork between July and September 2004. However, by the end of this period, there were some important leads to follow, including the appointment of a new director to the university holding company, as well as discovering two further key spin-offs.

Four further interviews were undertaken in the period October-December 2004. In these interviews, we sought to snowball out to firms and USO with whom they had some kind of working relationship about which they had something interesting to say. We identified that there were five communities that we were interested in, university managers, academic staff, spin-off staff, other firms working with USOs and regional institutional partners. The definition of communities was simpler than in the Newcastle case study, because very few of the academics interviewed were also running companies. What did complicate it was that there were people who had fulfilled multiple roles in their time in the university, and critically, played multiple

roles in the unfolding narratives about the university. This was not a problem for the research; indeed, in Chapter 7 we argue that this movement process has been an important part of the way particular projects and activities have become embedded in the routine life of the university. In table 1 below, we enumerate the interviews undertaken during this period based on the current main employment of the interviewee.

Table 1 The interviews undertaken during the research period by category

Category of interviewee	Number	Category of interviewee	Number
University central employees	5	Spin-off/ not academic	15
University Research Institutes	6	Regional development organisations	5
Academics	4	Third party firms	2
National policy-maker	1	Other Higher Education	1
Independent consultant	5		

Source: authors' own calculations

Although there does appear to be a preponderance of firms falling into the spin-off category, this arises because of a peculiarity of the Twente arrangement which encourages much commercial activity other than contract research to be channelled through spin-offs. Thus, there are four people in this category who would be classified as third-party firms in the Newcastle case study (or as corporate spin-outs), at least two people establishing spin-offs of spin-offs, and one person who relocated from another country to establish their business.

The interviews followed a semi-structured pattern, focusing in each case on the core activity and what had been done to build up and develop the particular activity, and how USOs had related to this. Because of the diversity of the interviews, the particular questions and thematic focus varied in each interview. Drawing on past work on university/ business interactions (Benneworth, 2001; Benneworth & Dawley, 2004; Benneworth & Charles, 2005), in each case questions reflected how the knowledge pool assets were used by the individuals and their organisations to accumulate knowledge capital activities.

With the academics, for example, the interviews examined the tensions of managing commercialisation within a strategy to sustain their research groups. The interviews with university central managers focused on how the universities had supported individuals wanting to spin-off firms, to ensure that it contributed to the growth of the university as well as the growth of the region. With all the third party firms, the interviews explored how working with universities and university spin-offs has contributed to solving their own innovation problems and growing their business. As we have noted above, not all the interviewees were easily categorised – some had fulfilled multiple roles in their careers, in ways which materially affected the story (particularly those involved with the TOP (*qv*) programme), whilst many of the spin-off companies had not followed a straightforward route.

This working paper presents a very basic first analysis of the situation in Twente to highlight some of the key dynamics operating, the underlying processes and the tensions emerging as Twente has over the last 20 years cemented its reputation as an entrepreneurial university. For the knowledge pool and each of the supporting three sub-systems identified in the literature review, we have attempted to examine how the network has grown, and whether there is sufficient growth to suggest that it is a qualitative strengthening of the knowledge asset base in the region. For each of the three sub-systems, there are three dimensions explored, whether the nodes are bigger/stronger, whether connections are more numerous/ higher quality, and whether the shape of the network has changed (and whether the North East's position in that network has improved). This is done in each case to examine whether the changes have improved the position of Twente in the wider political-economic situation within which it finds itself. These four analytic chapters form the basis of chapters 6 to 9; in order to grasp the significance of the analysis, it is necessary to have an understanding about the Twente economy, how monoculture led to crisis and impending collapse, and the centrality of the university and its engagement policies to the 'regional rebound'. It is to those issues in Chapters 4 (the Twente region) and 5 (the University of Twente) that we now turn.

4 The Region of Twente: towards a second R&D hotspot³

In this report, we look at the role that university spin-off companies have had in supporting the regional economic development of one peripheral industrial region, the region of Twente in the east of the Netherlands. The region has a relatively recent history, although much of its history over the last century has been one of decline, marked a failure to find institutional solutions to the regional problems. The region emerged in the mid 19th century as the leading textiles region in the Netherlands, and associated with that textiles industry, built up a dense network of related activities in machines and metal processing, with famous companies such as Stork emerging. However, from the mid-20th century onwards, the decline of the textiles sector had a very significant impact on the regional economy. Indeed, the prospect of the disappearance of the textiles industry was the principal stimulus to the creation of the university in 1961. Understanding the impact of the university therefore requires some understanding of the regional situation in which the university was created, and in particular, the balance between what was preserved and strengthened in the region, and what had to be created *de novo*.

In this chapter, we present an overview of the economic development of the Twente region, and in particular, dwell a little on the various efforts that emerged since the 1960s to promote economic development in the east. Hospers (2004) draws out the connection between the two growth events in Twente's history, noting that external impulses (the creation of a textiles industry and a technical university, both driven by central government) were embedded successfully in the region; from this, he argues that there is a need to concentrate on finding and introducing new external impulses to revitalise the region. The problem from Hospers' perspective is that the region has failed to develop a strong regional leadership, in contrast to other peripheral regions such as Friesland and Groningen, who have been very successful in winning subsidies from the centre. Conversely, Twente as a region emerged with a strong division between the *steden*, the urban areas, and the *platteland* or rural municipalities; the

³ This chapter was written in conjunction with Dr. Gert-Jan Hospers

cities were the primary generators of wealth, but also the source of many of the region's problems (such as unemployment). Moreover, there has been no tradition of co-operation between these key cities, which has reinforced the absence of regional leadership. This barrier has systemically prevented regional interests from mobilising in the last forty years to lobby for external investments that could spark new growth prospects in the region. The key challenge for Twente in this period has been in working across a highly fragmented and informal governance system to bring together an effective decision-making arrangement for the whole of the city-region. This provides the framework for understanding the various levels at which the University of Twente, and its spin-offs, contribute to helping to solve the various problems faced by Twente as a peripheral region.

4.1 Introduction and historical background to the region of Twente (1574-1976)

The region of Twente occupies the far east of the Netherlands, bordered by Drenthe to the north, and Gelderland to the south, and is the eastern part of the province of Overijssel (see figure A). The IJssel is a large river which runs to the west of the province, and which used to provide access to the North Sea through the Zuiderzee before the enclosure of the IJsselmeer in the 1920s. The name of the province literally means “beyond the IJssel”, and the IJssel river played an important role in the history of the province. To the east of the IJssel lay gravel banks and sandy soils which were unsuitable for intensive agriculture, which produced a particular type of farmer small-holding in which farming activities were supplemented by house-based industry, in particularly the hand weaving of wool from the nearby herds of sheep. The economic centre of Overijssel before the industrial revolution were a number of towns which lay on the IJssel and were able to exploit its accessibility and build connection into international trade networks, in particular the Hanseatic League, to build a prosperous mercantile economy quite separated from the impoverished hinterlands. Although these factors were primarily of significance hundreds of years ago, the vestiges of its economic history remain an influence on the economic development trajectory followed by the region.

Figure 2 The location of Twente in the Netherlands and Europe



Source: ITC, Enschede.

4.1.1 Twente before the Kingdom of the Netherlands

The territory of what is known today as the Kingdoms of the Netherlands and Belgium emerged in the 15th and 16th centuries as a series of feudal possessions within the Holy Roman Empire, which towards the end of this period passed into the ownership of the King of Spain. A very strong trade culture had developed within these various holdings, because under the feudal relations then prevailing, a number of cities had been able to negotiate themselves special town charters freeing their residents from the bonds of serfdom, in recognition of the extraordinary economic contribution they made to estates and wealth of their liege lords. In Overijssel, Oldenzaal was established as a Hanseatic City, a partner in the north European trading league in the late 10th century, Diepenheim in 1105, and the city of Delden received its civic charter in 1333. The Lutheran religious reformation in the 15th century

spread to the northern areas of the Spanish Netherlands, and its challenge to Catholic Orthodoxy prompted a crack-down on Protestantism after the death of Charles V. The southern provinces rebelled and achieved independence in the 1560s and William of Orange led an uprising in the northern provinces which led to the creation of the United Provinces in 1581. The united provinces emerged as a series of independent, but nevertheless confederally organised territories, with a national assembly formed from the appointees of the various rulers and governors of its constituent territories (van der Meide, 2004). The pre-eminent position at this time was held by the house of Oranje, who were later to become the Royal Household of the Kingdom of the Netherlands. Spanish attempts to reconquer their lost territories faltered at the river area, and were able to take occupation of the present-day Belgium. The fall of Antwerp in 1581 led to an exodus of many wealthy merchants who relocated to the northern provinces, and stimulated the vast expansion of the Dutch economy which was to become known as the Golden Age (*de gouden eeuw*) (Harreld, 2004).

The strength of the Dutch economy in this period lay in its location at the Delta of a number of rivers (Rhine, Maas, Schelde, IJssel), making the territories an ideal centre for trade and a natural cross-roads for economic activities. These rivers also protected the northern Netherlands from further incursion by Spanish troops until the formal ending of hostilities with the Treaty of Westphalia in 1648. The Netherlands' position at the cross-roads of Europe led to a very rapid period of economic development and growth, although based on mercantilism rather than true industrialisation. The Netherlands during this Golden Age of the 17th century was arguably the richest country in the world, its rich elites able to patronise the artistic world, its ordinary inhabitants able to purchase traded goods from the East such as tea, coffee and spices (Wenneckes, 1993). There was considerable local industry, and Brouwer (2005) notes that in what are now the provinces of North and South Holland, 40% of the workforce were employed in industry. However, the thrust of the economic revolution lay in the west of the Netherlands, where the port cities of Rotterdam and Amsterdam acted as the engines of growth for their hinterlands. The same situation prevailed in the east of the Netherlands, where the Hanseatic cities of Deventer, Zwolle and Zutphen thrived and grew. In Twente proper, the poor climate and soils proved a hard environment for farming to thrive, and the region largely stagnated, although linguistic and other cultural evidence suggests that Twente was

never particularly isolated as a region in comparison with the Friesian, Zuiderzee or Zeeland Island communities. Harreld highlights the importance of cattle trading through Overijssel, connecting the herders of the west Netherlands with the burgeoning German beef markets. ... identifies this continual cross-border movement and interaction as one explanatory factor in the absence of a strong regional dialect in Twente, in contrast to Friesland. A critical part of the Twente culture to emerge at that time was what Bulter (2000) has referred to as “noaberschap”, literally “neighbourliness” but more properly a shared sense of community responsibility amongst those eeking out a living in the harsh climes, thin soils and meagre ecology of the Twente region.

For the next century, the Netherlands went into economic decline as conservative elites failed to invest in innovation and new opportunities, and failed to consolidated their early economic growth into a full economic revolution (Brouwer, 2005). The internal stagnation was also exacerbated by a declining European population reducing the demands for Dutch mercantile services and agricultural products. The rising availability of cheap overseas imports led to a collapse in local employment opportunities in the western regions, and failed to provide any kind of stimulus which might have promoted economic development in the east of the Netherlands. This produced a very negative mindset, referred to by some (including Hospers) as the *Jan Salie geest*, an idiom conjured up by the poet Potinger in the 19th century poem *Jan, Jannetje en hun jongste kind* ; the spirit of Jan Salie was the tendency that settled in the Dutch psyche as a consequence of the 18th century decline to always look fondly to better times in the past in preference to taking risks to build a better future (Wenneckes, 1993).

In 1793, after the French revolution, the country was occupied by France, who very quickly introduced a version of their Jacobinist state, which created a huge and centralised machinery of government which later greatly facilitated the nation building process within the country. When the French Empire under Napoleon collapsed after the retreat of the French *grand armée* from Moscow in the winter of 1813, the French-occupied Netherlands provinces hastily moved to declare themselves independent, to avoid occupation by the advancing Prussian and Russian forces. There was at the time a series of splits within those provinces along two main lines, religious and linguistic. The northern provinces had been settled by inhabitants

speaking a set of Saxon-Germanic dialects which were the antecedents to modern Dutch, whilst the southern provinces had been largely settled by French-speakers. Overlain on this linguistic division was a separate religious division, roughly along the line of the Maas/ Schelde, which had featured in the main defining religious events, the emergence of Calvinism in the north and the re-Catholicisation of the Southern Netherlands after the fall of Antwerp in 1581. After the independence of the Netherlands in 1815, the new king, Willem I moved to tighten his grip over the levers of power in all the provinces of the new country. This was seen in the south as a threat to their francophone and Catholic traditions, and tensions gradually built until an uprising in Brussels in 1830 led to the formal secession of the Belgian provinces into a new country (1839), which built a separate identity drawing heavily on the French language.

During the emergence and subsequent stagnation of the Netherlands in the 17th and 18th, the economic geography of Overijssel was dominated by the IJssel cities to the west of the province. Consequently, following the formation of the Kingdom of the Netherlands, when the law was drawn up to establish a formal non-feudal Province for Overijssel, the assumption was made that the economic, political and cultural axis around which the province would rotate would be the River IJssel. Consequently, the Provincial Capital was established in Zwolle, at the mouth of the IJssel, a sensible decision given the then-location of economic activity (Timmers, 1997). This entirely failed to anticipate the separate emergence of the east of the Province as the third economic centre of the Netherlands. The consequence of this decision was to prevent the emergence of a capital city in Twente, and later to create a vacuum in governance; this clearly undermined attempts to develop a collective response to the crisis in the textiles industry which emerged 135 years later.

4.1.2 The new Twente in the 19th century

From 1813 onwards, Willem I had actively encouraged the development of a textiles industry in the Netherlands to exploit the captive markets of the newly taken Far Eastern colonies. The Netherlands at that time was in a serious economic slump, as demands for its services declined as France and the UK began their own industrialisation processes, but hindered by the so-called *Jan Salie* spirit, the Dutch failed to modernise (Wenneckes, 1993). The centre for this industry re-emerged in

Gent, a large city in the Flemish (Dutch speaking but Catholic provinces in the south of the United Kingdom of the Netherlands). Gent was in one of the territories ceded by Willem I in 1830, and immediately after the partition his attention returned to how a textiles industry could be built in his new kingdom. Having decided to support textiles by exploiting captive colonial markets, a specific organisation was created to support the industry, and a location was sought to focus investments in textile development. The decision was taken to support investments in textiles Twente by the Dutch Trade Society, NHM, (*Nederlands Handels Maatschappij*), who brought in Thomas Ainsworth from the UK to transfer his technologies and introduce mechanisation to the industry. They operated a monopoly system whereby they guaranteed to buy up all production, and then sold it on at a considerable premium to the Dutch colonies, supported by aggressive tariff barriers for non-Dutch producers.

Two areas were seriously considered, around Haarlem to the west and Twente in the east. The region of Twente was eventually chosen for a number of inter-related reasons. The first was because the King had visited a number of exhibitions in the UK, and was obsessed by the need for implementing the latest techniques in industry, to overcome the traditional anti-entrepreneurialism of the *Jan Salie geest*. Given the absence of existing firms in the region, new firms established in Twente could adopt the latest and most productive techniques. Secondly, there was already a tradition of textiles in the region, albeit in hand loom weaving of wool rather than the machining of cotton. Thirdly, wage levels in the east were very low (around half of the levels in the west), because weavers were also farmers, and no one was fully dependent on weaving for their living; furthermore, there was a pool of available labour immediately ready for exploitation. Fourthly, and finally, the king realised that his continued legitimacy required the adoption of more liberal social policies, and creating a state-regulated textiles industry in Twente would allow the prevention of the types of slums seen at that time in England, and which were elsewhere in Europe to be the breeding ground for the revolutions of 1848. A textiles school was developed in Goor, on the western border of Twente, and a number of graduates of the school established their own daughter schools. Three years after its formation, Hospers (2002) estimates that there were thirty weaving schools active in the province.

This economic boom associated with monopoly-sheltered growth naturally reshaped the wider economic and urban geography of the Twente region. The 1840s and 1850s saw an unprecedented expansion in transport investment with the creation of the railways which provided an alternative mode of transport to the canals which were not really suited for the transportation of goods through the slightly hillier east of the Netherlands. A number of new cities emerged in the east, dominated by the textiles factories around Enschede and Almelo, and the Stork works in Hengelo. The urban geography of these new cities was shaped by the location of the railways as nodes for transportation networks, around which clustered factories, which then in turn created new housing estates nearby for their workers. These new cities in many cases lacked a strong historic core, because the historical cities – Delden, Oldenzaal and Diepenheim, were not at the centre of transport nodes, and so not good locations for new industries. At the same time, the west of Overijssel did not experience the same growth impulse, although the Provincial Government – with the responsibility for overseeing the development of Twente – remained located at Zwolle, whose economic power dwindled as the centre of economic gravity shifted towards the east of the province.

4.1.3 Innovation vs. stagnation: building strong regional networks

The period of protection proved to provide a very useful window for the development of the textiles industry in Enschede. Hospers (2002) argues that the extent of the influence of NHM on the development of the Twente region was considerable; he cites as evidence the example of the new town established near Hellendorn which became called “Nijverdal”, literally Industrial Valley, and which still exists today. The monopoly position served the Twente economy well, and wages doubled from 1832 to 1850; at the same time, associated industries built up in the region, including machines and metal manufacturing for the maintenance of factories. Brouwer (2005) gives evidence that from 1820 to 1930, the textiles and clothing industry was always one of the three most important activities in Overijssel,. She notes that the nature of that industry changed from non-mechanised textiles including knitting factories, through cotton factories in the 1870s to labour intensive mechanised manufacturing by the 1910s, supplemented by clothing and fashion sectors. Brouwer also notes the importance of Stork in shaping Hengelo’s development, even after the relocation of

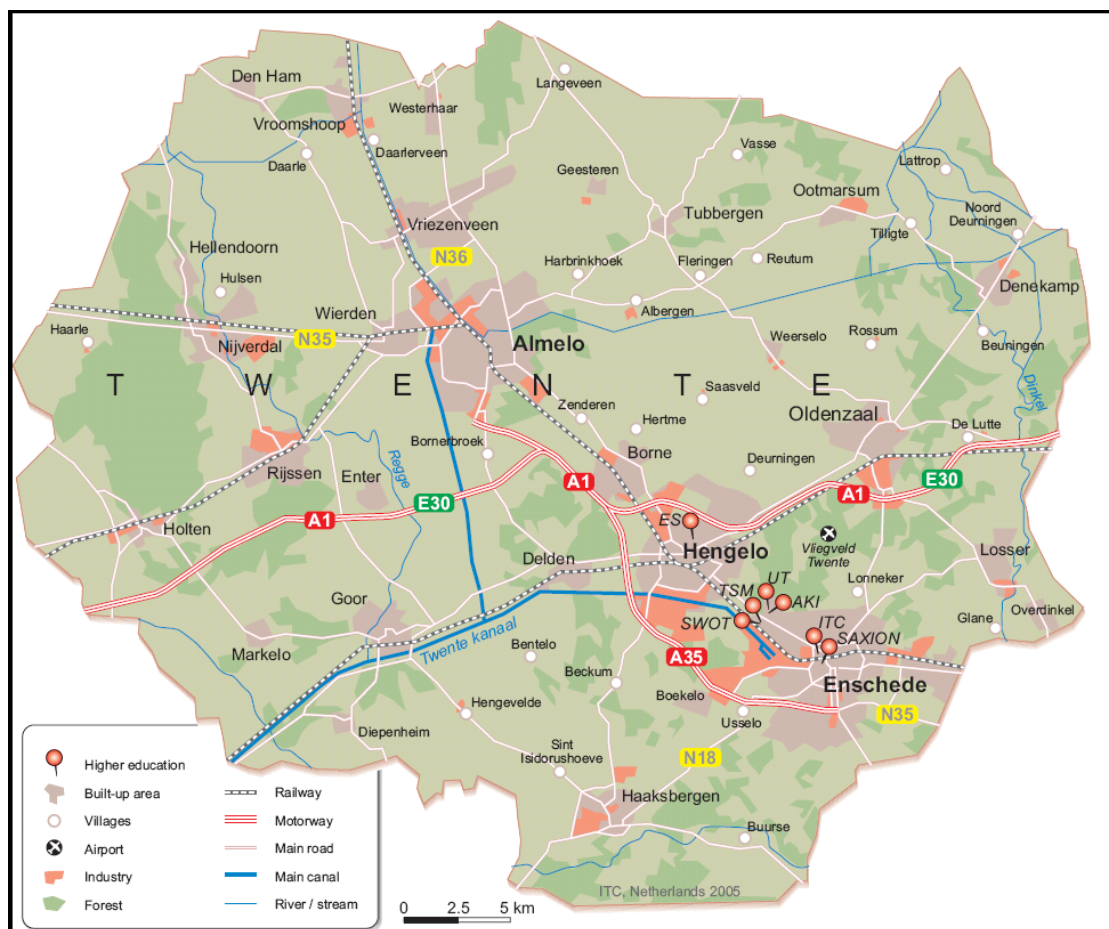
its headquarters elsewhere in the Netherlands, because of the social and physical developments which built up around its site.

The broader process of industrialisation was associated by with a number of important institutional innovations which can be seen as important in the development of a modern economy in Twente. The region was the first to create a farmers' credit bank (1896), which was later to play an important role in regional development in its later incarnation as the Rabobank. A regional entrepreneurs' society (VCO-NCW) was created in 1899 to begin to articulate the interests of the business classes in the economic development of Dutch society as a whole. This period from the 1870s-1910 was associated with the industrialisation of Germany, which in turn created a booming internal market for textiles for working classes finding employment as demand for trade services rose considerably. Up until the second world war, there was a specialisation of industry in the region, as Hospers (2005) noted, "During the 19th and first half of the 20th century Twente was constantly growing in textiles and metal manufacturing, providing not only mass products, but also specialized clothing, synthetic fibres and metal-electronic equipment." A number of successful non-textiles businesses emerged in the region, including Stork, and many of those adopted the same benevolent paternalistic attitudes towards their employees as had the earlier textiles businesses.

The monopoly situation which served the establishment of the cotton industry in Twente rather well had a number of draw-backs as the industry reached maturity. The government control of the cotton market crowded out the private sector from trading in cotton, and the security associated with the guaranteed prices (and sheltering from external competition) provided by NHM discouraged investment in innovation to increase productivity. NHM actually connived at this discouragement; Thomas Ainsworth attempted to establish a factory in Goor but was prevented from so doing by NHM, by refusing to buy the outputs of his factories. The formal monopoly of NHM ended in 1860, although the industry retained its privileges and protections until the loss of the Dutch East Indies, now Indonesia, in 1949. The overall effect of the protection was to produce a strong economic monoculture in the region – although there were other firms, many of them in machineries were dependent on the textiles industry. The protection afforded the textiles industry did allow the creation of pleasant conditions for workers; the suburb of Pathmos to the south west of Enschede

city centre was built at the turn of the century, and allowed the workers to share in some of the comforts brought by an extremely profitable cotton industry. Likewise, the 't Lansink garden city was built in Hengelo at the behest of the Stork entrepreneur C. F. Stork. However, the paternalism associated with industrial monoculture also lay the seeds for an extremely sharp downturn were the cotton industry to suffer a reverse – when the industry began a prolonged collapse after World War II, it appeared as if that could lead to the unravelling of the entire economy of Twente.

Figure 3 A map of the Twente region showing the location of its higher education institutes, 2005



4.1.4 Rise and fall: the regional co-operation paradox

The Netherlands was lucky not to suffer prolonged the unravelling of Empire which sapped the vitality of other European states, including France, Portugal and the UK. After a relatively brief war of independence, the Dutch East Indies colony achieved nationhood as Indonesia in 1949, depriving Dutch industries of a captive market and source of cheap raw materials. The national response to the dual challenge of the loss

of empire and the post-war reconstruction effort was the dual realisation that the Dutch economic future lay in its historic location as the transport hub for western Europe, and that its manufacturing economy would become increasingly dependent on value-added products and technical services rather than mass production. Discussed at rather more length in chapter 5, a number of universities were created to revitalise the technical base of peripheral regions in the 1950s and 1960s, in Maastricht, Eindhoven, Twente, and a private business school near Utrecht. In the case of Twente, the creation of the university came too late to save a textiles industry which had grown complacent behind the Dutch protection walls, and the industry lost some 40,000 jobs over the course of 35 years of steady decline.

The post war economic history of Twente was dominated by two countervailing trends. The first was that the region successfully underwent post-war reconstruction and participated in the Dutch economic miracle, albeit focused primarily on manufacturing rather than the new service industries which were dominating the west. The Dutch government placed a premium on building a dynamic open economy based on high value exports (Sorgdrager, 1981), leading to the creation of the European Economic Community in 1957 and the Benelux Union in 1958. This provided access to new markets for Dutch businesses, and stimulated a reconstruction and then consolidation boom which masked for a long time the second of these trends, which was the steady decline of the textiles industry. Despite the new market opportunities available for textiles businesses within Benelux and the EEC, Twente textiles businesses continued to shed labour at an alarming rate.

A clear challenge for the region in response to this crisis was twofold, to recognise that the steady shrinking of textiles was leading to a crisis situation, and then to avert that crisis by redefining the contribution that it made to the Dutch economy. The university rose to these challenges by emphasising the contribution that it made to the development of its region by the 1970s. However, the governance structure of the Province had altered little from 1825 to the 1960s, with a Province headquartered in Zwolle; a Twente 'regional authority' had been created in the 1960s covering what were the 22 municipalities within the historical boundaries of the Twente region. The national government in The Hague recognised from the 1950s onwards that there was a significant mismatch between this governance structure and the need for a set of regional institutions which could deal with the unfolding crisis in the textiles industry.

However, the national government failed to impose an external solution which would have compelled regional co-operation or created a new regional centre.

The problem for the region was that there was not a strong regional political will to produce a collective response to the economic problems and their consequences, such as the later city dereliction and urban flight. At the heart of the problem was that there was no single urban authority able to assume the role of regional leadership on the grounds that it represented the real motor of the regional economy. From 1966 onwards, attempts were made to foster collaboration between the major urban centres of Twente, Enschede, Hengelo, Almelo and Borne. A successful and stable configuration for a new institutional structure could not be found, which in turn led to a continual process of iteration and tinkering, which further undermined the prospects of ever developing an effective solution. As Hospers (2005) notes:-

“Plans for a City Belt, District Twente, Province of Twente, Twin City (Enschede-Hengelo) and Twente City all failed because of internal fights and interest conflicts”.

Hospers and Van Lochem (2002) also note that a strong regional leader did not emerge at that time. There was a Twente *Gewest* or regional authority which did little else than prepare the lobbying for the creation of a province of Twente. The dream of provincial status received a further impulse with the creation of the new province of Flevoland in 1985 from the reclaimed lands of the North East polder and East and South Flevoland. Both Rotterdam and Friesland achieved enhanced powers in 1997 (the so-called *Stadprovincie* reforms, Timmers, 1997) because of the charisma and political skills of their *de facto* regional leaders, respectively Bram Peper and Hans Weigel. Friesland achieved recognition of its autochthonous community and distinctive language, whilst Rotterdam achieved special economic powers to manage the port infrastructure. Failure to organically produce a regional leader was paralleled by the failure of the wider regionalisation process to create effective regional institutions. Twice proposals for a separate Twente province came before the national parliament, and twice they were defeated, on the more recent occasion the Hengelo representatives arguing that the province would undermine their own local interests. Thus, there was no prospect to use a new regional tier to articulate a clear regional vision and create a compulsory planning framework to manage the city region in a joined-up and integrated manner.

This failure to develop a regional tier through co-operative mechanisms sits very uneasily with the narratives of *noaberschap* outlined above which have formed an important part of the Twente self-image. The seeming paradox referred to by Hospers (*inter alia* with Van Lochem 2002; 2003) is that the cultural self-organisational tendencies of Twentenaars have not been matched by a capacity of the municipalities to organise co-operation effectively between themselves. Although a number of regional leaders emerged (so-called Mr. Twente) at different times, these individuals led on the basis of common membership of a number of key bodies, producing a very *ad hominem* type of regional leadership, and one which did not necessarily outline their particular (and relatively short) terms of office. Although people like Dr. Kroese from Koninklijk Ten Cate textiles played an important role in mobilising the campaign for a Twente University in the 1950s, business leadership in Twente did not regularly extend into the public realm.

The overall effect of this was to undermine any collective attempts to deal with the textiles crisis on a regional scale either to initiate actions which might stimulate entrepreneurship and innovation in textiles or through early investment in technologies and businesses which might have provided some economic continuity. The 1970s were a period of generalised recession across the Netherlands, and this produced a significant problem of dereliction, especially of former textiles buildings, as former large enterprises finally went out of business. The responsibility for dealing with these very place-specific (and very costly) problems fell heavily on the particular municipalities who faced them. One of the barriers to creating a regional tier was an unwillingness of the rural municipalities in Twente, facing their own budget crises, to contribute to dealing with the manifestations of the regional problems that fell within the jurisdictions of other authorities. The failure by local authorities to deal decisively with the dwindling textiles industry and to initiate and support a new regional growth dynamic merely exacerbated the problems, and meant that when the economic reforms did come, there would remain little of the old economy which could be consolidated and reinvigorated to compete in the knowledge economy.

4.2 The ‘Twente Wonder’: repositioning the region in a national space-economy

By the 1970s, the economic crisis in Twente had reached a point of unsustainability (see table 2 below). Unemployment in some municipalities reached 25% as textiles businesses disappeared entirely, and there were almost no businesses in a position to be creating new employment. In response to this clear crisis, the Province and the national government together decided to create a Regional Development Agency for Overijssel. The RDA was called the Overijssel Ontwikkelings Maatschappij (OOM), and it was created as one of a family of five agencies covering the non-metropolitan areas of the Netherlands, including LIOF for Limburg, NOM for the North, BOM for Brabant and GOM for Gelderland. The immediate priority for the OOM was the creation of employment in the region, and, in common with many other contemporaneous RDAs (including the UK’s Scottish and Welsh development agencies), began to seek out the kinds of inward investors who would create jobs in sufficient numbers to replace those being lost through the economic restructuring of textiles. The OOM also realised the importance of the retention of existing investors; as a number of local and national concerns were sold off or bought out, efforts were made to assemble support packages to try to anchor those firms in the region.

Table 2 The decline of the Twente textiles industry 1955-1985, employee numbers

Year	Employees
1955	44,000
1960	39,500
1965	34,000
1970	22,100
1975	15,300
1980	8,200

Source: Lambooy (1995) on the basis of ETIO-figures

As the immediacy of the employment crisis receded in the 1980s, OOM was able to broaden its remit to develop mechanisms for supporting other types of activity. OOM also had responsibility for the development and provision of business estates in Overijssel; Twente certainly had no shortage of land which could easily be redeveloped for new business parks, and OOM began to invest in infrastructure to support existing and growing businesses. From the mid 1980s onwards, the employment situation was stabilised to the extent that OOM had some latitude to think about how it could create new endogenous growth potential. It was at precisely

that time that the Technische Hogeschool Twente (THT) was reinventing itself as “University of Twente: the entrepreneurial university”, and attempting to mobilise regional stakeholder networks to win support in The Hague for its own ambitions to develop a wider set of curricula and courses.

4.2.1 Regional development in the 1980s: building a regional knowledge economy

The new outward-facing University of Twente demonstrated its willingness to engage with new types of regional activity, attempting to create local projects and stimulate regional entrepreneurship. This created an environment in which the regional development agency was able to propose a series of projects which aimed to build a knowledge campus around the university estate, as the ‘highest’ technology set of activities in the region. One of the main drivers of this process was the creation in 1985 of the Business Technology Centre (Van der Sijde *et al.*, 2001). This was created as a public-private partnership between two corporate partners, and the two regional universities, UT and Saxion. The idea is that the BTC would act as an interface between the university and the region, and in particular would provide incubation space for new high technology companies forming from a variety of sources, including from the university and Saxion. Although the BTC comprised at first a single building across the Hengelostraat from the university, the creation of the BTC was the first step in the development of the Business and Science Park (Van der Sijde *et al.*, 2001). The BTC very quickly managed to achieve high occupancy rates from high technology companies, including a large number of university spin-offs, a situation which persists to this day.

The creation of the BTC provided a flagship property development which formed the basis for the development of a much larger Business and Science Park. This was complemented with the creation in 1987 of the *Ondernemershuis* (Entrepreneurs’ House) also on Hengelostraat. The origins of the building lay with the decision of the Twente Chamber of Commerce to relocate from Hengelo to Enschede to help discharge its functions for support for high technology business, through an organisation called the Innovation Centre (these functions were later to be placed in a separate public sector organisation, Syntens). OOM helped to develop the business park up to its current size of 40 ha which also provides a high technology entrance to Enschede from one of the main routes into the city, the A1 as well as from the local

train station. The development of the high volume of science activities in the 1980s was also greatly assisted by the establishment of the Centre for Micro-Electronics (Twente); this was a government technology promotion initiative which sought to encourage the three Dutch technical universities to engage more in pushing micro-electronics technologies into Dutch SMEs. Funding was provided for three years for each technical university to establish such a centre; the UT centre, which became CMET, originally located in the BTC, and then moved into another building on the BSP as the company grew and was later rationalised (*cf.* chapter 6). This all helped to establish the pattern of a cohort of high technology companies around the university in the business and science park, which seemed to demonstrate that the technology promotion policies were working, and helping to use the university to create a new regional growth dynamic around technology and the university knowledge base.

The BTC also played a role in the building of the softer entrepreneurial networks which lubricated the university-based knowledge economy. One example of this was the case of the Technologie Kring Twente (the Twente Technology Circle). This was created in 1987 as a networking organisation, encouraged by the BTC who at that time were trying also to provide mentoring and business support services as well as start-up business units. The name echoed the existing Industrie Kring Twente (IKT), which was a networking organisation of primarily larger businesses in the whole region, but the focus of the TKT was at first to help small firms meet large firms' purchasing departments in order to generate sales leads (*cf.* 8.3.2). There was a sufficient throughput of businesses from TOP and other sources in the BTC to increase membership from 20 in the early years to around 100. At that point (1990), the BTC staff were able to invite a number of the members to take over the leadership of the organisation, and develop the network organically.

4.2.2 The 1990s: growth, hyperbole and burst.

The success in building up the business park, and its hard and soft infrastructures, was of course interconnected with efforts to attract inward investment, and to support growth by existing businesses in the region. The presence of high technology spin-off firms was itself an attraction for companies considering investing in the region; they meant there was an existing technical workforce, particularly in the course of the

1990s in IT and software engineering. In common with other peripheral regions, in the course of the 1990s, Twente, province, region and municipality began to realise that the flow of high employment inward investment was limited, and likely to decline in the future. They instead began to focus on targeting their inward investment promotional budgets on attracting companies requiring access to unique pools of skills and knowledge in the region. The 1990s was marked by a great deal of success in making this step up what some pundits have called the investment value chain, from branch plants to development stations and research laboratories. Ericsson, Bell Laboratories and CMG all established development and R&D facilities in Twente in the course of the 1990s, and it did appear that the region had managed to overcome the weaknesses and the lock-in which were a consequence of its industrial monoculture focused around textiles and the textile supply chain.

These efforts were also supported by a shift in the policy environment at a national and European level away from subsidies for mass employment creation to a focus on support for indigenous potential. The new law for higher education (WHW) in 1993 created the promotion of regional economic development as one of the statutory purposes of the research active universities, extending to all universities what had previously been the exclusive responsibility of UT. The region at this time was eligible for the receipt of European Regional Development Funding, and a large number of technology projects were developed seeking to encourage collaboration between firms in the region. The Province developed a Regional Innovation Strategy under the European RIS programme, and later on, a RIS+ strategy, which was in turn turned into a Innovation Strategy for the province once European funding had expired in 2001. It was clear that in terms of the knowledge base of the Province, the motor of this regional economy was the knowledge agglomeration that was building up in Enschede around the University of Twente. The structural funds were therefore spent in supporting the mutual vision of an entrepreneurial university driving forwards regional economic development, and as we will see, some of the projects which the university became involved in were a little too remote from the university's core interests to achieve long-term sustainability. The structural funds did provide support for the university's spin-off promotion instrument (the TOP programme, *qv*) and did lead to the creation of at least one successful cluster, around medical technologies, from a number of discrete European funded projects.

In response to this, the regional development agency began to explore options for investing in high growth potential businesses. The university had already created a holding company for investing in its spin-offs from the TOP scheme, through the Holding Technopolis Twente vehicle (*qv*). In the early 1990s, Innofonds was created as a public investment company capitalised by three large regional partners, OOM, Saxion and UT – these participations demonstrated clearly that the intention was to fund high technology businesses. About €1m was invested in two tranches in 35 companies, with the aim being to provide a mechanism to assist proven businesses coming out of incubation schemes like TOP and the BTC to grow sufficiently to be in a position to win further finance.

During the course of the 1990s, a great deal of excitement grew as the technical potential of ICT to transform business life appeared to begin to bear fruit, and a race began to invest heavily in IT, both in the physical networks necessary for the exploitation of IT and also in the R&D to realise new technological opportunities. UT had invested at a relatively early stage in campus IT networks and the creation of an electronic learning environment for the university, and had significant research strengths around IT. Investment off-campus was also encouraged, and the university and other public bodies invested in the NDIX, the Netherlands-German Internet Exchange, located opposite the BTC in a former bank building with a vault used to store servers, as the backbone of a telematics infrastructure for the easy. A national Telematics Research Centre had been created at the University of Twente as a collaborative venture funded by public and private sources. In 1997, the Telematica Institute was created on the back of this acknowledged research strength to be one of the Netherlands's four "Leading Technology Institutes", a programme which was latterly adjudged to be a successful replication of the Fraunhofer model in a regional innovation system which otherwise bore little resemblance to the rather munificent environment for innovation in Germany.

Alongside this investment in infrastructure for ICT developments, attempts were also made to stimulate commercial exploitation of the knowledge assets in the region. The 1990s were a period of bubble growth in the ICT industry more generally, and the effect of the bubble was to generally distort investments in ICTs by over-estimating the long-term yields of those investments. Part of the investments which were made around Twente were influenced by the bubble, and consequently they suffered from

the shake-out and asset disposals which accompanied the bursting of the ‘bubble’. The ICT boom created systemic problems, as the viability of many large companies was threatened by unwise investments, and those companies – the exemplar being the UK’s Marconi – were forced to divest or close otherwise sound businesses. A number of the ICT businesses which had been attracted to Twente went into retrenchment as a consequence of the bursting of the bubble, the most notable of these being the Ericsson R&D facility located in the Enschede BSP.

One of the negative consequences of the bursting of the high-technology bubble was that it created a generally difficult environment for high technology start-up firms of the kind clustered around the university. The boom had encouraged the creation of a number of new economy businesses which would prove to be unviable, but which nevertheless were able to acquire funding because of the uncertainty which initially existed over the assumptions which they had to make in order to develop sensible business plans. This process had been connived at by a series of Dutch government policy instruments seeking to promote high-technology businesses. “Dreamstart”, “Twinning” and “Biopartner” were designed to hot-house high growth potential businesses and then provide them with seed capital to get them quickly to the point where they could raise new investments. The reduction in the general availability of investment finance meant that many companies who had been established as development companies seeking to prove and develop particular ideas to secure further investment were and unable to secure those further investments necessary for their survival. This badly affected both Innofonds and Twinning, as a number of their investments simply went bankrupt, and the cost of the policy seemed to hugely outweigh the potential future returns. After the bursting of the bubble, the Government divested itself of the Twinning and Dreamstart holdings, although Biopartner was retained prior to the introduction of the Technostarters regime.

By the early years of the twenty first century, the knowledge economy of Twente had certainly endured a number of severe blows. But, there did appear to be a certain degree of resilience to the knowledge activities underway. A number of businesses did spin-out of some of the businesses which closed, and the university managed to sustain the rate of new firm formation through its TOP programme. A fire at UT created a temporary shortage of space which was overcome by hiring a building developed for, but never occupied by Ericsson, Capitool 15, which prevented an

abandonment of the facilities around the university. The evidence appears that the region had made some progress in developing a high-technology and knowledge-intensive economy, but that those knowledge-intensive elements were highly fragile. Moreover, the region still had not come to terms with the legacy of its industrial past and restructured into the type of knowledge-intensive business service focused economy common in the west of the Netherlands.

4.3 A new perspective for Twente: the region into the 21st century

The early years of the twenty first century have been quite unforgiving in Twente, as they have with the rest of the Netherlands. The economy continued to grow quite slowly, and unemployment rates were at historically high levels. There have been a number of high profile branch plant closures as well as some plants that have announced significant numbers of job losses in Twente which have further exacerbated the region's economic problems. Added to that has been the decision of the national government to close a military airbase near Enschede which has recently been developed as a civilian international airport providing freight services as well as some passenger charter flights to holiday destinations. The response that has emerged within the region has been significantly by the government of the day. At the time of the research, the Dutch government was formed by the second Balkenende cabinet, a right of centre coalition of conservative and free-market liberal parties, who were committed to significant reductions in public expenditure. As part of that, the government were committed to ending subsidy arrangements for poorer regions (particularly the Kompas subsidy plan for the North, which absorbed around half of the whole Dutch regional development budget), proposals were promulgated in the MINEZ policy statement "Pieken in de delta". These various factors have all contributed to the current regional policy framework in Twente, which consists of a range of documents from New Perspectives for Twente (*Nieuwe perspectieven voor Twente*) regional strategy, through the Triangle, the Regional Technology Platform and the REOP (regional economic development plan).

4.3.1 The national policy framework: the new innovation agenda

The Dutch economy entered a period of stagnation in the 1970s, in which the Netherlands's *rapprochement* with Israel meant they suffered particularly from oil boycotts during the Arab-Israeli war and the two oil crises. From around 1980, the

Dutch government became concerned with declining levels of productivity improvements, and the mismatch between high levels of investment in the science base and relatively low levels of business innovation, which was believed to make a significant contribution to the stagnation of the economy (OECD Observer, 2004). In 1982, Ruud Lubbers became Dutch premier with a commitment to increase the efficiency of the Dutch economy and reduce public spending. This Christian Democratic/ Liberal coalition produced three relatively stable governments in which in turn gave way to a much more vulnerable left/ right government under Wim Kok, Labour Party leader. The defeat of Wim Kok's social democratic coalition in 2002 at the hands of a new populist movement, *Lijst Pim Fortuyn*, brought an end to an era of consensual politics in the Netherlands, typified by the typically Dutch version of corporatism involving peak interest organisations (unions and employers organisations) and the government, the so-called polder model.

The change of government brought to power Jan-Peter Balkenende, a conservative politician who formed a coalition with a greater commitment to reign in public spending. After collapsing within 100 days, a second election affirmed the democratic desire for such a centre-right coalition, although less dominated by members of the *Lijst Pim Fortuyn*. One of the main targets for this government in recent years has been the reduction of non-productive spending by the government; the vision of the Balkenende cabinet has become associated with his personal commitment to the promotion of innovation as a motor for the renewal of Dutch society. As a recent OECD report on Dutch innovation policy (2004) noted, Balkenende has created:-

“a sense of urgency with respect to innovation, making innovation one of the top priorities of the second cabinet Balkenende. There came additional funding for innovation and research, including a raise of the [SME R&D tax credit] budget. New white papers were written on innovation and science policy, and stakeholders were unified in the Innovation Platform” (*qv*) (OECD 2004, p. 14).

However, the main noticeable effect of this has been an erosion of the value of the funds available for public spending – public bodies have been encouraged to do more with the same amount of resources, which could conceivably act as a stimulus for public sector bodies to be more innovative. In the field of education, despite

significant increases in student numbers and the creation of a market system for student funding, the government subvention to the universities has not increased significantly, although the student fees payable by the students themselves have steadily increased by around €100 annually to stand at €1800 per student at the time of the research (OECD, 2003).

This approach to innovation through austerity has spread to many spheres of public life, including regional development policy. The framework for economic development in the Netherlands is ostensibly set through the policies of two Ministries, the Ministry of Economic Affairs (MINEZ) and the Ministry for Housing, Planning and the Environment (VROM). Both of these departments publish framework documents which set the parameters for national spatial economic policy, and which both draw on and join up the policy of other departments. The VROM leading plan is the 5th *Nota Ruimte*, which sets out the spatial planning concepts which are to be used in Dutch planning, and applies them to produce a model for conceptualising the Dutch space economy. Important within this plan is the idea of the two Dutch mainports, *viz.* the airport at Schipol and the port complex at Rotterdam.

The MINEZ plan is entitled *Pieken in de Delta*, and this allocates particular economic roles to particular places dependent on their existing economic structures. Central within this is the idea that all regions have to perform effectively if the national economy is to remain competitive. As the State Secretary for economic affairs notes in the introduction to *Pieken*:-

“The Netherlands enjoys a richly variegated economic landscape, and every region has its own strengths and opportunities. From an economic perspective, we are far from a “low country” – we can see these peaks arising throughout the delta ... the cabinet wants to exploit all these regional strengths, because in a competitive world economy, only entrepreneurial regions can lead the Netherlands to the top of the national economic league table” (Van Gennip, in introduction to MINEZ, 2004, p. 9, authors’ own translation).

The two documents are cleverly woven together so that when read together, they provide a clear picture of the role the central government allocates to the regions in

terms of contributing to a broader national project of raising innovation and productivity levels and addressing economic stagnation.

The 4th *Nota Ruimte* established that the western Netherlands conurbation often called the Randstad was really comprised of two separate but interdependent wings, so *Pieken in de delta* developed separate roles for each of those two wings, the northern wing building on Schipol to be a centre of knowledge intensive business services, and the southern wing using the Rotterdam logistics infrastructure to become a global distribution management hub. A significant rail development is the planned *Zuiderzeelijn* high speed rail line linking Amsterdam to Groningen in the north and on to German Friesland. This will also provide the capacity for the north of Flevoland to become part of the commuting hinterland of the north Randstad (Amsterdam). Consequently, on the basis of these anticipated improved transport links *Pieken in de delta* allocates the North East of Netherlands the role of a “Gateway to North West Europe”. Both documents (*Pieken* and the 5th *Nota Ruimte*) use the concept of “network cities” as one of the concepts for both urban and economic planning in the Netherlands, concentrating economic activities, and new housing and commercial infrastructure developments around six core city areas.

4.3.2 Reinventing Twente through the national policy framework?

In terms of science and technology policy, the planning framework makes it clear that the main national technology hotspot is (to be) located around Eindhoven in North Brabant, the location of both the Technical University at Eindhoven, as well as the research and development facilities of Philips. However, *Pieken in de delta* also indicates that east of the Netherlands has the potential to be a high-technology region for the Netherlands, with the role of “Utilising knowledge concentrations”.

“In the east of the Netherlands, knowledge clusters around the Universities of Twente, Nijmegen and Wageningen offer important starting points for knowledge and productivity development.” (MINEZ, 2004, p. 14, authors’ own translation).

The problem that the Netherlands faces – in contrast to the UK – is that the general austerity means that the government in many cases lacks the tools to realise these ambitions, and to shape the general economic environment in ways that effectively deliver these spatial roles. In the UK, significant increases (from a very low base) to

R&D expenditure allowed the government to invest in capacity building in universities in less successful regions (with things like the Regional Innovation Fund and Smith review), whilst still targeting the majority of funding on existing excellence. By contrast, in the Netherlands, the *verdieptingsbelied* (concentration policy) in which research spending was increasingly targeted on excellent research institutes was supposed to be accompanied with a *verbreedingsbelied*, to allow investment in potential excellence and latent capacity. However, austerity has led to a prioritisation of rewarding excellence over investment in future capacity. Indeed, the Government white paper was entitled “Focus on excellence and greater value”, and a recent report to the OECD on the Netherlands noted that:-

“state funding for research activities is decreasing. Research intensive institutions are become more and more dependent on enterprises, government institutions, programmes of the EU and “collecting box” funds [charities] to be able to do research (OECD, 2003, p. 11).

This seems to limit the opportunities for a region like Twente, where there is latent capacity and a strong research base, but still relatively limited knowledge exploitation. However, the government has established a range of funds to encourage increased innovation and exploitation of knowledge. Perhaps the greatest example of the capacity and limitations of the Dutch government can be seen in the case of the Dutch Innovation Platform. The idea was launched with some fanfare by Balkenende himself in 2003 and formed a centre-piece of the Dutch EU presidency. At that time (late 2004), the EU was having problems in meeting the target of raising R&D expenditure to 3% of GDP (the so-called Lisbon targets), and Balkenende expended significant effort in attempting to establish European Innovation Platforms. The idea behind the Platform was to assemble an expert group of stakeholders in innovation, from successful businesses, universities, and other social groups, and together identify the barriers to effective innovation which could then be precisely targeted with light-touch (and hence low cost) policies. One such activity was Casimir, a project launched to provide greater opportunities for researchers to develop careers between universities and industry, funding researchers to undertake medium-term placements in research partner institutions to strengthen ongoing connections and facilitate technology transfer (MINEZ, 2005a). By early 2005, the Innovation Platform was receiving a great deal of criticism from opposition politicians who argued that it was

merely being used to avoid taking hard decisions, and it was preventing the cabinet from leading in developing a stronger commitment to innovation (MINEZ 2005b).

5 The history of the University of Twente⁴

“An entrepreneurial university is not a university led by an entrepreneur, but an organisation that demonstrates entrepreneurship at every level”.

Professor dr. ir. Harry van der Kroonenburg, Rector Magnificus, University of Twente 1979-82, 1985-8.

* * * * *

The University of Twente is a relatively new institution, and was created in 1961 as part of a broader post-war drive within the Netherlands to encourage a shift towards an economy based on high value added production rather than cost competition. Despite this relatively recent creation, the University of Twente has had something of a turbulent history. The institution began life as the Technical Polytechnic of Twente (‘THT’), and was created with a remit to behave very experimentally and innovatively. The collapse of textiles in Twente in the 1970s, as well as the abandonment of some of the features trialled by THT during this time left the institution as an apparent luxury which the recession-hit Netherlands could ill afford, culminating in Parliamentary calls for its closure. This provoked the university to reinvent itself during the leadership of the renowned *Rector Magnificus*⁵ dr. Prof. ir. Harry van den Kroonenburg. A great deal of effort was taken to increase the impact of the university on its region, culminating in its rebranding as “University of Twente: the entrepreneurial university”. Following his retirement from the Executive Board in 1988 for the second time, the university continued on the same trajectory, although subsequent pressures diluted the focus on regional engagement. By 2003, commitment had drifted to the point where the Executive Board once more decided to revitalise the university’s emphasis on promoting regional engagement and entrepreneurship.

⁴ This chapter was written in conjunction with Dr. Gert-Jan Hospers

⁵ The governance of Dutch universities is somewhat different; since 1974, they have been managed by an Executive Board (*College van Bestuur*) of three or five members, with a minority appointed by the crown (i.e. Government), with a Rector Magnificus as the Senior Academic, and a chair who tends to be an external member (although Frans van Vught was chair and Rector in his second term (2001-2004)).

Although much has been written about the university of Twente, and in particular concerning its approaches to entrepreneurship, we would characterise much of this writing as lacking a strong sense of the history of the place. Even a paper by Frans Schutte⁶ devoted less than a paragraph to the history of an institution whose regional engagement policies came to reflect his interest and enthusiasm in the subject. Likewise, the latest report on the Temporary Entrepreneurs Scheme (the so-called TOP programme) condenses the history of the scheme into four sentences. The problem with these potted histories is they fail to capture the complexities and pressures which the university has had to navigate in building and sustaining this regional mission. Some of these tensions begin to become evident in the introductory paragraph above, and there are many other areas where this is true. The university has strengths in biomedical engineering, for example, and these can only be understood in the context of the Twente region's attempts and subsequent failure to win the 1970s competition for the 8th Dutch medical school.

It is our contention that the contemporary regional engagement mission and systems of the University of Twente can only really be understood in conjunction with an understanding of how those systems were arrived at. In this chapter, we trace the evolution of the university, and its regional engagement activities through the last 43 years, to set out a more reflective framework for how UT was engaging with businesses at the time of the research underpinning this report, 2004. A number of Dutch language histories of the university have been published corresponding with the twenty, thirty and forty-year anniversaries of the institution. To some degree, we draw on their periodisation of the different phases of the life of the university (*cf.* Sorgdrager, 1981; Bekius-Wilkens *et al.*, 1991; Groenman, 2001). Although the periodisation has corresponded with the anniversaries of the university's foundation, it also reflects different phases in the life of an institution, the start-up, the growth and maturity phases of the biological life cycle. Arguably, UT has entered a fourth phase, which continuing the biological metaphor could be described as 'senility'. UT has entered into discussions with the two other technical universities, Delft (TUD) and Eindhoven (TUE) to create a federal Technical University for the Netherlands as a

⁶ The longest serving member of a Dutch university board since the changes to university governance were introduced in 1971.

merger of the three current institutions. This change has yet to have significant impact, although the three institutions have long been collaborating, a consequence of the idea that each technical university would have its own disciplines and philosophies, and they would collaborate rather than compete.

By the time of this research, the university was very different in form to the original university envisaged by the Creation Committee in 1960, but many vestiges of this history were evident to this day. This chapter draws heavily on those three previously mentioned histories of the university, as well as the interviews undertaken within this research, which included a number of principals involved in the TOP-scheme, the Business & Technology Centre, the Liaison Group and the university board. To understand more deeply the current technology transfer and regional engagement arrangements, we provide a retrospective of the university's history, beginning when the pressures demanding a university for the east reached a national level.

5.1 Reconstruction, beauty parades and Minister Cals (1945-1961)⁷

In common with many western countries, the Netherlands went through several successive waves of expansion in Higher Education. The first of these came in the 1920s, when two new institutions were created in the south of the Netherlands, the Catholic Universities of Tilburg and Nijmegen. These were part of a more general expansion in education reflecting the emancipation of catholics, and the creation of the Dutch consociational settlement of separate cultural pillars, the so-called '*verzuiling*'. It was the second phase of expansion, in the wake of World War II, in which the Netherlands underwent the same kinds of expansion that the UK addressed through its Robbins report, and which were common in industrialising countries. Indeed, the pressures faced by the Netherlands in the immediate post-war period were somewhat greater than those immediately faced by France or the UK. As victors, both France and the UK were able to benefit from the restoration of an international system of trade within their respective Empires, underpinned by the Bretton-Woods arrangement. As victims of an occupation, the restoration of the *status quo ante*

⁷ This section draws very heavily on Sorgdrager (1981), and Gellekink (2001) particularly where corroborated and inflected with material from the interviews (although they may not be independent sources).

bellum was less of a boon for the Netherlands. The four-year war against Indonesia highlighted very early after the war the fact that the Dutch would be increasingly forced to trade globally without tariff protections, and that their traditional industries would come under increasing competition from overseas businesses.

The Dutch response to this was typically pragmatic, emphasising the importance of local adaptation to these new trading conditions rather than attempting unnecessarily to prolong their empire or to retreat behind tariff barriers. In particular, the growing Dutch population associated with the baby boom would require the creation of new employment opportunities as the baby-boom generation grew up. This implied the need for a period of rapid economic expansion and reconstruction, in which universities were to play an important role, by equipping the population with the skills needed to compete in the (then-)modern economy. The Technical University at Delft had already created in the 19th Century (1843, Wenneckes, 1993) to meet the needs of the then-newly created Kingdom of the Netherlands' demands for engineers, and offered a different model to the ancient Dutch universities of (*inter alia*) Leiden and Utrecht, emphasising application of knowledge to practical problems rather than isolated academic learning. In 1947, the Holst Commission was appointed to report on the expansion of higher education, and amongst its recommendations were the expansion of the existing Technical University at Delft, as well as the creation of a second Technical University.

The Dutch HE system, and its funders in the Ministry of Education (MOCW⁸) were throughout this period acutely aware of the relatively small size of the Dutch higher education system. There was great care taken in this expansion to ensure that the changes were complementary to existing institutions to ensure that scarce and small resources were not wasted. The main regional debate at that time favoured a revitalisation of the south, at that time suffering from the restructuring of coal-mining in Noord Brabant. The field comprised four main competitors, 's Hertogenbosch, Weert, Eindhoven, Maastrich, as well as a late entry from Arnhem, which never really gathered much momentum because of its proximity to Nijmegen, itself a beneficiary of previous expansions. The 's Jacobs Commission recommended creating that second TU at Eindhoven, in support of the national flagship electronics concern,

⁸ In Dutch "Ministerie van Onderwijs, Cultuur and Wetenschap" (Education, culture and science)

Philips. The Technical University of Eindhoven was subsequently created in 1956, and from that time it enjoyed a very close technological relationship with Philips, which continues to this day⁹.

Figure 4 A map of the Netherlands



Source: CIA World factbook

There appears to have been little discussion of the possibility of locating the second TU in the east or the north of the Netherlands. However, the creation of a TU to promote regional economic development in the south appears to have stimulated a local mobilisation around the time of these debates towards interest in a university for the east of the region. The economic history of the east, outlined in the previous chapter, had left the region without a full higher education institution. The region had grown hugely in the 19th century on the basis of the textiles and associated industries such as machining, but there had not been an associated demand for high-level, graduate skills from these sectors. In part, this was associated with the complacency of the large textiles companies, who behind the protected markets of the Dutch East Indies were content to take profits without investing heavily in the kinds of innovation

⁹ As part of the celebrations of the 100th Birthday of one of Philips' most successful chairmen, Frits Philip, TU/e symbolically styled itself "Frits Philips University" for that day, 16th April 2005.

which would have required graduates and their higher level skills (Hospers, 2002). Moreover, the predominantly protestant composition of the communities of the east of the Netherlands had resulted in the previous expansion in the 1920s having no impact on Twente. In 1945, as with similar old industrial regions such as Nordrhein-Westfalen, Twente emerged from WWII facing the prospect of economic reconstruction of a region lacking a strong technological university base.

5.1.1 The regional response to the post-war expansion of HE

In the wake of the second world war, recognition grew at a national level of the need for a new national innovative impulse to meet the impending employment pressures of the baby-boomer generation culminating as we have seen in the creation of TU/e. In tandem with this national debate, local pressures grew for the creation of a new university for the east. Regional actors in the east had been active in 1947 in trying to attract the Dutch Institute for Foreign Service (NIOB); this was a private business school created by Albert Plessman, chairman of KLM, and was funded by leading Dutch companies. Despite these efforts, it was located instead in Nijenrode, a castle in the ‘green heart’ of the Netherlands, from whence it derives its current name, Nyenrode University. This failure notwithstanding, in 1949, a report was written for the Economische Technische Instituut Overijssel, setting out the value to the region of a university in the east. Around that time, (1948 according to Gellekink) a specific organisation was created to lobby the government in The Hague for precisely that end, *De Stichting tot bevordering van het Technische Hoger Onderwijs in de noorderlijke een oosterlijke provincies*¹⁰). This was a foundation supported by businesses and government in the four North Eastern provincies¹¹, and led for many years by Dr. Kroese, the chairman of local textiles company Ten Cate, described by one university board member as the “uncrowned king of Twente business” (Lookeren-Campagne, 1991, p. 13).

¹⁰ Literally “Foundation for the Promotion of Technical Higher Education in the northern and eastern provinces”

¹¹ These four provinces were Drenthe, Friesland and Groningen (the north), Overijssel and for a time, East Gelderland, when Arnhem was a possible location for a third TU.

This foundation commissioned three professors, Groenman (Utrecht), Van Hasselt (TUD, and later a professor at the new university at Twente), and Van Heek (a Twentenaar working at Leiden) to write two reports on the practicalities of establishing a university in the east. The second report (1959) recommended locating such a new university in Twente, and a sociologist at the municipality of Enschede was commissioned to determine where the best location for the university would be, although perhaps unsurprisingly recommending Enschede. Although these reports were not endorsed by the Government in The Hague, they did clearly influence the debate when the Minister for Education decided that a further Technical University was required for the benefit of the Dutch economy. The opportunity arose because the creation of the second TU at Eindhoven, whilst very successful in its own right, had not fully met the Netherlands' needs for technical education. The Ministry for Education appointed a further commission in 1957 (Piekaar-Neher) to consider the expansion of higher education in the Netherlands, and it was this Commission ultimately which led to the creation of the Technische Hogeschool Twente in Enschede. This Commission sat, along with another Commission considering technical higher education, and they reported jointly in 1959 to provide a ten-year road map for Dutch universities.

That joint report (in English "The expansion of higher education to 1970") began by noting that there was a profound need for the expansion of higher education in the Netherlands, but that there had been a stagnation of demand from potential students in the preceding years. Any expansion therefore needed to focus on attracting new people into higher education, from people who traditionally would not have considered going to university. The report recommended that there be an emphasis on training on subjects with high employer demand, in particular civil, mechanical and electronic engineering, chemical technology and applied physics, so the degrees offered would be more attractive because they would come with an effective guarantee of a highly-paid technical employment.

The committee made a series of practical recommendations to support this broadening of access to universities. These recommendations included considering different and flexible progression pathways, faster degrees, the integration of technical and business education, and better student accommodation. There was some concern expressed during this Inquiry by the existing two TUs that there were insufficient staff available

for such a new university, and it was acknowledged that the staff of a new institution could not be drawn from the existing professoriate of Dutch universities. The committee also made some recommendations that were not adapted by the Minister, and which could have precluded the emergence of UT, including the idea that a third TU could be an addition to an existing university (which was lacking in the east). This built on a recommendation of Groenman *et al.*, that the university should have both technical and pure science subjects within a single university.

5.1.2 From a university for the East to “Technische Hogeschool Twente”

Fortunately for the region of Twente, the then-Minister for Education Minister Cals was minded to ignore that latter recommendation in his policy note to Parliament, *Report on the Expansion of Higher Education* (1961). Lookeren-Campagne (UT Board Member 1980-1992) opined that the strength of the regional lobby did indeed swing the Ministerial decision towards locating the Third TU in the East (1991). The note from Education Minister Cals to Parliament did indeed recommend that there be a third polytechnic, to be located in the east of the Netherlands. The experience of TUE suggested that a new university would raise participation rates in the surrounding areas, and locating the university in the east would clearly tap into a thus-far unserved population. Parliament expressed its displeasure with the haste with which fully-formed proposals had emerged from the Ministry with only limited consultation. Moreover, Parliament were unwilling to sanction the dual creation of a liberal arts university in the east in parallel with the 3rd TU, so the THT was to be built around a very limited core of technical subjects not already offered at Delft or Eindhoven.

The first task was to determine where to locate this new technical university, and the idea of its regional value featured clearly within that decision. The Piekaar-Neher commission had received solicitations from four cities in the East of the Netherlands, Arnhem, Deventer, Enschede and Zwolle. Arnhem, 100km to the south of Twente in Gelderland, was rejected because of its remoteness from the key industrial areas in whose support it was created, as was Zwolle to the North West. The two other applicants split the recommending commission. The majority went for Deventer, a Hanseatic city on the IJssel to the west of Twente, which appeared appropriate because of its large local catchment population. It was a historic town appropriate for

a ‘seat of learning’; from the 17th Century to 1870, it was home to the Deventer Athenaeum, which was an independent post-graduate academic college. It could comfortably (in spatial and cultural terms) accommodate the influx of newcomers – staff and students – the 3rd TU would bring. By contrast, a minority supported Enschede, on the grounds that it was actually in amongst the industry which it was supposed to support, it would have the greatest stimulating effect on the locality, and it had a suitable patch of land for development, the Drienerlo Estate. This estate was confiscated from its German owner, who had returned to Germany under disputed circumstances towards the end of WWII, and was passed to the municipality. The availability of this estate was important in nullifying Enschede’s advantage in the lack of an existing middle class community, because the university could be developed in such a way as to accommodate the newcomers away from existing communities in what was proposed as the Netherlands’ first campus university.

In the wake of these mixed messages regarding location, there was a huge conflict between regional stakeholders over which city should benefit from the new university. According to one journalist working at the time, Jan van den Dungen, there was a vicious battle fought between the places, not least in the pages of the local press (cited in Groenman, 2001). This reflected the fact that Twente had played such a strong role in winning the third TU for the east, and the region was not prepared to lose a second TU to Arnhem or the IJsselvecht (Deventer) for lack of lobbying effort. The *Deventer Dagblad* noted that although Enschede had some good kindergartens, they lacked a single grammar school, cleverly alluding to Deventer’s historical (although then-defunct) institution the Athenaeum¹². Dr. Kroese, chairman of the Stichting Technische Hoger Onderwijs, riposted by dismissing Deventer, noting that there were more employed by Ten Cate than in all the cake, box and sausage factories in Deventer¹³ (van den Dungen in Groenman, 1991). More positively, leading candidates, Deventer and Enschede, used the university as part of re-imagining

¹² In the Dutch education system, the *Athenaea* and *Gymnasia* are the high schools that prepare pupils from the age of 12 for university education, as opposed to preparing for the universities of professional education (the Hogescholen) or Craft or Trade Education.

¹³ These were the three staple industries at that time of Deventer, a Hanseatic city on the River IJssel, which marks the western limits of Overijssel province.

themselves in the future. Deventer saw its university-led future as a small Paris with the IJssel playing the role of the Seine, rambling through the town. Meanwhile Twente saw itself as an emerging small nation, busting with optimism and entrepreneurship and ready to become one of the leading European growth regions. In the wake of the committee's deliberations, and the propaganda battle, the decision was taken by Parliament to locate the university, the Third Polytechnic, at Enschede, and was enacted through the *Staatsblad* on 1 December 1961.

A "Commission for the 3rd Polytechnic" was established under the chairmanship of Professor Berkhoff, who was later to become the inaugural Rector Magnificus. The decision was enshrined in the law for higher education (WHO or *Wet voor Hoger Onderwijs*), increasing the number of accepted *Technische Hogescholen* from two to three. It is important to stress that although the "regional mission" was important in bringing the THT to Enschede, and in particular in convincing Parliament to choose Enschede over Deventer, from the outset, THT was conceived of as a national institution fulfilling national roles. Increasing education opportunities for creating engineers was a vital part of the ongoing reconstruction effort within the Netherlands. Moreover, as Sorgdrager noted in 1981, educating engineers became one of the Netherlands's main contributions to the western alliance; by revitalising the Netherlands as a centre for trade between capitalist nations, a firm economic footing was provided to underpin the military-economic basis of western powers. Indeed, the 3rd TH committee stated clearly that their view of what they had to do in creating a new institution was to 'place' the region within this national/ international project. As the chairman of the founding committee noted, their aim was that in the future people would say that the east of the Netherlands was where effective and reputable engineers came from.

As a result of these convolutions, the parameters were established within which the university would take form. Following signals from the Commission on the Expansion of Higher Education in 1959, the Government had legislated for the new institution to enjoy considerable new flexibilities to experiment to make university education more attractive to an increasing number of students. The idea was to create a new innovative institution, learning from the lessons of the two previous TH's, but extending them to make higher education more appealing for a wider class of people. Innovations would include locating on a single campus, having a nurturing and

familial atmosphere to encourage more people to leave home, to have a business-relevant curriculum mixing technical and commercial subjects, and more streamlined progression through the degree, including a general scientific education and the so-called “Baccalaureate”. The innovativeness of these proposals meant that it would be a full three years from the appointment of the Founding Commission to the opening of the first academic year.

5.2 *Het experiment in de bos: the early years (1961-1975)*

The appointment of the preparatory committee in 1961 set the foundation for the creation of THT as a viable entity. The basis for the institution was to be around three main faculties; civil engineering, electronic engineering and chemical engineering, which could be - and later were - extended. There were debates about a number of the proposed innovations, including the introduction of a general engineering degree, the idea of a common curriculum for the first year (“*de algemene propadeuse*”), and the idea of a shorter baccalaureate qualification as an alternative available alongside the somewhat lengthier engineer’s diploma taken more generally. The right of UT to attempt these innovations had been underpinned by a contemporaneous law backed by Ministers and Parliament, but neither Parliament nor the Ministry foresaw the difficulties associated with creating such an innovative institution, nor the potential that failing to succeed with those innovations could have for the legitimacy of the 3rd TU.

5.2.1 The formal fabric of the university; the experiment in the forest

The commission, under Berkhoff’s leadership, set about establishing a university, creating and filling faculties and educational courses, building a campus and creating a management structure in time for the official opening of the campus. The role played by Minister Cals in bringing the university to Enschede was reflected by rewarding him with an eponymous road on the newly developed campus, Calslaan, a main north/ south access route through the residential areas to the west of the campus. The university was officially opened on 14th September 1964 by Queen Juliana and Prince Bernhard, although the first academic term, and the first students, had arrived on 1st September. The university had developed its own form of governance structure, with a management board responsible for central services and policy development,

but with a high degree of devolution to the three, later four, faculties under the direction of their respective deans.

As had already been noted, there was a shortage of staff available to take up academic appointments because of the relatively limited pool within the other two TUs, and because of the fact that some subjects were not covered elsewhere in the Netherlands. This provided UT with the opportunity to recruit people from industry as much as from other universities, and ensured that the professoriate did not have a purely academic perspective on their problem solving. The novelty of the institution and the shortage of available academic staff meant that the university evolved out of people known to be available by existing staff members. One of the professors who had written the first report in 1959 on the expansion of HE in the east, Professor van Hasselt, was recruited as Dean of the faculty of Mechanical Engineering¹⁴. This informality of recruitment also meant that some of the innovations could not be implemented because the staff were not available to take them forward.

The Drienerlo estate was developed with the intention of producing an archetypal Anglo-Saxon campus university (Dirck & Timmermans, 2001). The campus concept which emerged owed more perhaps to the older collegiate universities of Oxford, Cambridge, St. Andrews and Durham than the campus universities (the so-called ‘plate glass’ universities) then being built in Britain. There was also some fear that the arrival of hundreds of new staff and students would place huge strain on a town with almost no capacity for or experience in dealing with these highly educated and culturally-distinct newcomers. The aim to attract more students from traditional unwilling groups encouraged the designers (van Embden & van Tije) to attempt to create a coherent and familial atmosphere on campus. Their functionalist philosophy was that students and staff would live and work alongside each other in separate residential and academic areas, and could exchange, interact and build an academic atmosphere akin to a cloister. The first two weeks of the academic year were planned to introduce these new students to campus life, to explain the university’s philosophy and help them make the transition to life away from home. Committee members who had studied at Delft introduced an accommodation system of “student houses”

¹⁴ Werktuigbouwkunde

managed by senior students who would help inculcate the campus philosophy into new arrivals.

5.2.2 Expansion of the university: new faculties and glass barriers

We have already noted that one feature of UT was that it was predicated upon a gradual disciplinary expansions beyond its engineering heartland, although the first attempt to do this led to a disappointment. The university was clear to articulate its desire to build a research and teaching base for medical education, because of its absence from the east, the nearest teaching hospitals being located in Groningen and Nijmegen. In the 1960s, the Dutch government signalled its desire to create an eighth medical school, which offered a clear route to THT to pursue its disciplinary expansion. Consequently, steps were taken within THT to develop an infrastructure for medical education, albeit non-clinical, in association with other partners in possession of complementary assets, particularly access to clinical education.

The idea of a partnership appealed to the original ideas of one of the founding professors, Van Hasselt, by now dean of the Mechanical Engineering faculty, and a partnership was established with the Rijksuniversiteit in Groningen (RUG) and the Ziekenzorg in Twente. The basis of this partnership was that Groningen would provide student education, alongside a research centre in Twente in which researchers and students could work, drawing on their partners with RUG and Ziekenzorg for clinical opportunities. This partnership did impress Parliament, but in a race between the newest universities for the Medical School in 1969, the very newest institution, Maastricht, beat Twente into second place in a decision that Sorgdrager reported as having more to do with electoral politics in Limburg than educational and research capacities in Overijssel. There was considerable disappointment associated with this decision; there had been a considerable regional mobilisation around the idea, including a local poster campaign with the slogan “De chirugijn – Limburg, de medecijn – Twente”. Of course, to build these partnerships, a number of research groups (“*leerstoelgroepen*”) had reoriented their interests towards biomedical fields, something which was not easily reversed, and consequently it was later possible to develop research and educational strengths in biomedical engineering.

One area where expansion was more successful was in the development of a business/social sciences faculty. The 1960s were, as we see in the following section, a time

when there was considerable social unrest and disquiet over the future direction on technological evolution. Questions were being asked in society about in whose interests these advances were, and how technological change could be harnessed for the greater common good. Answering these questions required both a detailed understanding of the underpinning science as well as the use of emergent social science methodologies in science and innovation studies, capturing political, legal and ethical considerations alongside the purely scientific. These questions were therefore both multi-disciplinary and applied scientific, and so clearly fell within the purview of a technical university; providing commercial education meant that there was already an infrastructure to address some components. A failure to increase the number of new technical students forced the Executive Board to consider expanding the non-technical fields. To consolidate this activity, in 1969 the board decided to create a new faculty, Management, Government and Applied Education (BBT¹⁵) was created both by appointing new professors as well as bringing together engineers and scientists already dealing with these fields. A typical example is that of CSTM, the centre for the clean environment, which was created out of a water management group in civil engineering, but which was already engaging with the political decisions and social issues which underpinned the technical and engineering decisions involved in water service provision.

5.2.3 More general changes and the end of the experiment

The Dutch university system was affected from the late 1960s onwards by the radicalism affecting campuses across Europe, with students feeling that the management of these institutions did not adequately reflect their interests and concerns. In the 1970s, the Dutch Ministry of Education gave a great deal of thought to how the universities could be reformed to accommodate the legitimate grievances of students and to prevent a recurrence of the tensions which led to the occupation of Tilburg Polytechnic by irate students in 1969. A law was promulgated in 1970 which created a single governance structure for universities, comprising an executive board of three or five members (including one or two Crown appointees), and a Court of

¹⁵ BBT is from the Dutch faculty name, Bedrijfskunde, Bestuurskunde en Toegepaste Onderwijskunde. This department is now Bedrijfskunde, Bestuurskunde en Technologie, but still BBT.

Overseers with up to 40 members, including a group of external stakeholders appointed by the Crown. Most critically, students (and also staff) were able to elect their own representatives to sit in this Court.

In THT, the traditional system of a Court of Curators and a Senate had been rejected in favour of a more streamlined system of a strong Management Council, and weak supervisory Court, in which significant powers were devolved to the Deans. Although under normal circumstances, this situation did streamline performance, it did inhibit during the 1970s the development of an internal response to the governance crisis facing Dutch HE. Power rested with the Deans of the Faculty, but they were not interested in university governance, because their main interest was in regulating and ensuring the quality of their respective faculties. The university moved towards this dual management system in 1971, with elections to a shadow governing body leading to full elections in 1972, and the appointment of the new College van Bestuur, the executive Board from 1st September 1974. Thus, another distinction held by the old THT was subsumed within the new general law, further eroding THT's claims to be an experimental university and hence a special case.

5.3 A new lease of life: governance reform, and the Entrepreneurial University (1975-1988)

The failure or curtailment of a number of the experiments around which THT had been designed served to undermine the legitimacy of the institution. The *algemene propadeuse* was abandoned after 13 years, and the faculty of general science (which had previously provided the commercial education in parallel to the technical departments) became a fully-fledged faculty (BBT) with its own non-technical educational pathways. Likewise, the then-Minister for Education, Diepenhorst, pronounced the baccalaureate dead on the grounds it was desired neither by students nor employers. The desire to create a cloistered campus environment for staff and students to live and work in close proximity collapsed under the financial pressures and demands for expansion in the 1960s and 1970s. The informal governance structure had been replaced with the generic Executive Board and Court model. In short, what had been conceived of as a small and perfectly formed technical polytechnic had transformed itself into a somewhat detached elite institution following traditional paths and failing to engage widely with business interests,

particularly following the collapse of textiles and associated mechanical industries. There was considerable pressure from Government to close the university, which at the time was educating some 2,500 students with around 100 professors, a very intensive staff/student ratio. In response to this crisis of legitimacy, the university management decided to both increase the number of students, but at the same time to increase the engagement of the university with its community and society in general, thereby increasing internal income generation and reliance on the state (Lookeren-Campagne, 1991).

5.3.1 Reinventing UT as the entrepreneurial university

During this period, Lookeren-Campagne (1991) argues that there were three main changes within the university. Firstly, there was the rise of the two-core university with technical and social faculties (Wagenmakers, 1991); although the original idea had been to undertake both technical and business education in one degree, full business studies departments had emerged, which further increased the level of business training possible. These initial changes reinforced the multi-disciplinary role for the university championed by Dean Prof. van Hasselt, and over the period, as we have seen multi-disciplinary activities increased. This was reinforced by allowing, then requiring students to take study credits outside their parental discipline. From its nadir of comprising 12% of the curriculum, this new situation promoted the growth of cross-faculty learning to the point where 40% of all study credits were earned by students outside their parent faculty. This lay the foundation in the 1990s for the introduction of the Major/ Minor approach to education within UT, to increase its uniqueness but also its attractiveness to overseas students.

The second issue was around increasing local embeddedness; at the time in the late 1970s when Twente entered its textiles crisis, the Rector Magnificus (qv) and Queen's Commissioner worked very closely to harness the indigenous potential of Twente to effect a turnaround in regional fortunes. This had a profound impact on the university, and shaped its approach to regional engagement which has endured to this day. The model was predicated on the notion that the university could provide the business leadership otherwise lacking in the region, and create regional activities and institutions that could move outside the university, and improve and strengthen the regional economy.

The third was the rise of the idea of UT as the entrepreneurial university, being willing to take risks for the sake of its goals, which included regional development. This was associated with successive boards' desires – in the light of the failure of many earlier experiments – to retain a novelty, dynamism and innovativeness. Although attempts to negotiate a special status for the university in its dealings with the Ministry for Education in the 1980s failed, the university did rebrand itself, and made serious efforts to diffuse this new cultural idea into a range of activities carried out by the university. Lookeren-Campagne cited UT's development of a satellite campus in Leeuwarden in Friesland, as an example of the university's adopted slogan of the 'entrepreneurial university' in action.

One example of how these changing management principles produced concrete changes in the activities of the university can be seen in the emergence of multi-disciplinary activities within the university. Multi-disciplinarity fitted neatly with the idea of a regionally engaged university, bringing experts with fundamental knowledge together in ways to solve specific problems of more general interest. The original idea that all technical students should also have a commercial and social education had dwindled to occupying around 12% of typical curricula. Multi-disciplinarity offered a means to rectify this situation. The university specifically promoted much multi-disciplinary working, in areas like the creation of CSTM, and through the later "Major/ Minor" reforms. By the late 1980s, significant amounts of UT's research were co-ordinated through these multi-disciplinary research institutions, something which were to become more important as the Dutch government became increasingly concerned with concentration of research funding on leading research groups, again seeking ways to maximise the global impact and significance of a very small HE system.

There are a number of these multi-disciplinary institutions, and they are important to understanding USO activity within the University of Twente. After the failure noted above to win the 8th medical school, medical research activities within the university focused on the field of biomedical engineering. Although at first the focus was on education, co-ordinating the provision of multi-disciplinary educational routes, a research institute for biomedical engineering was created in 1991. This was originally seen as a means of co-ordinating research across the university, and later it became one of the four spearpoint institutes with greater responsibilities for organising

research and seedcorn funding of new research areas. Other similar spearpoint institutions about which considerably more will be said later are the MESA+ (Micro-electronics, Materials Engineering, Systems and Actuators) and CTIT (ICTs) research institutions, both of which were being created at this time as mechanisms to bring multi-disciplinary approaches to bear in finding commercially exploitable solutions to problems.

5.3.2 Exploiting the new governance structure: the role of Harry van den Kroonenburg

One of the strongest influences at this time on the university was the Rector Magnificus, Professor van den Kroonenberg, who served two terms (1979-1982 and 1985-1988). The Professor was an expert in energy technology, but was also very highly motivated to develop the regional role of UT, and to use this unique orientation to increase the respect and standing the university had both within Government and amongst external actors. He was a firm believer in commercialising knowledge, and as a professor in electrical engineering had created an opportunity for his higher-level students to gain study credits through commercialising discoveries from their dissertations. Speaking as early as 1982, he argued that the university played a critical role in building a new knowledge economy in the Twente region, both indirectly but also directly, and that direct role had to be built up with institutional support, in parallel to the spill-over technologies and graduates from the technical faculties (van den Kroonenberg, 1996).

The van den Kroonenberg period is characterised by this idea of the university leading the creation of regional activities which would over time fill the empty space of Twente and create a fully functioning regional economy. It was under van den Kroonenberg that the university was rebranded as “UT: the entrepreneurial university”, which reflected his belief in the benefits that a university could bring. Important in this was the idea of partnership; the university was not the only significant actor; there were important local innovating companies (*inter alia* Signaal, Stork, Ten Cate, Nedap), there was a University of Professional Education (Enschede Hogeschool), the municipality, the province and the regional development agency (OOM).

Thus, leading the mobilisation of these actors was an important role for the university, but he also realised that regional mobilisation on its own was insufficient to address Twente's structural problems. The cases both of the 3rd TU and the 8th Medical School indicated the importance of engaging with national actors, and demonstrating the contribution made by regional actors and their proposals to the contemporaneous national development project. An important part of van den Kroonenburg's activity was this external liaison role; many of the interviewees related how their early ideas were supported vocally by Van den Kroonenburg, and he played a strong role in national funding for these regional projects. He used his national contacts to persuade the Ministry of Economic Affairs (MINEZ¹⁶) of the value of what Twente were doing. This led to funding for the TOP programme and the national university technology transfer programme 1982-1987 (*qv*).

This policy of actively engaging with The Hague did not just bring small sums of funding for pilot programmes, as the *f.* 500,000¹⁷ associated with TOP (*qv*) undoubtedly was. One significant scheme which came to the Netherlands associated with Van den Kroonenburg's lobbying of MINEZ was the Centre for Micro-Electronics Twente (CMET). This was a technology transfer organisation created with national funding as an adjunct to the university, and populated in the first instance with university staff. Each Technical University was provided with funding to establish such a centre. The concept adopted by Twente – as articulated by one founder staff member – was to get technologies out from the university into companies, so the departments of CMET reflected university research strengths, including sensors, and interactive learning software. The organisation grew to 70 employees, which attracted government attention of the unwelcome variety, and the organisation was privatised. However, the case did demonstrate the viability of the

¹⁶ In Dutch *Ministerie voor Economische Zaken*.

¹⁷ *f.* Refers to the pre-euro currency of the Netherlands, "guilders"; the abbreviation *f.* is taken from an obsolete unit of currency in the low countries, the florin, and is used much as "d." was used in pre-decimalisation Britain to refer to pennies, alluding to denarii (?). There are approximately 2 guilders to the Euro (2.2). It is important to remember that the Netherlands enjoyed relative price stability through this period, so whilst £1 (1971) is worth £20 (2004), no such radical adjustment for inflation need be made; people were happy to talk about euro and guilder prices interchangeably, without saying (as happened in the UK interviews) that price levels have changed dramatically.

regional partnership approach to win external funding to create regional anchors for technology activities, and help to build a new knowledge economy for the region.

5.3.3 Towards a “Twente model” for regional engagement

At this time, four key features of what could be called the Twente model emerged, and which persist in some form to this day. The first was the creation of a dedicated office within the university for entrepreneurship promotion and external engagement, in 1979. This was originally called the *Transferpunt*, and was created to help SMEs gain access to the university staff, the idea being that large firms already had the resources to access university staff, but small firms were much more likely to make a positive contribution to the region. The model captured the imagination of policy-makers in The Hague within MINEZ (almost certainly with some encouragement from Van den Kroonenburg), and in 1982, provided a five year grant to all universities to operate such an office. However, unsurprisingly, five years was insufficient time to make the necessary cultural changes and the programme was largely deemed a failure. Thereafter, funding from the Government to promote SME innovation was handed to a series of Innovation Centres outside the universities, in what were the forerunners of what was to become Syntens, the national organisation for SME innovation promotion. Although many universities in the Netherlands abandoned their Transfer Offices at that point, UT persevered with the concept, albeit under a different arrangement whereby the *Transferpunt* took responsibility for earning its own funding. At this time, the institution also changed its name to Transfer Research and Development, echoing the very successful technology transfer organisation at Leuven University. This requirement to cover its own costs placed a great deal of pressure on the office to undertake directly-earning contract work, something which was to unravel in the 1990s, as the office undertook projects of increasing irrelevance to the interests of the Board.

The second element of the infrastructure was the creation of the Business Technologie Centrum-Enschede, in an industrial estate opposite the main entrance to the campus. Because the university had been developed on a confiscated country estate, it was surrounded by significant amounts of empty land, and even by the 1970s, the only facility located there was a small office of TNO, the national technology transfer organisation based in Delft. The regional development agency, a bank and an

American computer company invested to develop a physical innovation centre adjacent to the university, which opened in 1982. Professor van den Kroonenberg was on the BTC's Raad de Commissaris, the oversight body for the BTC, and was immensely supportive of the whole concept, encouraging both his professors to engage with the centre, but also beginning to argue that there was a more general Twente model of university commercialisation emerging in the East Netherlands. Of course, one element of the BTC model was that this would be a place where university spin-out companies could move, remaining physically close to the university, whilst establishing their independence from their parent research groups.

The third element of the infrastructure was the creation of a legally separate body to undertake commercial dealings within the university environment. This led to the creation of Holding Technopolis Twente, or HTT, which is still the formal company through which shareholdings in related companies are held. One of the first activities of HTT was to develop a hotel on the campus to provide a location for conferences, and, increasingly importantly in terms of revenue generation, post-qualification education. However, although this development, which created the Drienerburgh conference centre was highly successful in commercial terms, this HTT did not develop during this period into anything approaching a commercialisation organisation – it was merely a receptacle into which could be placed shareholdings in university-related companies.

The final element of this infrastructure was the emergence of the TOP programme, which was heavily influenced by van den Kroonenberg's own experiences in encouraging his own graduates to establish their own companies. The university commissioned in 1979 a local business consultancy, itself a spin-off, to analyse the success factors for USOs. The study was completed, and van den Kroonenberg then went to the government and sought funding for support for the four factors they identified, advice, finance, housing and going links to a university department. MINEZ provided a one-off grant to the university, which the university used to create the Temporary Entrepreneurs Scheme¹⁸. The university used the scheme to offer repayable loans to people who wanted to set up companies on the grounds that they were sponsored by a university department, and would commit to producing a

¹⁸ In Dutch, Tijdelijke Ondernemers Programma, leading to its mellifluous English acronym, TOP.

business plan within one year, taking the advice from a “Commission” of other regional entrepreneurs. This scheme has been incredibly successful, as much as an export to other places as within the university, and has been widely copied in the Netherlands and beyond.

5.4 From an entrepreneurial university to the university of entrepreneurs (1989-2004)

The period after the departure of Professor van den Kroonenberg from his second period as Rector Magnificus was followed by a set of extensive changes in the way the university carried out its engagement with the regional environment. During the inter-regnal Rectorship of Professor Draaijer (1982-85), the technology transfer activities were continued, not least because of the MINEZ grant for the transfer office. Van den Kroonenburg presided over the change of name in 1986 from THT to University of Twente, and over some expansion, with the creation of a department of philosophy of science, technology and society, and a foundation year campus in Leeuwarden, in Friesland. By contrast, the chairmen that were to follow had to take particularly hard decisions, not least because of the continual financial pressure under which the university was placed. Most cruelly, the Government passed the leases on the buildings over to the university in 1991, five years before they were condemned by the municipality for a lack of compliance with safety codes. The lack of a refurbishment grant from the government forced the university to invest €200m in a full campus refurbishment which had not been adequately financially planned.

The overall effect was to lead to a continuing set of pressures for change, which was somewhat destabilising for the regional engagement structures. The following Rector, Professor De Smit (1988-1992), pursued internationalisation extremely intensively, as well as encouraging the creation of new multi-disciplinary subjects, Civil Engineering and Management, Communications Sciences for Engineers and Business Admin and ICT. His successor, Professor Theo Popma (1992-1996) was concerned with cementing the position of UT as a research-led university at the time when there were increasing national pressures towards the concentration of research educational reform. This led to the creation of the spear-head research institutes as the focus for all research activity, and further collaboration between the three technical universities. Professor Frans van Vught, (1997-2004) was concerned with the development of new

subjects, particularly in the medical field, as well as introducing compulsory Minor programmes for all students and introducing the Bologna-facing Bachelor/ Masters structure to the university degrees. Given that van den Kroonenberg's successors had such large agendas for reform, it is perhaps unsurprising that the centrality of regional development drifted somewhat in the period.

5.4.1 From Harry van den Kroonenberg to Frits Schutte

One of the first indicators of success for solidifying research strength, Popma's aim, came with winning the Telematica Research Centre. UT had led in developing taught courses in IT from the late 1970s onwards, in the context of relatively slow progress across the Netherlands as a whole. Their research programme had already won the region the CMET (*qv*), which was privatised in the late 1980s, but in 1991, UT's strengths in ICTs brought the newly created TRC to Twente. Although there was a formal bidding process for this centre, which was funded by leading Dutch companies, there was an informal process of lobbying to the Government from the municipality, the university management and the faculty of Telematics. This brought independent research funding for the centre, and for five years, the centre grew organically, until Minister Waaijer decided that the Netherlands needed to develop Technology Push Institutes. This concept developed into the Leading Technology Institutes; although they were notionally national networks, they provided funding to significantly increase the amount of research undertaken, and were located at the three TUs and the agricultural university at Wageningen. By the time of the research (2004), there were around 200 people employed in the "Telematica Institute", the name adopted by the LTI; although the TI was located on the UT campus at the time of the research, the reorganisation of the campus meant that TI was moving to downtown Twente, as part of the Roombeek regeneration project.

During this period, Professor Popma was greatly involved in promoting research institutions within the university, because of a 1986 law which had stated that Dutch research would become increasingly concentrated within formal research institutions. The university therefore pursued a strategy of creating a set of research institutes ("the spear-point institutes"), effectively as a holding organisation for participating research groups within the university, without a strong physical footprint on the campus. The exception to this was the MESA institute for nanotechnology, which developed a set

of clean facilities on the university campus. The research institutes all appointed commercial directors as well as scientific directors, with responsibility for knowledge valorisation, despite the fact that the institutions – which from 1999 received a five year funding package – were not to be evaluated on their commercial outcomes. Supporting the development of spin-off companies fell well within the responsibilities of these commercialisation directors, and despite the fact research groups were nationally and internationally oriented, the research institutions also managed their regional engagement.

The one constant factor during much of this period was the presence on the board of dr. Frits Schutte, a board member with responsibility for regional development; his departure led to a reappraisal of the priority given to and the mechanisms for university regional engagement. Thus, there was a lot of turbulence in regional engagement, and the particular structures were continually being reformed and reformed. The main change which unfolded in terms of the transfer office at this time was the previously mentioned requirement for it to become self-funding after the expiry of the MINEZ grant in 1989. One expertise that the transfer office had was the TOP programme, promoting entrepreneurship by building networks around existing institutions, and the university became drawn into a series of entrepreneurship promotion activities that became increasingly detached from the actual interests of the university. UT's technology transfer office was in 1997 running an entrepreneurship programme in Curacao, and they also became involved in running lower level training courses.

Whilst those activities were worthy in themselves, they were not necessarily something that should be undertaken within the university, and this undermined the esteem with which the transfer group was held. Covering the group's costs was also problematic, the funds through which they were paid were very lumpy, which led to the group being merged with other activities, including the international office and the communications office. The way the group reinvented themselves was to reposition what these activities brought into the university. Since 1987, there had been a Centre for Innovative Entrepreneurship (CIOT) under the leadership of professor Wim During within the BBT faculty. In 1998, the transfer office approached During to see if the programmes they were running also offered opportunities for academic research; because they were mentoring high technology start-up companies through

the TOP programme, that would permit them to use these successive cohorts as data points for research projects on entrepreneurship. They built up a database of these companies, as well as writing papers on the theoretical implications of the entrepreneurial practises with which they were involved.

Schutte was also actively involved in the production of these publications, and during Popma's Rectorship, was a founding member of the European Consortium of Innovative Universities. This helped to build a perception of Twente as entrepreneurial and TOP as a successful project which assisted with the long-term survival of the project within the university. Consequently, when Schutte left the university in 2000, it was possible to move the TOP project over to the During group, from where it was managed both as an entrepreneurship stimulation activity but also an academic research project.

5.4.2 The evolving regional development environment: maintaining regional leadership?

In this period, the university also fulfilled an important role in providing regional co-leadership, continuing the strength that had built up as Province and University had to fight aggressively to preserve and reinvent the university in the 1970s and 1980s. There were a number of projects involving the university, its research departments, the municipality and the development agency attempting to improve the quality of the Twente economy as a place to do research. A number of projects were undertaken, and much was written about them by the university, although their precise impact on the local economy is much harder to measure. One area where the university definitely made a contribution was in the attraction of inward investment, particularly in the field of ICT; possibly the biggest success was in the attraction and retention of a research laboratory from the Swedish mobile telephony company, Ericsson, but Lucent, KPN, and Logica all established research activities in the region, ostensibly to access the knowledge facilities at the university in terms of both graduates and professors.

The second area where the university became involved was in the formation of an investment fund for high technology funds in Overijssel. Dutch regional development agencies have powers to make investments in small companies, and a dedicated seed-corn fund was formed in 1996 as a partnership between UT, Saxion (the local

university of professional education) and the regional development agency, OOM. The fund, Innofonds, was set up to fund product development after proof of principle, which meant the company had to have at least some prior investment in it. The funds were invested in two tranches, 1996-1998, and 1999-2001, which meant that the investments became caught up to some degree with the bubble economy of the late 1990s. However, despite that, a majority of investments survived in some form; following the merger of OOM with its Gelderland neighbour GOM, to form an RDA for the east, Innofonds' holdings were placed in the hands of PPM Oost NV ("Eastern Public Venture Capital Fund"), in which the university had a shareholding of around 4%. Innofonds was a useful source of venture finance for spin-offs from UT, and in the remaining nineteen companies in the current portfolio, the majority of them are university spin-offs who have progressed through the TOP scheme.

The university also became involved in a number of regional projects, both regionally originating, but also involved with regional teams bidding for national funds. A number of these were under the auspices of Structural Fund actions (ERDF and ESF), and involved promoting entrepreneurship amongst particular groups. UNISPIN was a project development by various entrepreneurial European universities, including Twente, Linköping and Shannon, promoting university spin-off activities. The Twente Knowledge Initiative aimed to help companies work together to develop products collaboratively to sell overseas. Netlab was a European SF project which encouraged the formation of cluster groups with the university, local SMEs and local large firms, to produce collective R&D projects. Both these two projects involved a regional organisation, the Twente Technology Circle (TKT), which is a group of 130 regional entrepreneurs who regularly meet to discuss their issues and to try to encourage greater collaboration between them; despite the obvious potential for university involvement in TKT, and the dependence of TKT of a number of USOs (particularly TOP companies), until very recently, the university was at arm's length from TKT, although more recently, the commercial director of one of the Spearpoint Institutions (Iddo Bante) of CTIT, joined the board.

The university has also been involved in the development of the regional development strategy; the vision of the regional development agency is what is called "Triangle". The idea for this is to promote three high technology centres in the east, Twente, Nijmegen and Wageningen, each providing the basis for the stimulation of their local

environment, to build a critical mass of activity as a bulwark against the pull of Eindhoven in the south. The Twente ‘arm’ of the triangle is based on the strengths of UT, and is called Twente Technology Valley. The Twente Technology Valley is overseen by a “regional innovation platform”, which brings together a range of regional stakeholders to produce a tangible set of actions to achieve the “Triangle” vision. Two of the fourteen members of this platform, established as this research was being undertaken, were members of the university¹⁹, and a third, Dennis Schipper, is the owner of a Twente spin-off. Schipper in turn led on one of the Triangle projects, which was the Twente Mechatronics Foundation (SMF²⁰); when a UT professor in Mechatronics (Schipper’s own doctoral supervisor) retired, UT simultaneously retired the post. This was bad for a number of regional mechatronics companies who drew on the graduates and post-docs produced by the research group, and so the Foundation was formed to fund a replacement professor; the regional support through Technology Valley is one of time rather than cash, as the Foundation. There is also a municipal strategy, the Netwerk Stad Twente project which is developing the Twente Knowledge Campus (Kenniscampus), which has developed the concept of “Care and Technology” (Zorg en Technologie) as being an area on which the university could make a substantive contribution to urban development.

The particular aims of the university in these various activities are somewhat diverse; although the university has a mission to assist regional companies and promote innovation, the precise means by which this has been pursued has altered over time. As higher education budgets in the Netherlands have stagnated, so there has been a tendency to win large research projects from industry by recourse to a few large collaborative projects. Although this is supported by the way that much university research is funded, for a four year period, there are not strong mechanisms for undertaking small pieces of contract research directly. In part, that was an element of the value of the TOP scheme, in which consultants would exploit knowledge in the short-term that university departments did not want to exploit. There are commercialisation institutions within the university; a typical one is the European

¹⁹ Both are members of the College van Bestuur, Willem te Beest and Frans van Vught (although both will have left the university by October 2005).

²⁰ In Dutch, Stichting Mechanica Valley

Membranes Institute, part of Professor Matthias Wessling's Membrane Technical Group; at the time of the research, the EMI was involved in short-term consultancy work as an adjunct to the main university-based research group.

5.4.3 The regional engagement infrastructure in UT, 2004

By 2004, there had been quite a shift in the activities through which UT validated its title as “the entrepreneurial university”. The university senior management were interested in promoting entrepreneurship throughout the university. In terms of the vision of Van den Kroonenberg, the university was entrepreneurial in the sense of providing all graduates with the access to entrepreneurship training, and then allowing those graduates to transform the regional environment. UT is now recognised as a leader in producing spin-offs which play a regional role in economic development and help to embed university knowledge in the surrounding area (Sociaal-Economische Raad, 2003). However, efforts were also being increased to proactively ‘push’ technologies out from the university into companies, either through spin-offs or with licensing deals. From the 1990s onwards, as we have seen, the university was under increasing pressure to redevelop its campus. The Ministry for Education had granted the physical university estates to the universities in 1994, but without providing a dowry for refurbishment. UT faced a real problem because its 1960s estate had a lifespan under forty years, and they had to enter into a deal with the municipality of Enschede to completely rebuild the estate by 2008 to avoid its immediate closure for breaching safety regulations. The redevelopment, for which the university had not planned and for which there was no direct funding source, was budgeted for at €30m, and which was secured by mortgage.

This huge investment in new estate allowed both a rebuilding of the infrastructure, but a reconceptualisation of the university, to reflect a regional role not anticipated by its original master planners in the 1960s. and to build an “extended science park” in the Twente region based around the university but also encompassing other innovative companies nearby (the new knowledge park initiative). In the words of the current master planner, Jan Hoogstad,

“the management were keen on the idea of interactivity as the key word for the master plan ... I have been surprised how deeply the idea is embraced across the whole of the university” (Van Duuren, 2004, author's own translation).

These activities are by no means independent; the overarching technological development plan for the region is Triangle; underneath that lies Technology Valley Twente, which aims to bring economic development to Twente. Underneath this lies the more concrete project Twente Knowledge Campus initiative, and as part of this lies Care and Technology. The university engages with these activities at a variety of levels, with Executive Board members, professors and the university services all engaging in partnerships to deliver regional development projects within Twente. Some key elements of the outward face of the university of Twente at the time of the research were:-

- Tissue accelerator: this is a hothousing incubator for IP in the field of tissue engineering, an area of biomedical technology that the university has extensive strengths in. The skills in this area were stimulated when a research team ‘spun-into’ the university from research intensive company Isotis. The accelerator funds an entrepreneur to develop a business plan and then seek further continuation finance. The intention is to extend the approach to other specific domains as the value of particular niche technologies becomes apparent.
- Holding Technopolis Twente (management). One role fulfilled by HTT is to manage the IP held within the university; until 2004, this approach was very weak; a change in rules merely discouraged professors to be entrepreneurial, and left the entrepreneurship to TOP-pers. The intention is to create a framework where IP is exploited to maximise value for inventor, university and region.
- Holding Technopolis Twente (participation): the other role played by HTT is as an arm’s length body controlling the various investments made by the university. These cover 8 university spin-offs, three university activities (conference centre, business school and nanotechnology centre), and external infrastructure organisations (the business technology centre and the local internet exchange).
- Spearpoint Institutes: there are 6 spearpoint research institutions, and the four most closely related with technology and engineering have dedicated commercialisation directors; one of those, MESA+, has its own dedicated

nanotechnology facilities (owned by MTF); these promote spin-off and licensing activities.

- TOP/ TOP+/ TOP *et al.*: the university has a number of TOP-related entrepreneurship promotion activities; TOP remains active (the most recent schemes started in March 2005), and NIKOS are running similar programmes for a vocational college in Hengelo (Campus Business Centre), *Kansrijk eigen Baas* in de Achterhoek (*qv*) and the Minor in Practical Entrepreneurship (which provides 20 ECTS for students following a TOP-type arrangement).
- Twente Technology Valley: this is the framework developed by the regional development agency OOST for Overijssel, to ensure that Gelderland is not the only beneficiary of Triangle. The main activity is an innovation platform which has €00k to implement light touch support activities.

6 University spin-outs building a territorial knowledge pool

In the model proposed in chapter two, we identified that the ‘knowledge pool’ effect was the main mechanism whereby regional territorial advantage was built by spin-offs companies. Although the literature review suggested that there were other important mechanisms by which the ‘pool’ was built, developed and sustained, at the heart of our model is the idea of this ‘pool’. The basic idea is that the process of spinning off a company makes the university better at working with other companies, and hence makes the university more competent at working with these firms. It is possible to envisage a range of mechanisms by which this would occur, such as the professionals or academics being involved with spin-offs becoming more commercially minded, or the improvement of technology transfer institutions, projects and routines within the university. In this chapter, we look in more detail at the process of building a territorial knowledge pool. The basis of the pool is in beginning from the assumption that spin-off activity contributes to building particular shared territorial innovation assets which are more readily available than previously. Because Twente is a poor environment for innovation and entrepreneurship, this constitutes an improvement in the overall regional economic situation.

In this chapter, we begin by considering who are the key actors in the process of spinning off, and how the particular activities they undertake become ‘regularised’ into ‘assets’ which can be used more repeatedly by others. We then consider the nature of the general assets which are produced at a regional level, and the extent to which these things are genuinely ‘regional’, in being more open and accessible. We in particular problematise the basic mechanism outlined above, and highlight some of the key issues which seem to be affecting the operation of the knowledge pool in the Twente. We then conclude the chapter with a more general discussion of how the spin-off process is directly contributing to a densification of the territorial innovation environment.

6.1 *The key actors in the knowledge pool*

In this research, we are considered in the kinds of knowledge which are rooted in particular places, and have some kind of ‘stickiness’ which allows them to become the

basis for particular innovative and competitive businesses. This concept of knowledge is as a very tacit form of knowledge, incorporating a great deal of know-how, know-who, and learning by doing, to situate knowledges in particular places, and to increase the access and uptake of the knowledges – codified and tacit – held within universities. Tacit knowledge and know-how are embodied in particular individuals, so as a first step in the analysis of the knowledge pool we turn to look at the individuals who participated in technology transfer activities in which spin-offs were significant elements.

In the research, we explored who was significant to the regional innovation process in terms of the way it was reported by the firms themselves. There were five groups involved in this process, the technology transfer professionals, entrepreneurial staff in the university, so-called TOP-pers (who went through the TOP programme), professional managers within spin-offs and third party firms seeking access to knowledge. This characterisation of groups, and indeed the types of people spoken to in the research, were quite different from those interviewed in the Newcastle research; whilst in the Newcastle research, the professional research group in many cases acted as a closed incubator unit, the innovation and incubation process in Twente appears to be much more open. In this section, we characterise the various individuals participating in the regional knowledge pool into five distinctive groups.

6.1.1 The managerial and professional technology transfer staff

The first group of staff involved in technology transfer were the university staff who were involved in technology transfer, and not part of the faculties themselves. There were a number of distinct sub-classes within this group, playing different roles in the internal knowledge community, an issue which will be dealt with at more length in chapter 7. What is worth indicating at first is that there was not a separate group within the university responsible for technology transfer. The university had created Transfer Research and Development in 1979 under the administration of Dick van Barneveld, and that had grown until the 1990s, when it became the Liaison Group, managed by Jan van Alsthé. However, from 1998 there was a determination within the university to get rid of the Liaison Group, and the technology transfer elements that remained by that time were moved across to CIOT as part of the creation of NIKOS (*qv*). Consequently, at the time of the research, there was not a formal

department or branch of the university responsible for technology transfer and regional engagement. The responsibilities that might conceivably have been found in such an industrial liaison office were spread across the other groups involved in valourisation²¹.

The first of these groups were those on the policy staff, including the Executive Board and also their staff who ran the mechanisms by which commercialisation and spin-off policy was enacted. UT was unusual in the Netherlands in that there was a formal office of the Vice Chancellor with around 15 staff, in contrast to the more usual 6-8. Despite this larger staff, the professors in the faculties and research institutes retained a high degree of autonomy concerning scientific matters, which in turn reduced the scope for the development of commercialisation policy in the university which can be enforced. The availability of a larger central staff did however mean that there were the staff available to develop policy for technology transfer and to operate a formal technology transfer framework, the Holding Technopolis Twente (HTT). One of the board members had a specific responsibility for regional engagement and commercialisation (Willem te Beest), and HTT was formally accountable to him, with a director and a Vice President. At times, when various board members had taken a more active interest in commercialisation, special advisers to the board had been employed; Frans van Vught employed Sjoerd van Tongeren initially to act as a special adviser to the board before moving to be the Vice President of *HTT*.

Figure 5 Branding: “University of Twente: the entrepreneurial university”



Source: University home-page (www.utwente.nl)

²¹ Many of the interviewees referred to valourisation rather than commercialisation; one interviewee explained it in terms of the word commercialisation having rather negative connotations around research; the term “valourisation” was adopted from Flemish Universities which had led the way in what Anglophone readers would regard as commercialisation.

The second group of professional technology transfer staff were the business development managers within the Spearpoint Institutes. Although these were created specifically to respond to the *verdieptingsbelied*²², to demonstrate that large numbers of papers, doctoral graduates and research funds were coming out of the university, the three research institutions that were interviewed had also each appointed business development managers. Each faced their own set of challenges: MESA+ involved managing a set of facilities as well as supporting research activity, whilst the other two BDMs were much more concerned with trying to identify research collaboration opportunities within the research centres. All three were however engaged with external actors, so Iddo Bante (CTIT) was on the board of the *Technologie Kring Twente (qv)*, Cees Eijkel (MESA+) is involved with Kennisinitiatief Twente, and Wilbert Pontenagel (BMTI) is involved with attempting to develop a medical school in Twente. A final employee in this area is Frank-Jan van der Velde, who ran the “Tissue Accelerator” within the BMTI; the accelerator is an attempt to pro-actively commercialise by identifying entrepreneurs, funding sources, technologies and market opportunities, then providing a formal framework for those firms.

The third group involved in technology transfer are those people who are running the TOP programmes and its successors. This group is actually a mix of internal and external staff. Thus, for the various TOP-type projects, including Hengelo College’s Incubator Centre, and Kansrijk Eigen Baas (a rural incubator programme) there are a number of project managers who are permanently on the university staff. However, the academics within the university (NIKOS) are also involved in the projects, including exploiting the data from the projects to convert into research projects. There are also a limited number of consultants involved in running TOP, mainly through TOPSpin International, a foundation formed in the 1990s to hive off the TOP activities which did not relate directly to the interests of the university. The reason these consultants are significant is because they have extensive business networks which they draw upon in appointing the TOP Commission, the panel for each TOP-per which guides them through the supported year.

²² The deepening policy; the decision by the Government research funders to concentration research funding in a limited number of globally excellent research centres.

6.1.2 Professors and permanent entrepreneurial staff

The second group involved in technology transfer were the professors themselves. Unlike the case of Newcastle, there were relatively few examples of where the professors themselves were active in commercialisation and had established their own companies. This appears to have been a reflection of the emphasis within the Dutch academic system on the primacy of scientific outputs and an undervaluation of commercial outputs. However, there were some professors within the university who were clearly entrepreneurial, not merely in terms of setting up their own companies, but also in being creative in managing a commercial research group, using that to channel resources back into the main research group, and sharing resources. Alongside this were the scientific directors of the Spearpoint institutes, who were entrepreneurial in the way they were able to develop the institution at the same time as managing their own *leerstoelgroep*²³.

In this research, we identified three staff members who could be described as entrepreneurial professors in the sense that they managed an academic and a commercial element within a single research laboratory. One example of this was a professor who had developed a formal commercialisation centre within his academic laboratory; the two were both run within the university, but the commercialisation centre was able to take short-term projects from businesses and share the infrastructure supported by the academic laboratory. The trade-off for the professor was that the repeated and informal contacts with businesses necessary within a commercialisation centre helped to sharpen the application of his own research, by providing interesting questions for the academic research to answer. A large number of TOP firms had emerged from that research group, and that stimulated the professor to set up his own business, which he did in partnership with a business consultancy specialising in new business creations. Thus, the three elements of the “entrepreneurial professor” were all to a degree mutually reinforcing, the academic

²³ The “leerstoel” group is the basic organisational unit of Dutch research, and is led by a professor, has a number of other academics, assistant and associate professors, and employs a number of post-docs and Ph.D. students, as well as hosting a number of masters’ students on placements and undergraduate assistants. Thus the working strength of such a research group (one professor) may be fifty people, of whom twenty are employees and five are academics.

work, the commercial activity and the spin-off company. Although two of the three entrepreneurial professors were previously employed at external companies, the third of the entrepreneurial professors had always been since his doctorate a university employee.

The second group of entrepreneurial professors were those who were involved in running the research institutes. We have already seen that those spearpoint research institutes had all appointed their own commercial directors, but it was also clear that the entrepreneurship of the scientific directors was important in ensuring the success of the research institutions. This was not least a function of the fact that the institutions were virtual – almost all professors in the university belonged in name to a research institute. The research institutions therefore had to be made into real institutions, with cross-group interactions, and the entrepreneurship of the centre directors came into play in this regard. One scientific director created a small fund to create multi-disciplinary Ph.D. positions in emergent areas, demonstrating that the research institute was stimulating novel research and encouraging multi-disciplinary work. Another centre manager had used the existence of a long-standing set of multi-disciplinary taught courses as a mechanism to recruit genuinely multi-disciplinary research staff (Ph.D.s and post-docs) to create new research groups outside the original faculty structure which gave legitimacy to the claims that the institution was more than a badging exercise. A third scientific director is a board member of the regional venture capital fund, PPM OOST and has been involved in ensuring that there is sufficient venture capital in the region to support the spin-offs which are emerging from the research groups in the centre. In all these cases, the professors were entrepreneurial in the sense of combining a variety of assets – university core-funding, ‘headroom funding’, commercial income, and marketable assets to produce ‘objects’ which demonstrated the value added of the research centres. Even though the scientific directors were not always themselves directly entrepreneurial, they were actively part of the university commercialisation community and contributed directly to the regional knowledge pool by expanding the scope and the opportunities available within the region.

There were also a number of university staff who then set up their own company in some manner. There were activities which operated as independent companies but were really just university activities, such as the MESA+ facilities management

company, the Hotel Drienerburgh company and Twente School of Management. However, there were other activities which emerged from the university from staff who wanted to establish their own companies. The most obvious example of this was when the university developed activities and these moved away from core university functions and so were privatised; both TMP (C2Vs forerunner, *qv*) and TOPSpin International fell into that category, and TTT (the precursor to 3T that was a successor to the Centre for Micro-Electronics Twente) fell into that area. It is possible to regard the Telematica Institute (*qv*) as a variety of this type of spin-off, the university research group supporting the creation of an independent research group. There was only one example found of where a company had been set up directly by a non-professorial member of staff, which in turn placed the funds into the university to employ him. One interviewee also reported that two of his technicians had left to set up companies making machines that he used in the laboratory, although it was not possible to corroborate this directly.

6.1.3 Temporary entrepreneurial staff (TOP-pers)

Possibly the most significant group involved in the regional knowledge pool were the TOP-pers, the participants in the temporary entrepreneur scheme at the university. The basis of the scheme was that anyone could apply to participate as long as they had an idea for a product, links to and moral support from a university research group, and were willing to work on the development of the business plan. This meant that any potential entrepreneur could use the scheme to access the loan, accommodation, technological support and commercial advice, not necessarily just those university graduates envisaged in Professor Van den Kroonenberg's original scheme. Indeed, by the time of the research, the various TOP-pers had a very wide range of backgrounds, as shown in table A below. Another significant fact is that a number of the TOP companies produced their own spin-offs, and in some cases, those companies were themselves eligible for TOP; the most notable example of this was Aquamarijn (a corporate TOP company), which also produced Medspray and NANOMI as graduate TOP-pers. TOP was intended to be a very flexible scheme, and it was for example opened up and promote to former employees of the Ericsson R&D facility in Enschede when its closure was announced in 2002.

Table 3 Source of the entrepreneurs behind the TOP schemes

Source of TOP entrant	Number
Graduate of university – first activity	5
Spin-off of TOP parent	3
Corporate Spin off	3
Corporate Closure	2
External person attracted to region	1

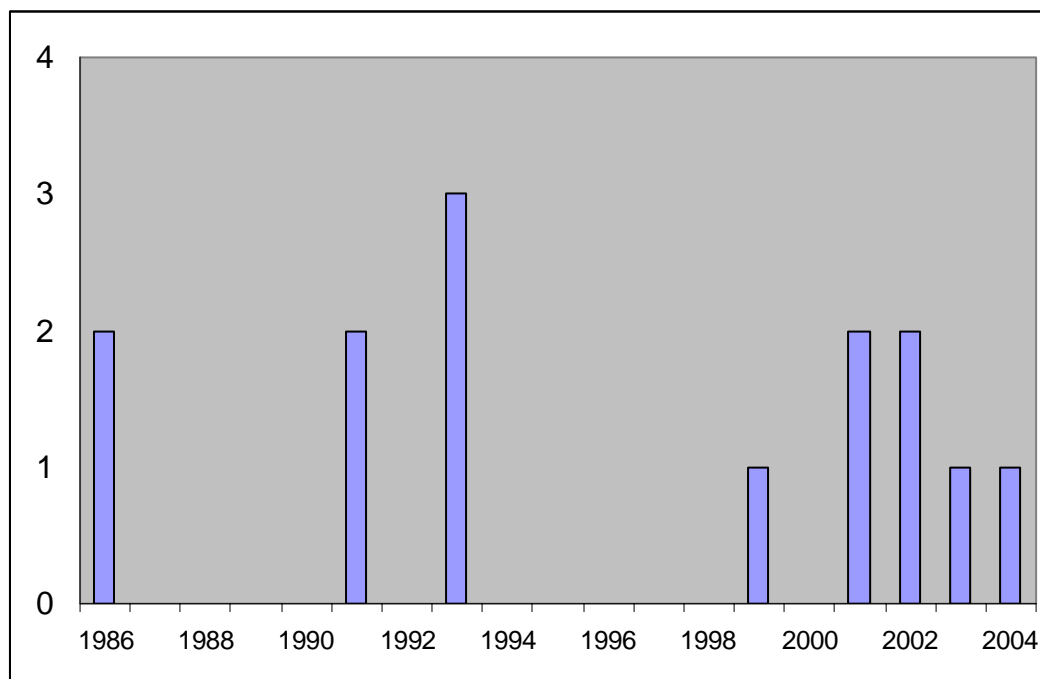
Source: authors' own calculations

The TOP scheme was not a formal university incubation scheme, and the entrepreneurs did take real risks in entering the scheme. The loans were personally secured rather than against the company, so if the company failed, the entrepreneur was still liable to repay the funds (€14000). These TOP-pers were not independent of the university, however, because of the requirement that there be a link to a research group; in many cases there were technologies that the companies exploited and so the university held stakes in those firms in return. Many of the companies had fairly extensive links to the university, but also, to each other, because TOP-pers in many cases had been students or had supervised other TOP-pers in similar areas. This meant there was a natural affinity between the companies, mediated through the university.

One function of the way the research operated was that the technological areas of the firms were fairly limited in their scope, and a large number of TOP-pers came from a relatively limited number of research groups, in particularly the MEMS group of Miko Elwenspoek and the MTG group of Matthius Wessling. However, beyond that, the most notable thing about the TOP companies is their diversity; the TOP programme is an archetype for what Clarysse *et al.* (2004) describe as a “low-selectivity” scheme, that is there are very low barriers to entry. Consequently, they cover a very wide range of business types, from consultancy, to manufacturing, and other service provision, although always tightly linked back to the originating university department. This makes it very hard to characterise them beyond providing some outline figures for them. One of the firms interviewed has grown to employ 200 staff on a turnover of €20m, whilst a further three employ more than 20 staff. The

TOP firms are also relatively evenly distributed in terms of their dates of formation, as the figure below shows.

Figure 6 The date of formation of the TOP companies interviewed



Source: interviews

6.1.4 Third party businesses

One area where there was less direct participation in the regional knowledge pool was by third-party firms. In part this was a consequence of the fact that the links between the firms and the professors was much weaker than in the case of Newcastle, where professors were undertaking commercial work through spin-outs as well as academic research. Consequently, there was not a strong link for third party firms into the university through the spin-off companies; the concept developed in chapter 2 suggested that USOs would increase accessibility to the university, by making the university better at working with commercialisation. However, commercialisation in terms of working with third party firms was separate from the formation of spin-outs. Whilst professors led on business interaction and collaborative research, USOs tended to have much looser links to the university. This was further reinforced by the fact that national funding programmes for collaborative R&D were not easily used by spin-off firms, and ran more smoothly when large firms and professors steered research projects which were then undertaken within the universities themselves.

There does therefore appear to be a lack of involvement of third party businesses in the regional knowledge pool, and in particular, commercialisation does not appear to have improved the participation of SMEs in the knowledge pool. Although the research did not find very much evidence of improved third-party participation in the knowledge pool as a consequence of USO activity, there are two areas where USOs were involved in improving the functioning of the regional knowledge pool.

The first area was that spin-offs had had a significant impact on the way that the university organised its commercialisation activity, and this meant that systems were already in place for engaging with small firms. The commercialisation directors of the Spearpoint Research institutes all had dealings with local small firms, and were helping them to work with the university staff in developing joint research and commercialisation activities. One of the TOP firms in which the university had a stake was formed by an entrepreneur who moved from another company to set up the business, and located in Twente because of the presence of the research group, and used this to negotiate access to the TOP scheme. The university also took a stake in the company on the basis of the co-operation between the firm and the university, and this was done through the HTT mechanism. We have already seen that the HTT mechanism was developed through past experience with other companies which more closely fit the archetypal TOP company of an engineering masters graduate commercialising something from their thesis. The presence of the extensive technology transfer infrastructure around the university therefore hides the extent to which the spin-off activities are opening up the university to third parties through these mechanisms.

Many of the innovative companies in Twente are large companies and these engage with the university, and are facilitated in some cases by the presence of USOs. In one example, the University of Twente was awarded €280,000 as part of its “Technology Exchange Cell”, which was led by Thales, the French defence manufacturing. The concept behind the project was to speed up product development in the medical sector by using virtual technologies and gaming approaches to identify new product/ market combinations. The project relied heavily on the presence of a number of USOs who could participate in real activities to populate the virtual design environment and give it real capacities. Likewise, the MESA+ facility had a number of contacts with large firms, who came to the university to use the commercial clean-room facilities, and in

two cases had located staff on that site. Those (high cost) clean facilities were themselves dependent on having a high local demand, much of which was provided by USOs located in the MESA+ incubator. Thus, the USOs in both these cases were important in opening up the university to outside parties, although in this case, large companies.

6.1.5 Business support agencies

What was perhaps most distinctive about the Twente case study with respect to both the literature but also the Newcastle case study was the degree to which the business support agencies were actually themselves a part of the knowledge pool. We regard the knowledge pool as providing a set of assets that businesses can draw on in seeking to overcome problems they face in the innovation process. It was perhaps surprising to discover how active these organisations were in directly assisting companies, as well as providing particular services to spin-offs and other high technology starter companies. We have already noted that the consultants to the TOP programme brought their own contacts into the scheme and used that to help the TOP-pers to access other regional assets. This sharing and networking extended into the business support agencies; there were a lot of people performing what were ostensibly bureaucratic functions, but brought to them experiences with science, entrepreneurship and innovation which were themselves drawn on by the entrepreneurs in a variety of manners.

A small number of those business support staff interviewed had formerly been entrepreneurs, but had either sold their companies or were more passively involved in them. Other business support agencies had been involved in high technology companies as employees, including university spin-off companies, and had been involved in innovation. This meant that the people developing policies for the support of high technology companies, including Triangle, Twente Technology Valley and the *Kennispark Initiatief* had their own direct experience of innovation problem solving in a less successful company. These activities and agencies also had links back – at a variety of levels – to the university itself. The overall effect of this was that there were a huge number of connections between people in the region which facilitated the accessing of resources for innovation and entrepreneurship. This definitely made a contribution to the knowledge pool, in some cases through tangible activities like the

Business Technology Centre, whilst in other cases, the connections helped to identify people who would be of help in dealing with particular problems and situations.

6.2 Processes of participation in the knowledge pool

For each of these groups, they each had their own motivation for participating in the knowledge pool. The university management was interested in creating a set of new entrepreneurial companies, to validate their position as an entrepreneurial university and their regional leadership role, which in turn legitimated the shaping of regional development projects towards their own interests. University academics were mainly interested in seeing their works valorised, both in terms of pieces of technology becoming commercialised, but also their masters' and Ph.D. graduates finding useful and productive work. The USOs, both TOP and other, were interested in establishing relationships with the university to cheaply access technology resources, whilst the TOP firms benefited from the access to assets that the scheme facilitated. The third-party firms were largely interested in accessing university technology resources as cheaply as possible, and the business support agencies were attempting to support high technology development to solve the 'regional problem' faced by Twente of a persistent lag between the regional and national economy. The mechanisms through which they participated in the knowledge pool reflected their divergent interests in the regional knowledge resources to be made available.

6.2.1 University management participation in the knowledge pool

The university management did not participate extensively in the knowledge pool, although obviously, the policy framework which they established was an important controlling factor on the capacity of other actors within the university to participate.

The first main mechanism that the university management were able to use was the Holding Technopolis Twente, the company established to management the university's IP. At the time of the research, there had recently been a new appointment to run this company, and this signalled a more general interest by the university managers to take control of technology transfer. Although the TOP scheme had been reasonably successful in its own way, it operated outwith the control of the management, and was a responsive rather than pro-active scheme. This possibly explains why the university management had developed the idea of the "knowledge accelerators" as a way to focus on a single technological field. The single field was

then more “controllable” for the senior management, in that they could approve or reject each field in turn, and had been able to approve the first accelerator, dealing with tissue engineering. Although it was reported that the purpose of HTT was ensuring commercialisation activities were held at a distance from the university, the knowledge accelerator arrangement also allowed the university management to take a close interest in them.

The second main involvement of the university managers in the knowledge pool was through their involvement in external activities. The Rector Magnificus, Frans van Vught, was a member of the national “Technology Platform”, which aimed to improve the technology policy environment in the Netherlands. After he retired as Rector, he was invited to serve on the Twente Innovation Platform, which was created to ensure that the Twente region benefited from the regional development strategy, Triangle. The university were also shareholders in a variety of activities that supported innovative high technology entrepreneurship. The university held shares in a number of spin-offs, which were managed through the HTT, either directly, or through PPM OOST, in which the university had a shareholding. Table B below shows the TOP companies in which the university had a participation.

Table 4 Participation by the university in TOP companies

Shareholding - PPM OOST via Innofonds	Direct HTT shareholding
Demcon Twente B.V.	HOMA Software B.V.
Fortes Solutions B.V.	Lionix B.V.
Lionix B.V.	Micronit Microfluidics B.V.
Micronit Microfluidics B.V.	SmartTip B.V.
Wireless & mobile communications Institute	Teletop B.V.
Twente Medical Systems International B.V.	
Travel Service International B.V.	
Vitriline B.V.	
Xsens Technologies B.V.	

Sources: www.utwente.nl/htt/deelnemingen/index.html; <http://www.ppmoost.nl/>

The third contribution made to the knowledge pool by the university management and central services was through the work of the business development managers within the Research Institutes. The BDMs were not in their currently employment academics, although they had solid experience of academic work, either through having been academics themselves, or having worked with academic research partners in large corporate research environments. The Business Development

Managers built a lot of the connections between firms and academics, and provided a degree of redundancy capacity. It was hard for academics at UT to build relationships with SMEs, because SMEs often lacked the research funds to work with academics. The BDMs appeared important because they were able to find ways to bring SMEs into the university, either as collaborative partners on ongoing research projects, or by building networked research projects where the SMEs only had to find a share of the costs.

The final contribution to the knowledge pool made by the university corporately was in the provision of what might be termed “infrastructure-in-use”. A number of the research institutes had some kind of physical infrastructure, and were able to make this available to SMEs to use for their own development activities. MESA+ was a very good example of this, in that it had a clean room, with a lot of machines that had been bought by research groups in the university, but could be hired by the hour, and the Institute could provide technicians to work those machines. A number of the USOs in nanotechnology found this a very useful service. Whilst physical infrastructure was not important for computing spin-offs, who often just needed a computer rather than office or laboratory space, what the university could offer was a massive Wifi hotspot with interesting development potentials not available elsewhere in Europe. There were three hotspots, one at the campus and one in each of the centre of the two nearby towns, Hengelo and Enschede. This infrastructure was interesting because it provided a ‘living laboratory’ for companies to develop solutions for portable applications which used (free) Wifi where available, and (expensive) GSM where not; there are obviously significant potentials for this in health informatics and continual health monitoring of moving subjects (e.g. pregnant women). Although the infrastructure was developed for the students’ needs, the particular BDM involved had ensured that it was allowed to become a wider territorial asset. There was also a group within the university doing research on it, and a group of technicians and other staff ensuring that the system worked more generally, and so used to dealing with (student) inquiries about the system, but also able to work collaboratively with other firms.

6.2.2 University academic participation in the knowledge pool

We have already noted that there were not a lot of academics who were running spin-offs as adjuncts to their ‘main business’, running an academic laboratory. There seemed to be something of an antipathy amongst professors to mixing academic and practical research. That being said, we interviewed some professors who were involved in commercialisation activities, and there were other spin-off companies, such as Teletop BV, who have links back to founding professors, in that case Professor Betty Collis. However, despite a rhetoric that the university is entrepreneurial, the attitude of the professors towards entrepreneurship remained ambiguous, with some professors interested in establishing companies, and others more concerned with their integrity. One associate professor in a research group which had produced a good number of spin-outs made it clear that commercialisation was not a university task from their perspective.

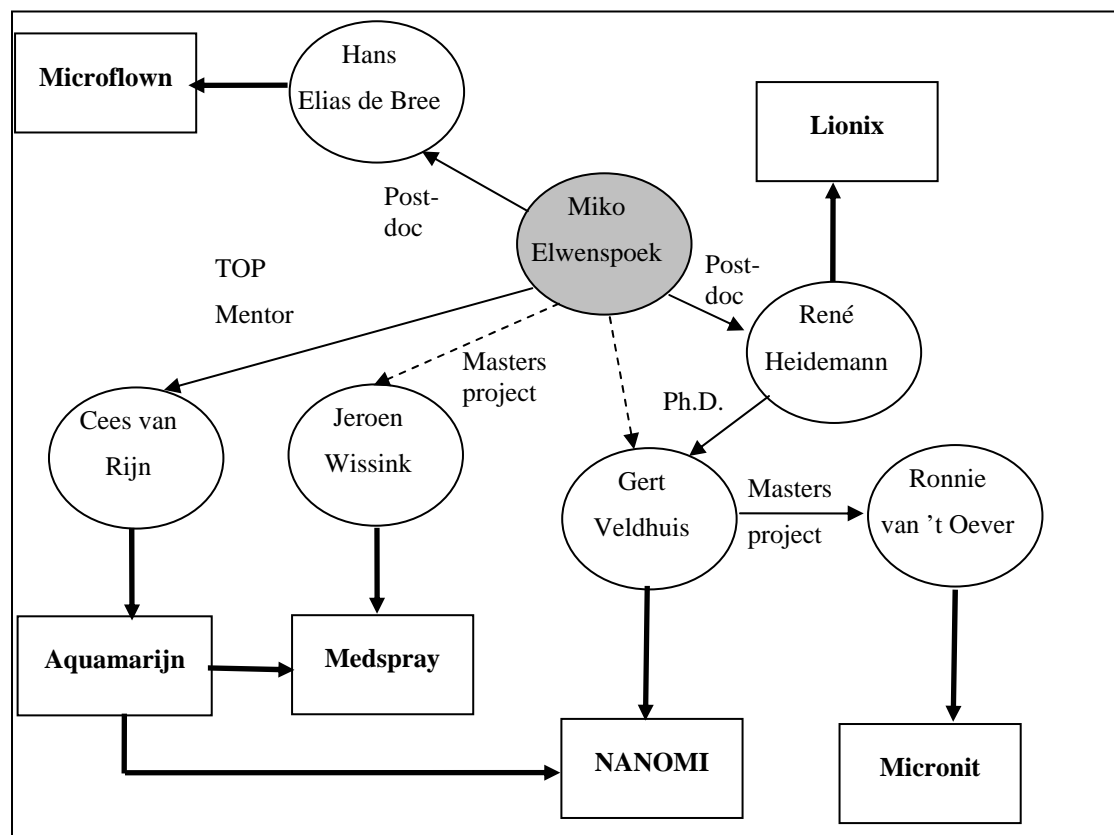
“We do not do that [commercialisation] ourselves. Usually when we do a project, we already have contracts with industry, especially in STW projects, we have the users committee, and we have these meetings. And as soon as there is something coming out of these projects that they want to use, then we encourage that, we would like them to use the research. But we will not do that ourselves... we make sure that those people that are involved know all the details, and if we have an idea of, of what could be an application, we will certainly tell them about that.”

Arguably the greatest impact of the academics on the regional knowledge pool is the role they play in nurturing the people who then go off and form spin-off companies. The research group operates as a community in which the participants learn a set of skills, build a set of contacts and decide to establish their own companies after completing some element of their education. The key mechanism is the education, in which the future entrepreneur participates in the normal life of the research group. In the Dutch system, graduates and promotions (Ph.D.s) are performance indicators which determine the unit of resource which the universities receive; in their pre-entrepreneur incarnation, the university is performing a teaching or research activity. In some cases, future entrepreneurs become involved in writing papers that then contribute to the research output of the group. However, in the course of that

routine activity, the junior staff members acquire a set of assets which then enable them to establish, at some later point, their own company.

The mechanism through which this operates is quite complex. In figure C below, we show the connections between one professor and six spin off companies; two of the spin-offs were founded by people who were masters' students within his group, two by his post-docs, one by a Ph.D. student, and one by an individual he mentored through the TOP scheme. However, this diagram does not show the complexity of the relationships involved in the formation of the companies; two of the companies are themselves spin-offs of Aquamarijn, and there are a range of other relationships between actors within the diagram that are not shown for reasons of clarity. Four of the companies are located at the MESA+ facility and still have regular contact in the various laboratories and clean rooms there. This is something which will be dealt with in more detail in Chapter 8 when we consider the extent to which what has built up around MESA+ can be considered a novel sequence of innovation, or a regional cluster.

Figure 7 The USOs pre-incubated within the MEMS research group, 1994-2004



Source: authors' own design

This raises the question of what it is in the research group which leads it to be such a useful source of entrepreneurs. The research suggests that there are a number of factors which make the research group in this case function as a pre-incubator for entrepreneurs:-

- The existence of supporting infrastructure: four of the companies are TOP firms, four are located at MESA+, two of the companies have investments from PPM OOST and two from the university so there are mechanisms to support useful ideas.
- Demonstrations: the firms shown in figure C above have emerged over ten years, and the rate at which they have formed has increased over that time; there are expectations amongst group members that good ideas can be turned into companies,
- Peer networks: a number of the firms interviewed noted that during their time in the research group, they made a range of contacts which could be exploited in a variety of ways when they came to set up their companies, from finding staff, to knowing other companies to get help from, to being able to commission small pieces of work during periods of extreme time pressure..

We highlight two features of this. The first is that the basic unit for the activity appears to be the research group (*leerstoelgroepen*), but that is not actually strictly true. In figure B above, we have omitted to show that a second research group – relating to membrane technologies – is also involved in that sequence, as well as having its own spin-off companies. What appears to be important is a critical mass of cross-fertilising activities creating technologies that meet the demands of applications, in the case above between micro-engineering and membranes, introducing nano-lithography techniques to membrane production. Likewise, in biomedical engineering, tissue engineering emerged as a cross-fertilisation between mechatronics and biotechnology, whilst in IT, the critical mass has emerged around various specific applications, particularly in medical fields. The academics were important in providing internationally recognised research groups that were pursuing elite research pathways in ways that led to the formation of spin-off companies.

The second key feature is the lag between the creation of the knowledge assets (during the individuals' time in the research group) and their use at the point the

graduates set up their businesses. In this sense, although it is true that the professors themselves are not being directly entrepreneurial in the sense of setting up their own companies, what they are doing is creating environments in which entrepreneurs can later flourish. A number of firms have formed explicitly to provide the ‘knowledge’ present in the particular laboratories; Pervatech and Krabbe were formed by technicians from the Membrane Group to sell machines developed in the Membrane Technology Group to a wider group of customers. As another professor involved in research activities noted, the companies did not relate directly to the research, but drew on knowledges necessary to research.

“Mostly, it’s not a sort of a specific project, so if you have a project to do research on a certain type of sensor, it’s usually not the sensor that is later used by industry. But it’s usually some spin-off items of the project, a certain fabrication technique or detail, so a lot of things that are used in practise are not the things we relate to in the project”.

A final contribution made by the entrepreneurial professors was through the attraction of new activities to the region. A number of speakers from the regional development agency and companies were clear that the professors were one (important) consideration for locating in the region. One US multi-national, for example, located its European office in the Business Technology Centre Twente specifically to work closely with one particular professor.

6.2.3 Spin off participation in the knowledge pool

A critical feature of the knowledge pool around UT was the spin-offs; in part this was a deliberate function of the low-selectivity approach pursued by Professor Van den Kroonenburg, but it was also a reflection of the difficulties that academics/*leerstoelgroepen* had in engaging regional companies whilst pursuing individual trajectories. The original concept was that the spin-off companies would force knowledge into surrounding businesses. This was to a degree limited by the specificity of much of the knowledge, and the lack of local demand for the skills, and in this research we did not interview any generic business consultancy firms. Given that the focus was on high-technology spin-offs with close relationships to research groups, it is hardly surprising that there was not much direct technology-push into local businesses. One spin-off provided IT services to local businesses in the

Business Technology Centre, and that gave the business a base-load of work to ensure its survival. However, the majority of the firm were so-called “born global” firms with international clients; even those involved in consultancy tended to do so as part of international knowledge flows with little regional footprint in Twente.

One of the contributions that spin-offs made to the knowledge pool was supporting the university knowledge pool. One of the spin-offs set up a company in a totally different field, drawing on technologies developed by Greek academics; subsequently, they developed links with academics in UT, and that led to a high-quality paper²⁴. Spin-off firms needed at the point of formation to quickly win contracts, and given that they were known to the university, selling into the university could prove useful in that regard. In many cases, doing this helped the university contribute to the knowledge pool. TOP in its current form only survives thanks to the ESF funding that a subsidy consultant won for the university in 1989, after which time 80% of the firms were formed.

MESA+’s own commercial laboratory facilities were run on two occasions on contracts to individuals establishing their own spin-off companies. At least one of the companies won grants for a machine for the MESA+ clean room, and that machine was available more generally to other companies after the life of the project; another company was involved in a kit-share, so the firm paid 50% to be able to access that machine half of the time, which was all the time they needed it for. The spin-offs also provide a legitimacy resource to the university, demonstrating that the university is indeed entrepreneurial – MESA+ is regularly visited by Government Ministers – in the last year preceding the writing of this report, MESA+ was visited by both senior Ministers in the Dutch Department of Economic Affairs (potentially important in terms of changing the place of Twente in the Dutch spatial imaginary, something we deal with in more detail in chapter 9).

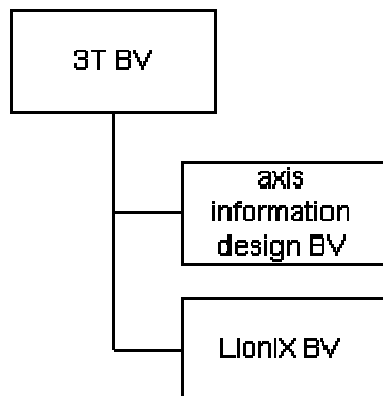
The second contribution that the spin-offs make to the knowledge pool is in terms of creating collective activities outside the university that create innovative assets more widely accessible. One example of this is the Mechatronica Valley Foundation (*qv*)

²⁴ Groß, P. Boller, K. J. & Klein, M. E. (2005) “High-precision wavelength-flexible frequency division for metrology” *Physical Review A (Atomic, Molecular, and Optical Physics)* 043824 (2005) (8 pages)

which was created to replace a retiring professor whose students were important to many regional companies involved in Mechatronics. Another example of this is the Twente Initiative for Medical Products, which was the subject for a Ph.D. thesis at the university (Klein Woolthuis, 1999). They are currently involved in the development of a number of specific projects, and the original idea has been co-opted by the regional development agency in support of the 'Triangle' concept. Spin-outs were also involved in revitalising one such organisation, the Twente Technology Circle (TKT) which is a networking organisation for regional SMEs; a number of the spin-offs noted that TKT (meeting entrepreneurs) was useful to them for solving the problems they faced in establishing new companies, such as developing their business plans, identifying new customers and raising finance. In contrast to the North East of England, USO founders played prominent roles in these regional activities, initiating, shaping and developing them. Dennis Schipper, founder of Demcon, for example, is involved in all three of these activities, as were Iddo Bante (a BDM) and Martin Eggink (owner of 3T, a spin-out of the Government research centre CMET).

The third contribution made by the spin-offs is that they provide a second degree of stability to the regional knowledge economy, which is still relatively new and underdeveloped, and was particularly hard hit by the bursting of the technology bubble in 2000/01. Innofonds, for example, saw a number of its investments fail as a consequence of the technology downturn, but one spin-off company bought out two of these companies from that firm, and was able to ensure that some of the company (including around half the associated jobs survived). The spin-offs have also moved activities between them as they have changed technology focus, drawing on the existing close links and knowledge in the business. A number of the spin-offs have produced daughter companies at varying degrees of remove, so two of the spin-offs, Axis and Demcon, have grown to become medium-sized business groups, whilst other companies have seen their own 'daughter' companies emerge. One example of this is shown in figure 6 below, taken from the website of 3T, which describes its daughters as partners.

Figure 8 Through the years, 3T BV has grown en (sic) two new partners originated from 3T BV

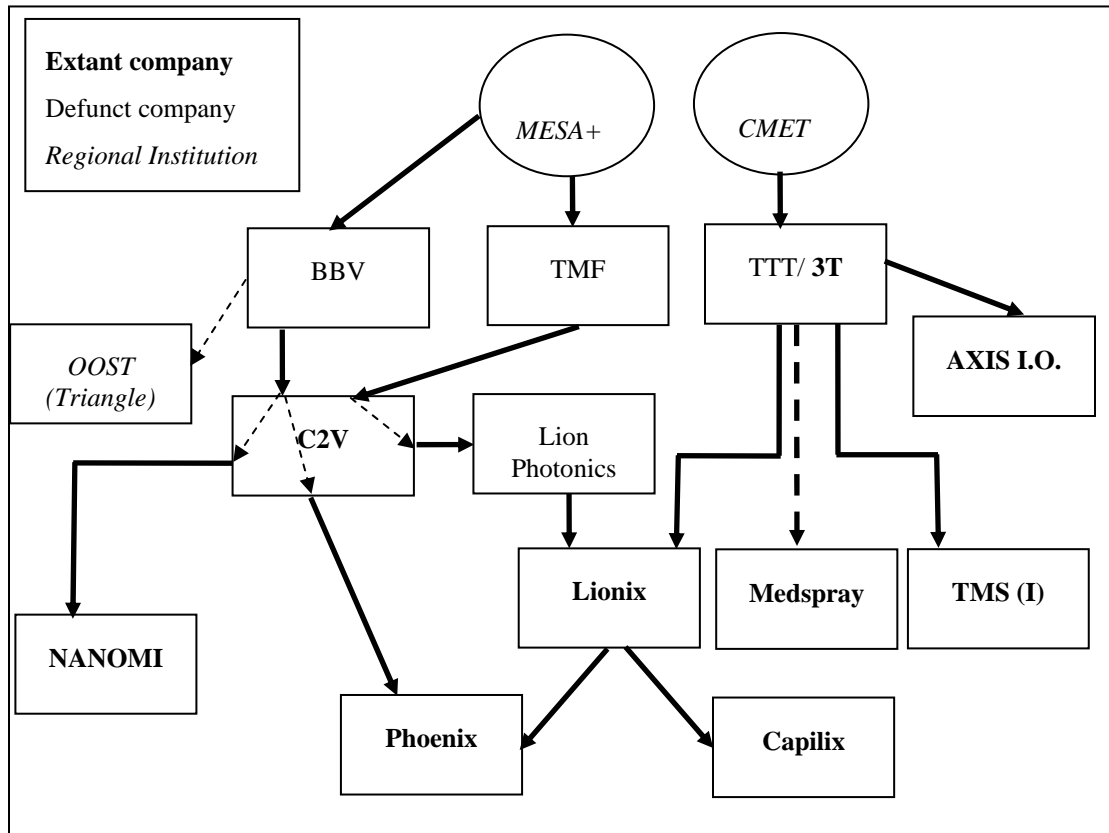


Source: www.3t.nl

More generally, the groups of small firms that emerged from the university were attractive to outside investors, and they contributed to building a sense of critical mass around the university.

This stability is illustrated in figure 7 below; there are some overlaps between this diagram and figure 5 above, but they demonstrate complementary aspects of the Twente model, namely that the research groups incubate connections and strengths that endure and are taken forward by individual entrepreneurs in the regional environment. Even when there are regional mishaps, like the bursting of the technology “bubble”, then the presence of other cognate activities helps to re-attach activities that come under pressure to the regional economy. 3T is an example of a company that has largely reinvented itself after its privatisation, but by finding partners for its unwanted activities, it has very effectively grown itself whilst maintaining its focus, leading to one of its products being named winner of the Mechatronics Trophy 2005, a Dutch biennial design competition.

Figure 9 The stability and continuity provided by the a group of spin-out companies from MESA+ and CMET



6.2.4 Other participation in the knowledge pool

There are also a range of actors involved in the production and support of the knowledge pool in the region of Twente, complementing and supporting the work of the other regional actors. What has been notable in this work is that they interacted closely with the university, and the spin-offs and have shaped their own strategies to reflect the strengths which the knowledge pool bring. These actors have contributed to the production of tangible knowledge pool mechanisms, which we identify and analyse in some more length in the following section. There were other regional firms involved in the knowledge pool to some degree, including Thales and Ureco. Thales helped to win for Enschede a share of the Triangle funds through its Technology Exchange Cell proposal. However, these contributions had not yet left their imprint on the regional development infrastructure as markedly as had those of the regional development agency, the municipality and the BTC (*qv*).

The regional development agency, OOST, is very interesting in this regard, as it contributed in a variety of ways to the various knowledge pool development

mechanisms identified. There is clearly motivation from the academics and the spin-offs to form clusters, to collectively innovate and develop new products. OOST has been active in supporting those activities; Mechatronica Valley had already been incorporated into the Twente Technology Valley (part of “Triangle”), and there was support for other such collaborative activities like the TIMP (the medical cluster). The RDA had recruited staff who had direct experience of the spin-off environment with responsibility for developing the technology element of the RDA strategy. The RDA also contributes to the “stickiness” of knowledge in the region. When a large inwards investor announced its closure in 2002, the RDA (OOM at that time) attempted to sell the business, and when that failed, helped a number of spin-offs to form, the most notable being Wireless & Mobile Communications Institute. This company (not interviewed in this research) was supported by the university via shareholdings but also a research contract, and is now part of the commercialisation activities around the IT research centre (CTIT).

The municipality has been quite supportive of the spin-outs coming out of the university in a variety of ways. The concern for the municipality was to ensure that the regional development strategy for the East (Triangle) brought maximum benefits for Enschede. The university is a clear benefit for the town, and it provides very valuable outputs for the local economic development strategy. In return, the municipality has supported the university and the knowledge pool in a number of areas. The Roombeek project is an good example of this; Roombeek was the site of the fireworks factory explosion in 2000, which devastated a poorer suburb of the town. Telematica Institute, a university spin-off institution, have been involved in the redevelopment of the site, and have recently moved into new premises in Roombeek, five km from the university campus. This in turn relieves some of the pressure of space on the university at a time when the university is cutting its floorspace because of the demands of its huge rebuilding programme.

A third local actor involved in supporting the regional knowledge pool is the Business Technology Centre-Twente, which we mentioned initially in chapter 4. The BTC has built up interactively with the development of the knowledge pool – its growing size reflects the growing demand for accommodation for knowledge-intensive businesses. The BTC has taken over management responsibilities for a second building

(“Capitool²⁵”) on the Science Park site, to provide space to accommodate growing high technology firms as well as managing a high technology incubator unit in Roombeek, the former Grolsch factory. Two of the three firms occupying the Capitool site are spin-offs of the university, Xsens and Newcom Consulting (although neither were interviewed in this research). The BTC itself hosted 10 spin-off companies interviewed in this research (including TOPSpin International, a not-for-profit foundation), out of a total of 66 companies listed on their web-site when this report was being drafted. A number of the other companies interviewed had at some point been on the BTC as part of the foundation process. It was deliberately decided by the BTC to avoid involving themselves with the development of companies, through participating in them or by selling them value-added services (beyond facilities management). The various staff involved with the management of the BTC have also been actively involved in the TOP programme as commissioners (the people who advise the individual TOP-pers).

6.3 Mechanisms for the deepening and sustainability of the regional knowledge pool

In the previous section, it has become clear that there are common mechanisms by which the knowledge pool is operating, with different groups of actors making different contributions to the knowledge pool. The next step in the analysis is to move from the analysis of what each group of actors was deriving as benefit from the knowledge pool to looking more closely at how one-off interactions with the knowledge pool were producing more stable hybrid assets outside the university that could be regarded as “territorial innovation assets”. In chapter four, we noted that Twente was often noted for the strength of its social capital, and its propensity to network, and this more general finding is certainly seen in the particularity of this particular case. It is the networks that have formed around the spin-off process which have become more solidified and accessible to others, thereby representing territorial innovation assets. Of course, the weakness in these assets is that because they are

²⁵ Capitool is the name of the street in the Business Park that runs from the roundabout parallel to the railway line and Hengelostraat, which in turn separates the university from the Business and Science Park. Maser Engineering (a TOP company) is also located in Capitool, as is the former site of the Ericsson R&D activity, one building now hosts the TOP secretariat.

based on social relations, they are not always immediately accessible to those outside the networks, a criticism levied by at least one interviewee of some of the supposedly ‘territorial’ innovation assets. Before we move to examine how effective these assets have been in improving the regional environment for innovation, we look at three areas where spin-off activities have produced more generalisable territorial benefits.

6.3.1 The formal spin-off process: “many hands building heterogeneous networks”

Although the spin-off company formation process could be thought of as a piece of heroic entrepreneurship, it is clear that there were better ways of conceptualising the process by which spin-off companies were formed around the university. Whilst the earlier consultancy-type spin-outs (such as Van der Meer and Van Tilburg Consulting, Echelon Advies BV) may have genuinely formed independently with only very limited links back to the university, in the previous section we have seen the kinds of interdependencies which USOs, particularly the TOP companies, exploited in their establishment. The USOs which are high technology spin-offs seem to be a nexus of a number of networks, and the “entrepreneurial event” involves drawing on each of those networks simultaneously whilst managing to deliver a particular set of services. There are a range of different networks which are drawn upon in forming these businesses.

- **Academic/ knowledge networks:** although the TOP scheme provides for an entrepreneur to be within a research group for one year, the TOP-pers drew much more heavily on the academic networks, as sources of personnel, as sources of delivery capacity, as contract givers, all of which were vital to the firm effectively ‘moving’ the technology out of the research group.
- **Peer/ business networks:** although the TOP scheme has a formal commission of three members who comment on the business plan, other networks were important for the new firm formations. The TKT was one mechanism which a number of starters found useful in preparing the business plan, and identifying potential business contacts. Another vital element were the roles played by past TOP-pers in supporting new ventures, formally through investment or informally through advice and guidance.
- **Support networks:** one of the main requirements of the newly formed firms was in winning sufficient contracts to become self-sustaining businesses.

There were a range of subsidy programmes that were seemingly readily available for the spin-offs. In some cases, like Technopartner, the firms accessed them on their own initiative, but there were other companies who had become involved in subsidy activities through their business contacts, like Netlab and TIMP.

Each of these networks have their own specificity and scope; the academic networks are incredibly tight, which constrains to where the development can be made. The peer networks – such as those around the TKT - are very loose, although some of them, when companies have established other companies, they are much tighter. Also particularly noteworthy about this process is that it is dynamic, and those that have benefited from the experience have remained in the region to contribute more actively to the process. This has different forms; there is a physical cluster of firms in MESA+ who are co-located with students and post-docs from various nanotechnology research groups in the university, and as we showed in Figure 5, a number of those staff and post-docs have moved across the divide to become entrepreneurs. Elsewhere, companies that benefited from being able to access subsidy programmes, particularly from the RDA, moved to ensure that similar programmes – accessible to other entrepreneurs – remained a feature of what was on offer in Twente. The dynamism of this suggests that the knowledge pool is expanding, certainly in terms of the volume of regional activity.

The spin-off pattern is not limited to the case of the TOP programme. One individual relocated to Twente because he had a near-to-proof idea and personal business experience (good sets of personal capital) and wanted to marry those personal attributes up with assets offered in Twente – the university, the BTC and PPM OOST. The Knowledge Accelerator Model currently being developed is a similar attempt to bring these diverse assets together, but with a greater degree of central (university) control over the process and consequently a greater university share in the outcome. The RDA recognised that there is a general model for supporting small businesses and attempted to develop a model for business support for new high technology firms drawing on these regional networks, the so-called “Technostarters” programme. However, the programme encountered problems in trying to create networks, whilst the strength of TOP and the Accelerator was that they drew on – and extended the scope of - already-existing networks.

Part of the model is the dependency back on the university, then the production of something which is outside the university. This means that the activities are rooted in the region, although subject to buy-out and take-over; one TOP company, X-flow, was bought out by Stork, and relocated to Almelo, 30km away, before being removed back to Enschede when Stork was itself bought out. However, it does call into question the contribution these firms make to existing regional companies, in terms of upgrading their technological capacity. This was the benefit which Professor Van den Kroonenburg originally conceived the spin-outs as bringing. Of course, there were spin-outs which were involved in pushing technologies – often via consultancy – into regional business, but there was not strong evidence that spin-outs were encouraging other firms to be more innovative; although there were third party firms involved in the collaborative research projects, the third-party firms tended to lead their initiation, and the spin-offs to benefit from participation. Only when the spin-offs had become well-established and successfully expanded were they able to bring a wider regional impact.

There is a question of how reproducible those benefits were; five of the fourteen TOP-pers were people who had a corporate rather than a graduate background, and so on that basis it could be claimed that the TOP programme was open to those outside the university. The fact that OOST were able to use the TOP programme as a means to support spin-offs from the Ericsson R&D centre closure suggests that the scheme was not as closed as it might have seemed. However, in all those five cases, the TOP-pers had some link to the university; in one case, they were merely working with a research group to use their equipment; in other cases, they had collaborative research projects with the university. The TOP programme is not therefore a ubiquitous mechanism for entrepreneurship; rather, it depends on identifying entrepreneurs with the capacity to absorb a set of assets that the university then makes available. Rather than being a fully autonomous activity, it is more of a boundary spanning function, bringing two bundles of assets together – those held by the university, and those held by the entrepreneur – and combining them to create a company. This reinforces in some ways the challenges faced in the regional; the assets which are combined in the TOP programme are quite valuable, although not exploited; these companies do not emerge *ex nihilo*. This of course reinforces the fact that the knowledge economy in Twente is not *terra nulla*, and that this policy has

been successful in creating knowledge assets which can be combined to produce new businesses.

6.3.2 Regional stickiness: ensuring sustainability in a subdued regional environment

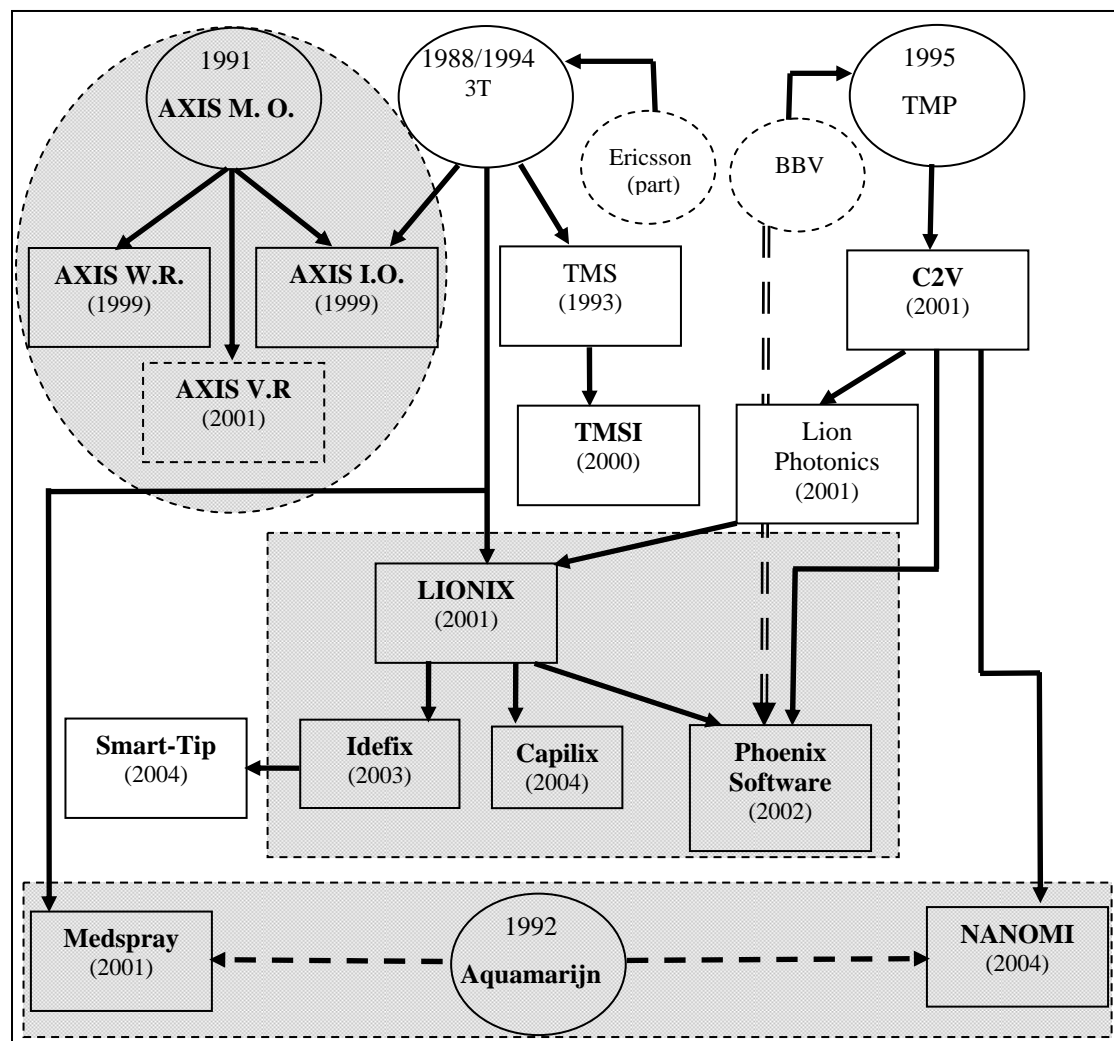
This observation suggests that Twente has a partly effectively functioning knowledge economy in which there are knowledge assets that can be combined to produce new growth trajectories. This in turn suggests that the Twente knowledge economy has to some degree matured. This is corroborated by the findings that there appears to be a degree of 'stickiness' in particular knowledge activities that gives them a longevity beyond the life of their institutional 'container'. In the case of Ericsson, for example, when the research centre closed, a number of new activities emerged drawing on the pre-existing relationships between Ericsson staff, the RDA and the university, creating activities that perpetuated *some* of the regional benefits of the Ericsson plant.

This seems to suggest that there is something which embeds these knowledge activities in the Twente economy, even when their primary institutional support, the business, has ceased activity. Of course, some of this will be through the people who remain even when a company closes; however, the decline of the textiles industry did not create a valuable human resource because other textiles firms had no demand for the labour. What has also emerged in the case of Twente is that there are other companies to take on those assets and move them forward, illustrated by the case of those bankrupted companies which were sold by PPM OOST to a USO company, thereby ensuring the survival of the knowledge in those firms.

The stickiness appeared to operate in two complementary manners. The first was that clear growth sequences emerged in Twente around particular technological areas. They increased the scope of activities undertaken in Twente, and also, they recycled resources between those activities. Figure 8 gives an outline of this activity from the example of nanotechnology and micro-systems activity. Even within the relatively small number of companies we interviewed, it was clear that there was a definite sequence of companies emerging, through spin-offs and their interaction with other companies, which helped with the development of a critical mass in the region. Firstly, new growth nodes had emerged in the network; the first main activity in the region was 3T, which emerged from the government research centre. By 1993, there

were a number of other companies active in the field, including Axis Media Ontwerpers, Aquamarijn and TMS. What was not clear in 1992 was the connection between these firms; although they were high technology firms, they did not have a clear significant regional benefit. By 2004, alongside 3T, and C2V, which was a spin-off consultancy arm of MESA+, it had become clear that Axis and Aquamarijn were growth nodes in the network, creating new companies and exploiting university technologies. A third company, Lionix had also acted as a growth node, creating one new spin-off company, and working to establish another.

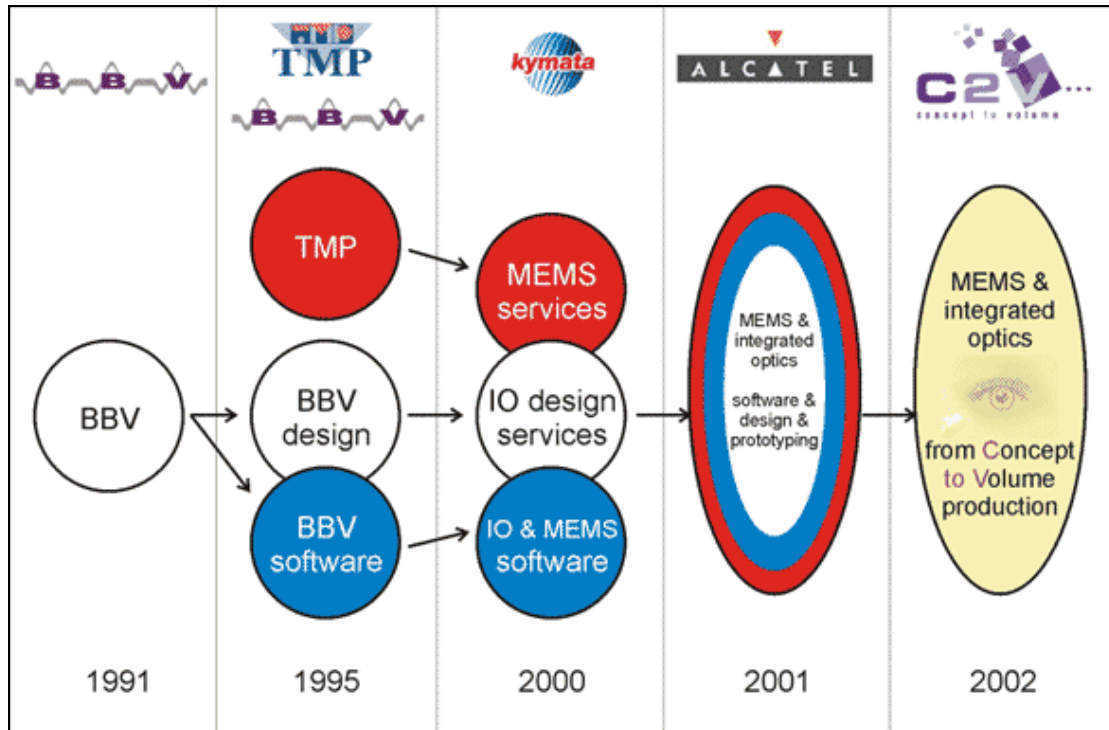
Figure 10 The build-up and emergence of new growth nodes in Twente 1992-2004



The second element of stickiness is the recycling of activities within companies, which suggests that whilst individual companies may come and go, there is sufficient activity to anchor technology – and people – in the region. On the diagram above, we show how two activities were ‘swallowed up’ by companies in the sequence, and have endured in some form – so one of the founders of BBV, which was bought out by

C2V, is now the chief technology officer of Phoenix BV. This recycling dimension is actually referred to on the web-site of C2V, shown below as figure A.

Figure 11 The representation of the history of C2V from its website

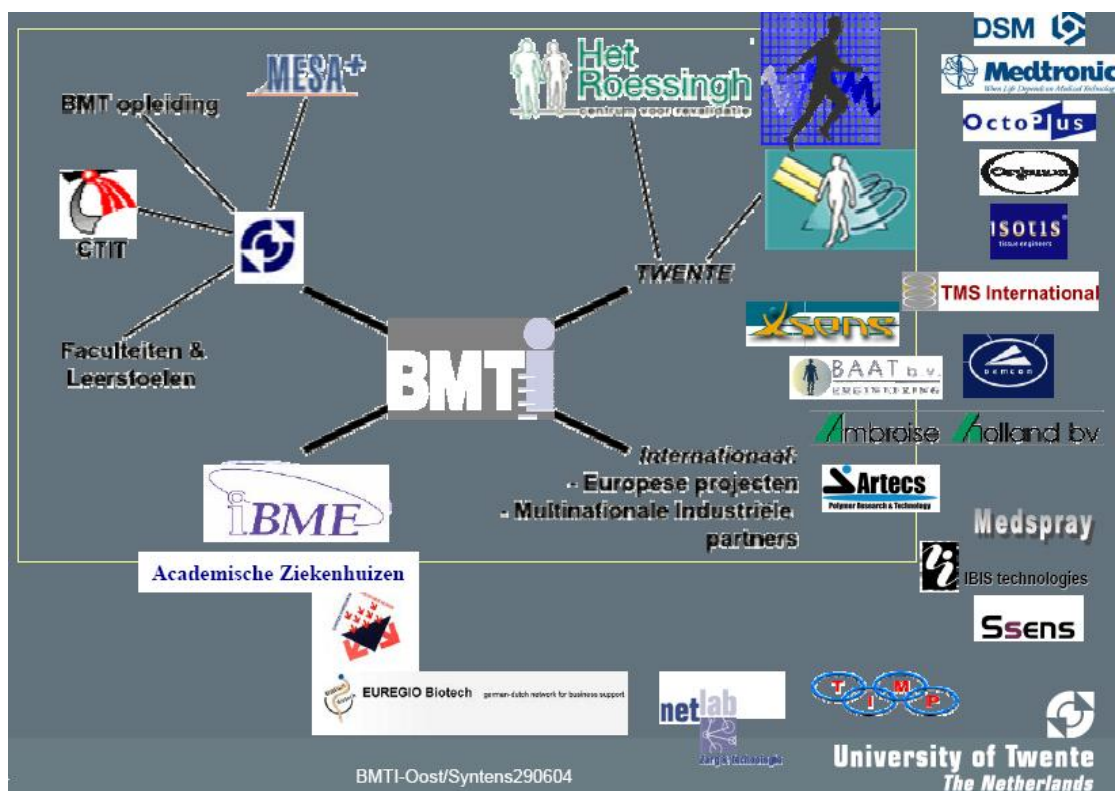


Source: C2V website <http://www.c2v.nl/fr_index.shtml?company/history.shtml>

Of course, the sequence is not itself particularly convincing as a motor of regional change; there are around 150 people currently working in this particular sequence of activity. If the 3000 of the TOP programme is not indicative of broader regional change, then 150 is not of itself significant. However, because it indicates both growth and recycling, it is a dual mechanism which could conceivably be more widely present in Twente. This sequence accounts for 7 of the 23 spin-offs currently associated with the MESA+ institute, which is one of six Research Institutes around the university. There could conceivably be a number of these new growing networks around the university, working in conjunction with the TOP, to take the global knowledge of the university and to ‘anchor’ it in Twente. The nanotechnology sequences are actually somewhat removed from large institutions in the way they are portrayed. The biomedical engineering research institute (BMTI) also involved the local hospital as well as a Rehabilitation Centre (’t Roessingh). In figure 10 below, we reproduce a slide from a presentation given by BMTI representing how their work is sustained. BMTI has four legs, one national (the national research institute for

biomedical engineering), one international (a EUREGIO project and framework research), but two local, one into the university and its other research groups, and then one, by far the largest in terms of participants, into the local economy (top right of diagram). Alongside 't Roessingh and Medical Spectrum Twente are a number of regional firms, including a number of USOs (Xsens, Medspray, IBIS technologies, Demcon), TMSI (the CMET spin-off) and a spin-in to the university (where a research group became university staff) Isotis.

Figure 12 A visualisation of the relationships between the Biomedical Technology Institute (BMTI) and regional/ wider partners



Source: Pontenagel presentation at OOST NV, 29th June 2004.

6.3.3 The production of a hard infrastructure for promoting innovation

The final area where spin-offs and associated had been involved in improving the regional environment for innovation was in the production of a hard infrastructure for supporting innovation. A good example of that was the BTC – the BTC was attracted to Twente because it was plausible to its backers that the university would be a good

source of entrepreneurs.²⁶ The BTC remained in Twente because it was a success in supporting high technology firms, and obviously, an important part of its cohort were firms from the university. The BTC were involved in establishing the Twente Technology Circle (TKT) along with one of their clients who was involved with the administering the TOP programme. BTC has expanded to provide services (“Capitool”) for firms outgrowing the basic incubation service, and two of its first clients for this service are spin-outs.

The second element of the hard infrastructure developed for commercialisation was the MESA+ facility. The university had rented its laboratory space to firms from the 1980s onwards, and the MESA centre had been in operation since 1992. The university decided to respond to the research concentration agenda by building a dedicated facility for nanotechnology, what became the MESA+ centre in 1997. MESA+ was built to provide in part clean laboratory space for the research groups, but as part of that, a dedicated commercialisation activity was created. At first, part of that activity included a consultancy activity, but that was spun off as TMP, which has since become C2V. The sale of TMP provided some funds for the facilities management company, Microsystems Technology Foundry which it has since invested in winning a subsidy and organising an international conference on nanotechnology. MESA+ is currently home to a number of nanotechnology spin-offs, and there are 23 industrial partners listed on its web-site as working using the MESA+ facilities.

The third element of the hard infrastructure relates to the creation of the Business and Science Park around the university campus. When the university was created, the Drienerlo estate was on one side of the road connecting the two nearby towns of Enschede and Hengelo, but neither side of the road was built up. The Business and Science Park has since been built from the main entrance to the university at Auke Vleerstraat approximately 1 mile parallel with the railway line. The current size of

²⁶ That plausibility had of course been constructed by actors within Twente, and spin-offs played a role in that; Professor Van den Kroonenburg began to tell that story from 1982 onwards, then Van der Meer and Van Tilburg (a spin-off company and developers of the TOP concept) had undertaken research for the Ministry of Economic Affairs that showed how successful UT (at that time THT) had been in producing spin-off companies.

the BSP is around 40 hectares, and it is home to a number of spin-off firms which have outgrown the university (van der Sijde *et al.*, 2002). The BSP did become home to a number of high-profile and high technology inwards investments, including Ericsson, Lucent and CMG, but with the decline in the ICT sector and the retrenchment more generally in the Dutch economy, they have either disappeared or are much smaller operations. In response to this, and also to the closure of the Twente Military Airbase, the “*Kennispark Twente*” (*qv*) initiative was initiated, to create an integrated and extended science park across the areas currently covered by the BSP, university and otherwise unused land between the two sites. The intention of that proposal is to create 10,000 new jobs in high technology businesses, replicating and extending the successes that have already been achieved with spin-outs.

Each of these developments has a number of features by which they contribute to the knowledge pool. This project began from Massey *et al.*'s (1992) observation that science-parks tended to be most successful in already successful regions, and that this fitted with a more general discourse about knowledge economy analyses using concepts developed in other regions. In each of the three examples, the hard infrastructure has been created in a way that it became ready-populated with a set of activities which contribute to the regional knowledge economy. As with the other elements of the knowledge pool, there is not just one network in operation, relating to property development and facilities management. The group of people working around the development of the various pieces of infrastructure have also become involved in other types of entrepreneurship support. The BMTI, for example, has pioneered the development of the tissue accelerator idea – BMTI has strong networks with a number of companies, a strong research group, appropriate facilities, and the accelerator concepts add to this investment funding. Other networks on which these infrastructural developments have drawn are the TKT and the TOP programme.

What has facilitated the development of the hard infrastructure is the prior existence of particular assets – including spin-off companies, which are then ‘solidified’ into knowledge pool assets. Each step of the process has extended the scope of what could be achieved, but then by being achieved, has produced a more valuable asset for the regional development. The issue with this knowledge pool asset as with the sustainable businesses sequences and the spin-off companies is the extent to which these benefits, which relate to particular individuals and networks, have effected a

more general regional change. This issue will be dealt with at more length in Chapter 8, but we now turn to consider some of the caveats and limits to the scope of the knowledge pool assets that appear to have been created in Twente.

6.4 Problems and issues in the creation of territorial innovation assets

Although the narrative in the previous section outlines the construction process whereby territorial assets were built, there were clearly problems in and limitations to the regional creation of territorial assets. We have already seen that the Twente region faces a significant problem and that the numbers involved with the university entrepreneurship programmes are a tiny contribution to addressing those issues.

In a less successful region, it is intuitive to expect that there would be problems arising because of a shortage of other regional assets, but it is clear that there were other kinds of problems emerging which were material to the functioning of the territorial knowledge pool. Third strand activity does sit uneasily alongside teaching and research activities at a micro-scale, in the way that there is tension within individuals caused by the efforts involved in balancing teaching and research work loads. These small problems in a number of cases caused larger problems. Moreover, it is also clear that the interactions between the different parties in the process was not always constructive. In some cases, where research groups became start-ups, then they could be neutral, but in other cases, where they recruited staff from one another, that could cause severe problems which were not a positive labour market effect.

6.4.1 Problems in the creation of territorial assets through spin outs

Much has been made in this chapter of the importance of the multiple-networks which have been constructed, and how elements from diverse networks are pulled together by regional entrepreneurs to produce particular outcomes. However, the networks did not function unproblematically; there were clear problems in some of the cases. The first problem is that the networks are not entirely conflict free, and that this can create problems in the opportunities of the networks, whilst what appears in 6.3 is an entirely positive set of narratives. Saxion, the University of Professional Education, and the University of Twente, are both shareholders in the BTC and PPM Oost, although both have very different interests, and different contributions to high-technology entrepreneurship. Saxion has produced high-technology companies, although they are not related to its (relatively new) research base, so the kinds of infrastructure which

interests UT is not necessarily of interest to Saxion, and likewise, PPM Oost has not invested in Saxion's companies which led it to reconsider its holding in the fund. Likewise, there are regular institutional re-configurations which do not complement existing activities. The decision in 1987 to shift government funding from university technology transfer offices to Chamber-of-Commerce based independent innovation centres significantly disrupted technology transfer networks, and led indirectly to the failure of the TRD Office within UT. More recently, Syntens, which is a national organisation responsible for promoting innovation in SMEs that emerged from the independent innovation centres, was re-organised from regional to national oversight²⁷. There were debates at the time of the research about doing the same to the regional development agencies, as part of a central shift away from subsidising the poorer north and east (*cf.* Chapter 9).

A second issue which was frequently mentioned was that of 'invisible barriers' or holes in those networks. When the networks have taken on a physical form, they have tended to promote themselves as being open and inclusive. In reality, as network members did not themselves know all available opportunities, there was a degree of complacency in some of the networks. As one person involved in organisation networking activities observed:-

“We have also another way of informal network, we have a project called Blind Date, we have a computer, we have a list of members, and we select at random pairs of members, who are invited to, to have a meeting...And the funny thing is we also had, the last nine days, there came a response from some guy “well I am working with them continuously together, well, can't you find another guy for me?” But that was not possible, and afterwards he told us that it was quite an interesting meeting they'd had, he had learned things that he did not know before about the other party.”

Exploring how spin-offs have been involved in developing entrepreneurial and innovative networks in Twente seems to suggest that the environment is a good basis for the formation of new companies and promotion of innovation in those companies.

²⁷ The best analogy for English readers is that the board mechanisms changed from those of the Regional Development Agencies to those of the Learning and Skills Council and its 'local' LSCs.

USOs are a part of these networks, but there is a question of how important they are in these networks. In the field of biomedical engineering for example, much of the critical mass was built up between the University and 't Roessingh, and the USOs then came along to involve themselves once tangible activities had been formed, a point obscured by the cross-sectional representation of the network in the BMTI diagram. This is a specific version of a more general problem with the nature of the regional networks, in how far these findings are more generally reproducible from the very limited number of experiences included in the research. Someone who had done research on business support for innovative small firms and then managed a project trying to build support networks noted that there was often a mismatch between the apparent potential of networks in Twente, and the ease with which they could be built

“One of the ways, in my opinion one of the best ways when you have a new idea you can match with already, companies that already exist and innovative companies, then the level of success can increase hugely. However, getting those links sorted is very difficult, and there are fewer of those links than you might expect”

The university spin-offs are not themselves particularly significant funders of research in the region in terms of the direct cash they gave to the university. Although some of the USOs did have links back to the research groups, the research groups were clear that the best mechanisms for third stream funding were large industrial concerns; one professor noted that although big companies could change their mind overnight, at least they would pay for work already done. Another professor had suffered when a local USO withdrew funding from a Ph.D. and the student left the university (50% of the research group income came from the number of Ph.D.s in the group); the same group had to fire a Ph.D. student working for a spin-off because the student apparently lacked the skills necessary for research in the SME environment. USOs were important in helping to bring funds into the region which were then subsequently invested. Where they were more effective was in winning subsidy programmes which could then be spent in the university. One of the two firms that had invested in equipment for MESA+, for example, had won a subsidy to buy the kit which could then be used by other users, and sold on by MTF. A number of spin-outs were on the User Committees for particular research projects in return for small direct contributions. Even at that simple level, there was apparently some antipathy between

the research group in the university and the spin-out firms, to ensure that public research funds were not being invested in private enterprises.

This is illustrative of a wider problem with the concept of UT as ‘the entrepreneurial university’, because the extent to which this was true, and the extent to which the university management pursued entrepreneurial policies, varied greatly in the period between 1986 (when UT branded itself as “the entrepreneurial university”) to 2004. The university has tried periodically to create free-floating funds to invest in development activities, but those funds were difficult to create and then were easily committed to particular activities, which made it difficult for the university to focus on entrepreneurship for the 18 year period under consideration. The personalities were also important, and there seemed to be general agreement that board member Schutte was an important promoter of the TOP approach to entrepreneurship within the university.

The departure of Schutte at the end of 2000 opened the door for a more comprehensive overhaul of commercialisation, and with the parallel financial pressures of the campus redevelopment, lay the foundations for the emergence of the more recent pro-active approach to entrepreneurship (exemplified in the tissue accelerator). This was associated with an increasing disregard for the TOP programme within the university, despite the fact that at a relatively low real cost to the university, it continued to produce new firms at a fairly impressive rate, which we illustrate in Table 5 below. The issue of the changing culture of and attitudes towards entrepreneurship within UT are dealt with in more detail in the following chapter.

Table 5 The rate of formation of TOP companies by Rector Magnificus

Rector Magnificus	Duration of term	TOP companies per year
W. Draaijer	1984-85	9.5
Harry van den Kroonenburg (II)	1986-88	17.7
Jos de Smit	1989-1992	14.7
Theo Popma	1992-96	18.2
Frans van Vught	1996-2004	16.6
Henk Zijm *	2005-	21

Source: authors' own calculations

Note: * - at the time of writing, Henk Zijm had only been in post for four months, during which time seven TOP schemes had begun

6.4.2 Solutions and learning activities in the Twente techno economic network

There are three main sets of activity which have made positive contributions to the Twente knowledge economy, although each vary widely in their scope, their cost and their general accessibility to a wider set of firms. The first is that there are direct links between academic research groups and some companies with local research activities, such as NEDAP, Vredestein, Thales and Philips. These links are no different to those that exist between research groups and companies in other parts of the Netherlands and Europe. The university contributes to anchoring those firms in the region, and spin-off firms can emerge as third-parties in the university/ firm relationships. However, as the case of Ericsson demonstrates, because R&D is a luxury for many firms, it is not a strong anchoring; in those cases of closure or run-down, what spin-offs were offering through the TOP model is a continuity of those activities in the region. This can be important because large companies can be important players in the knowledge networks, and allowing some continuity reduces the overall volatility of the network.

The second set of activity are the TOP firms; they exist at some degree of remove from the university, and except where they have become strategic partners of the university, they have become detached from the university. They are contributing to a knowledge economy in the region, but they are in many cases not taking that knowledge economy forwards. Not all the TOP companies achieve high growth levels, and some of the firms cease trading when better offers become available – this happened with four companies that formed after the closure of the Ericsson site, for example. However, balanced against the lack of dynamism is the relatively low cost

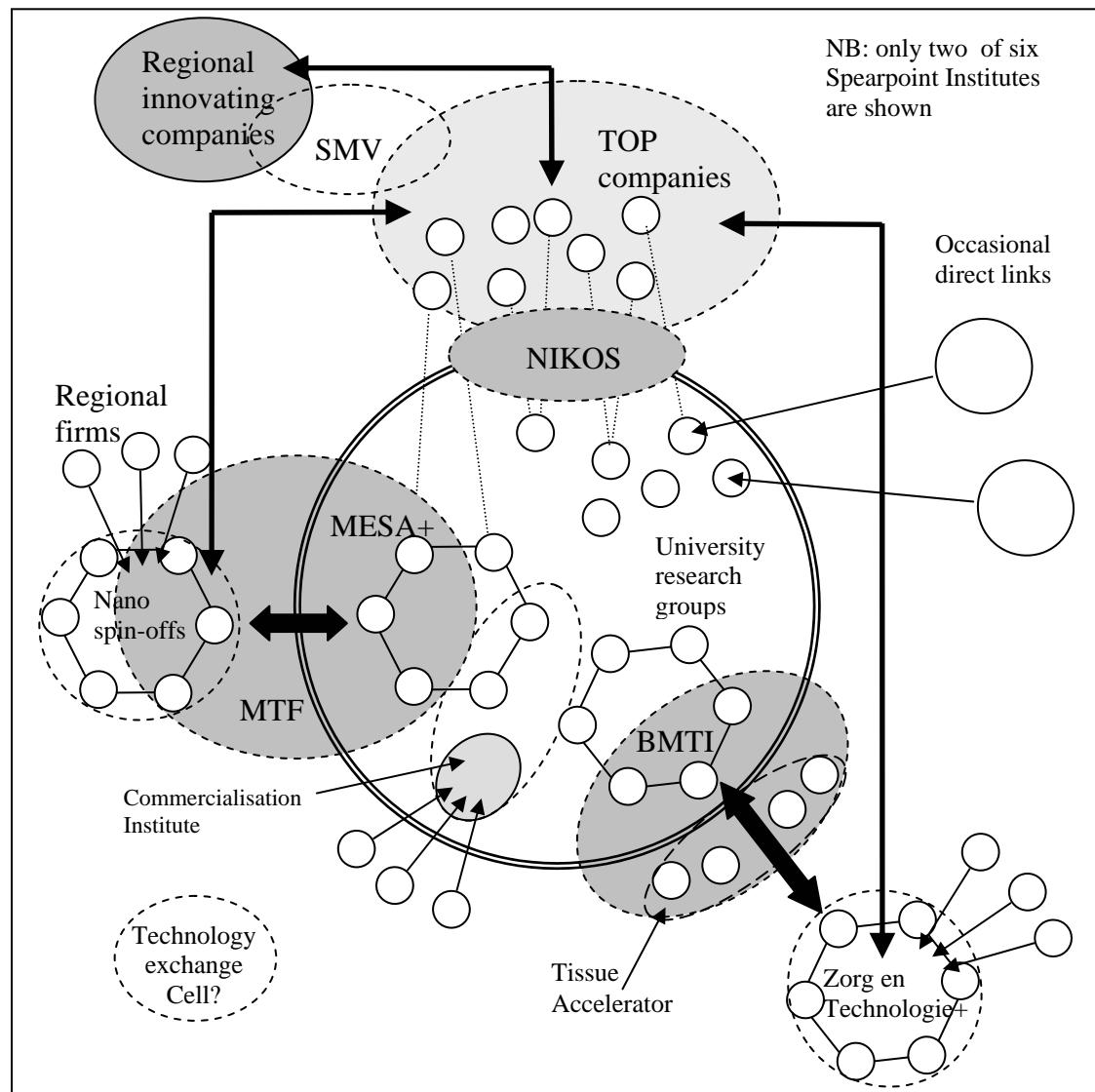
of these outcomes to the university, the established nature of the scheme, and its enduring relative success. Some TOP companies are indeed very high technology, and many of the MESA+ companies have been through the TOP process, and other high growth companies with links back to the university (e.g. Demcon, Axis, TELEtop) have a back in TOP. Some of the TOP-pers have taken a lead in various regional initiatives and networking activities, such as Stichting Mechatronica Valley, Netlab, TIMP and *Zorg en Technologie*, and cannot easily be dismissed as insignificant businesses.

The third set of activities are the institutionalised engagement activities through the research institutes. These are, particularly in the case of MESA+ and BMTI, resource intensive. The university has a discretionary fund of around 8% of its budget which has to be spent on developmental activities and a considerable amount of these are being invested in the research institutes and their associated activities. These activities have a relatively limited regional footprint with respect to the TOP activities. Conversely, as we have seen, what they have done in a number of cases is build up tight – but small – regional centres of excellence which have a chance to attract external interest and investment, something which we deal with more fully in chapter 8. In some cases, research groups have developed their own mechanisms for technology transfer, such as the European Membrane Institute, which at the time of the research employed six staff within the Membrane Technology Group. TOP companies are important within these various tangible network activities, which do clearly extend out beyond the university into the region.

We represent this in figure 11 below, and what is clear is how important spin-off companies from UT are in the functioning of this network. If the spin-outs are removed from the figure, then the university appears much more like a ‘cathedral in the desert;’. Admittedly, significant sums of resources would continue to flow into the university, from outside research funders who acknowledge the quality of the research being done within the university. The spin-offs fulfil useful regional lubricating roles, leveraging what the business development managers of the centres can achieve, and in the case of MESA+, achieving a (temporarily) independent trajectory of industrial development. Although this chapter considers the role of USOs in *building* the territorial knowledge pool, perhaps a better way to characterise the bulk of USO contribution is in *supporting* and *sustaining* the university knowledge pool. Certainly,

companies like Axis, Aquamarijn and Demcon are genuinely building new knowledge pools; Demcon has recently created a “knowledge campus” in the old Hanseatic town of Oldenzaal, 8 miles to the North East of Enschede, home to the group companies and also available as premises to other high technology firms.

Figure 13 A schematic representation of regional engagement activity at University of Twente, Autumn 2004.



Source: authors' own design

We would draw an analogy between this situation and the dualism associated with theories of light, which can behave either as a wave or as a particle, and is best understood in a context which depends on what you want to know. In this regard, we would argue that the regional knowledge economy has a duality between the regional knowledge pool and the distributed regional knowledge network. What we have

shown in figure 11 above is a distributed regional knowledge network which is much denser than we would have seen had we taken a similar observation in 1993. What we are then arguing is that this can be considered to represent a deeper regional knowledge pool than existed in 1993, albeit in a relatively limited number of fields of knowledge.

7 University spin-outs opening up the university

In the previous section, we considered how the spin-outs affected the routine of the operation of the territorial knowledge pool in the region. We noted that there were a range of networks which were overlain with one another, and spin-offs were one mechanism through which particular activities were created, grown and sustained in the region. Thus 'TOP' actually played a variety of different roles; extant TOP-pers were involved in supporting a range of regional initiatives, as well as supporting university research activities (like MESA+ and BMTI), whilst people coming out of the research groups were able to use the financial support and the business networks of the formal TOP programme to support the creation of their ideas. The one apparent weakness faced by the university is the relatively narrow scope of the contribution that it makes to the regional economy; although it has built a knowledge economy much broader in scope than that which previously existed, there is a huge segment of the economy – typically routine, Fordist manufacturing and service jobs – on which the university and its spin-outs have a negligible impact. In that regard, the university has been relatively passive in its attempts to force knowledge and technology into the surrounding economy.

However, the university has been actively promoting entrepreneurship for 20 years now, and the attitudes of those involved in technology transfer have evolved in ways that affect the overall attitude of the university. A number of interviewees voiced the opinion that the university had no interest in engaging with local businesses, because they were smaller and less lucrative than engaging with larger companies who could offer stable research contracts. This seems to add weight to the imperative for spin-offs to be contributing to the opening up of a knowledge pool in which the university centrally has no interest in making more accessible. In this section, we look at how the process of promoting spin-offs at the institutional level has contributed to making the university more accessible as a territorial knowledge resource, in order to be able to say more meaningful things about the territorial scope of the knowledge assets within the university. In order to do that, we look at how the culture within the university has shifted in the last twenty years, and the way that that evolution has affected the accessibility of knowledge resources within the university.

In the literature review, we noted that the community of practise literature, and particular its extension into the idea of an extended network of practise, was of use in conceptualising this process. In the analysis of this chapter, we extent the concept to a more general University of Twente Commercialisation community of practise. The first issue is that there is not really a single central commercialisation activity as there is in Newcastle. Instead, the business development staff at UT belong to the research institutes, the TOP programme is part of the BBT faculty, and the commercial activities, such as HTT, are a free-standing adjunct to the senior management team, the *College van Bestuur*.

So how can we make sense of this very divergent community, to be able to talk about “the university’s impact on the territorial knowledge pool”? Clearly, there are problems in talking about the university as a single community. In this chapter, we look at how the tensions between the communities and how that changed the institutional impact on the commercialisation community. We therefore examine the way that USOs have been used, taken up and represented within the commercialisation community of practise, their roles in shaping attitudes and policies towards commercialisation, and the way that past experiments have become represented in current policies. We begin by giving a basic narrative for the evolution of the business development “directorate” as a divergent ‘community of practise’ in the period immediately preceding the research, and identify some of the key routines, beliefs and practises of community members. We then turn to look at one of the main struggles within the community precipitated by USOs, how crisis has precipitated changes in those behaviours and mores. We then finally then finally turn to consider whether these changes in the university’s attitudes to businesses, associated with spin-outs, have had a beneficial or a negative territorial effect, by altering the accessibility of knowledge resources held within the university.

7.1 Defining the commercialisation community of practise at the University of Twente

The University of Twente has been a very experimental institution, and early on in its history, its managers deliberately kept the university remote from business activities. This remoteness was reinforced in the early 1970s by a series of changes to the governance structure of Dutch universities (*cf.* Chapter 4) which increased student

representation at the senior management level. However, from the mid-1970s, crisis in the textiles industry stimulated senior managers in the university to seek new rationales for the university, which included increasing the regional impact of UT. One of Van der Kroonenberg's innovations was the creation of the *Transferpunt* in 1979. By the mid 1980s, UT had rebranded itself as the "entrepreneurial university", and by the late 1990s, there was a large technology transfer office, then called the TRD responsible for commercialisation as part of a wider portfolio of externally-facing activities. The merger of activities to create the Liaison Group gives credence to the idea that the concept of an entrepreneurial university is inherently fuzzy. A number of interviewees noted that the university was not itself entrepreneurial, but allowed particular people to be entrepreneurial.

We have already seen that in Chapter 6, Figure 11 implies that there was no longer a single organisation in which all commercialisation activity was vested, and that the research institutes, commercialisation activities like the European Membranes Institute and the TOP programme, were all pursuing divergent elements of the corporate strategy. This suggests that a "commercialisation community of practise" within the university might be hard to define. Indeed, as one university senior manager noted, it was possible to regard the university transfer office at the time of the research as two people, the board member responsible for regional engagement and the director of the Holding Company. Talking about whether UT would create a dedicated central technology transfer office, one senior manager opined that...

"Liaison Group and the transfer office. It is all passed ... I don't believe in that concept because most it's managed by people that no one wants to employ any more and they are put in such as Liaison, thinking that talking with a lot of people, will realise liaisons, but it doesn't. Liaisons are realised by close collaboration between scientists and companies, not talking but having big meetings that close collaboration encourages. So the number of people that is on a co-ordinating level ... must be as lean and mean as possible".

In this section, we explore whether it is possible to define a broader commercialisation community within – and of course possibly beyond - the university, and whether it is possible to classify the types of people who participate in that community. We begin by looking at how the community has evolved historically, then how the various positions within the community have come to be

defined. We then look at the relationship between the various elements within the broader community, and the extent to which external partners have been able to get involved in these activities.

7.1.1 Changing the old university culture: realising the entrepreneurial university

One of the conundrums in understanding commercialisation activity at the University of Twente is the extent to which it is spread over a wide range of different activities. Although the TOP programme has achieved a world class reputation, it was clear that by 2004, TOP was left to function freely, and university senior managers were involved in a series of other initiatives to promote university entrepreneurship. However, there were a series of these activities which could be considered as vestigial, from the previous regimes of commercialisation, which together worked to support the current activities underway. The Holding Company (HTT) had been created in the late 1980s as a means to control a set of commercial activities within the campus such as the Drienerburgh Conference Centre, but by 2004, it was being used as a vehicle to manage participations (shareholdings) in companies that had been actively created by the university. There were people involved in the commercialisation community who had become involved through these earlier activities, and to make sense of how the whole range of activities cohered in 2004, it makes sense to present a short retrospective of their evolution.

The first point to note is that the university was commonly regarded as not being particularly regionally engaged prior to the arrival of Professor Van den Kroonenburg as Rector Magnificus. The University had developed its own culture quite quickly in the 1960s, as much as a reaction to changing circumstances as through the design of its creators (*cf.* Chapter 5). Although the TOP idea can arguably be traced back to Van den Kroonenburg's own experiments in student entrepreneurship within his own research group, there was considerable cultural resistance at first to the idea of business engagement. As one of the early pioneers of supporting high technology spin-offs noted, students seemed sceptical of the validity of trying to bridge between these two groups. According to him,

“In 1978, I started the first presentation, a small fair in the Mechanical Engineering department, together with the professors, and the students at that time were furious against, they nearly threw me out of the campus because

you should not mix up business world and scientific world at that time. It was a cultural shock, and that was also one of the reasons Professor Van den Kroonenburg – at that time he was just a professor of Mechanical Engineering department – and then he realised we should change the cultural attitude.”

Although Van den Kroonenburg²⁸ was to prove instrumental in taking the first tangible step through the creation of the TOP programme, this cultural resistance was a formidable barrier on which he required a number of external allies. On the one hand, early in 1981 he identified one university spin-off company, a business consultancy whom he commissioned to find more university spin-off companies. On the other hand, he began engaging with external actors to help with the realisation of his vision of disseminating university knowledge into the external environment. He actively engaged with business support organisations in the region, apparently as vehicles who could help transform the university culture, and do things which he, as Rector responsible for scientific direction within the university, could not promote. As one former manager of an enterprise agency noted,

“I had from the beginning 100% support from the Vice Chancellor, Professor Van den Kroonenburg, from the start he was president of our company ... Of course for such a company as [mine], my board is always, they introduced me in all the areas, so for instance, the Vice Chancellor, every person, every professor in the university know that I also reported to the Vice Chancellor so they were frankly opening doors when I came to their research laboratory”.

We have already seen in the previous chapter how the TOP programme had this hybrid nature, bringing together entrepreneurs (who were often graduates of the university), with professors, support structures and finance, all of which operated within their own networks. From its inception, TOP was managed through a university commercialisation group, *Transferpunt*, later TRD and then the Liaison Group²⁹, created in 1979, whilst being heavily dependent on resources held by groups

²⁸ Unfortunately, Professor Van den Kroonenburg was to meet an untimely end in 1996; consequently, all motives ascribed to him are deduced either from what he wrote (e.g. Van den Kroonenburg, 1996) or from what others reported with their own dealings with him.

²⁹ The name of this group was taken from the famous Leuven University technology transfer group, Katholieke Universiteit Leuven R&D, or LRD. The idea had been to call the similar organisation in

which it did not control. After Van den Kroonenberg's first term as *Rector Magnificus*, Draijer continued institutional support for TOP and the Liaison Group in his term as Rector between Van den Kroonenberg's two terms. At the end of 1985, the second phase of commercialisation within the university began, as Van den Kroonenburg began a second term as Rector, supported by a second board member who was very committed to this process of regional engagement, Frits Schutte. It was during this second period that UT rebranded itself as the "entrepreneurial university". As a one-time member of the university commercialisation group noted, Schutte provided continuity between the Van den Kroonenburg era and the future approaches the university was to take to technology transfer.

"There was one member, one CEO in the board was responsible for, as well regional development as for knowledge transfer policy, you must have come across his name, it's Frits Schutte ... he always had at least one member of the policy advisory team working with him, for him, to work on a wide range of fields ... We could talk a lot about structures and about whatever, but my angle is much more about cultures and the people that did it, the leadership figures, he has been there for a very long time. And you can say a lot about that, but at least the advantage is continuity, trust, these important factors in innovation. Knowledge, expertise. But also that he was holding the portfolio for finance, which is relatively important of course. He's been the leader and international spokesman for UT's role in regional innovation for about 10 years".

”.

It was in this time (1985-2000) that the next step towards commercialisation was taken, which was to create a formal structure within the university for the university to undertake commercial activities. At the same time, it was reported in the interviews that the university's naivety and enthusiasm for commercialisation led it to permit a number of activities to develop with which the board were not satisfied. An issue then emerged as the university introduced tighter financial procedures that producing formula grants for the teaching groups reduced the latitude that the senior managers had to take strategic initiatives by making professors do things. The grant

Twente, Twente Research & Development, but it was unacceptable according to one former employee. However, the initials were preserved (TRD) through the name Transfer Research and Development.

for *Transferpunt* came from the government lapsed in 1987, and from then, its members were responsible for covering part of their own salary. During this period, a number of interviewees remarked that the transfer activities became increasingly funding-driven, and detached from the main purpose of the university, the pursuit of research and education and using those as assets to exploit for the benefit of the region.

By the mid-1990s, the university executive arm started to attempt to regain the initiative through continuing the concentration of research into strategic institutes, and more importantly, by top-slicing money from the funding formula to be invested on activities of strategic importance. The main effect was that the various research institutes prioritised business development more directly, and in the late 1990s, MESA+, CTIT and BMTI all began focusing on particular business development activities. MESA+ focused on exploiting the facilities in the centre through the TMP foundation. The other shift to emerge, later in this period, was moving from reactivity to external requests to managing the technology portfolio of the institutions more aggressively to identify what a number of respondents referred to as “new product/market combinations”. These were areas where particular university ideas matched a potential new demand, and were worth investing in because they could yield higher profits for the university. At the same time, TOP continued with a high profile because of its success in employment creation, but with an apparent decreasing level of prioritisation within university senior managers. As part of Liaison Group’s attempts to stay solvent, they had developed European Social Fund and Framework Programmes deploying their commercialisation ideas, and they also used these projects to generate data for their own academic research.

The final set of changes came about in the first years of the 21st century, although the activities previously mentioned largely continued in some form. The main change was the disbandment of the transfer office, which had in response to the problems of the mid-1990s been reinvented as the “Liaison Group”. As part of this, the TOP activities were moved back into the faculty of Technology and Management to form the new Dutch Centre for Knowledge Intensive Entrepreneurship (NIKOS) under the scientific leadership of Professor Wim Daring. With the disbanding of the Liaison Group, responsibility for commercialisation passed to the research institutions, and increased the pressures on their business development directors to be more pro-active with

respect to commercialisation. One final idea which emerged during the study was the idea of the “tissue engineering accelerator”, that the university would identify and support entrepreneurs to create businesses in very clearly defined niche areas within the research institutes to create a rash of new companies. Interestingly, both TOP and the Tissue Accelerator were included in the Regional Economic Development Plan (the so-called REOP) published in November 2004 in which a broad coalition of regional organisations agreed to a set of common goals and mechanisms (*cf.* 9.2).

7.1.2 Configuring a new environment and creating new activities

The key feature about this new environment was how disparate it indeed was. As figure 11 shows, there were activities taking place all over the university, and connected through some external networks, which affected the cohesion of the community within the university. At the time of the research, there clearly had been a strong institutional commitment to using spin-offs as a mechanism to change the university. This was part of a broader idea of bringing more commercial activities onto the university campus, and as a vision was articulated by one of the staff responsible for business development thus:-

“So [the vision is] to end up in 15 years having this campus, and having a lot of high technology companies on the campus, on this site. And only high technology companies that need to be very close to use, not consultancy companies that can find their office anywhere.”

Within this framework, the divergent groups were pursuing their own activities in ways that did increase the scope of what the university was doing. It is possible to characterise the university’s approach in general as constructive exceptionalism, that is letting experimental activities experiment, then either incorporating them, modifying them, or in the case of some of the more peripheral entrepreneurship promotion activities, terminating them. The overall effect was that the commercialisation community was concentrated into a number of ‘nodes’ within which there were dense networks which were actively promoting entrepreneurship and technology transfer around the university. The nodes were acting as nexuses for a range of networks which bring together different assets which created more munificent environments for entrepreneurs.

These nodes were connected by much looser ties, which in some cases were mediated through the university (through the institute business plans), in other cases at a tangent to the university (through Innofonds and BTC in which the university had a share) and in some cases through external networks such as the TKT. Consequently, this gave the commercialisation network within the university a very diffuse appearance, and almost suggested that the university was not a significant boundary for these different activities. The problem with chapter 6 is that it provided a very static representation of those changes, and did not capture the relationships necessary for commercialisation. It was clear from the research that the various activities did not operate purely functionally, but acquired their own dynamics, momentum and ultimately, tensions.

A good example of this is the MESA+ institute, which was largely free-standing from the university, although there were 17 research groups which were actively participating in it. The research groups were not directly involved in commercialisation themselves, as we saw in Chapter 6, when one of the associate professors within MESA+ noted that:

“We do not do that [commercialisation] ourselves. Usually when we do a project, we already have contracts with industry, especially in STW projects, we have the users committee, and we have these meetings. And as soon as there is something coming out of these projects that they want to use, then we encourage that, we would like them to use the research. But we will not do that ourselves... we make sure that those people that are involved know all the details, and if we have an idea of, of what could be an application, we will certainly tell them about that.”

However, there was very clearly a set of activities within MESA+ which could be regarded as a commercialisation community. There was a Scientific Director who was committed to inclusion of commercialisation targets in its strategic planning. There was a commercialisation director who helped entrepreneurs in establishing businesses. The facilities manager and clean room manager posts had both been occupied at times, on a part-time basis, by entrepreneurs, who used the positions to cover their costs whilst setting up businesses. There was a foundation managing the facilities and reinvesting the surplus in development projects, some of which had commercial applications. There were positions available within MESA+ for new

entrepreneurs to help them establish their business. Within this critical mass within MESA+, we have already seen that other elements of the university commercialisation system were available, such as TOP and the Innofonds investments. This was all underpinned by a shared culture within those people in MESA+, as three quite separate entrepreneurs within the complex observed.

“Generally speaking, I don’t know, I have good contact with actually all of [the companies in MESA+]. I mean, part of it is that most of them are not in competition, so they really kind of benefit from each other and work together.”

“I know all the people here, because I come from this university, so I know which button or which person to contact, which button to push”.

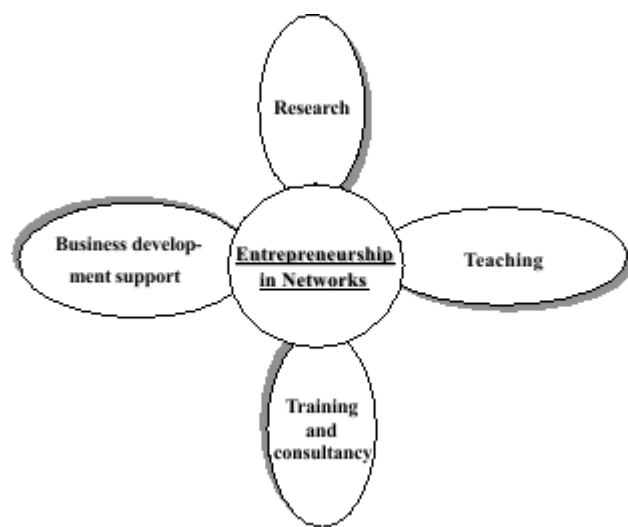
“Of course, I studied here and so I have a lot of relationships here, a lot of people I have worked with are for example, with [Company A], and my old colleagues from [Company B] are in the corridor. One is the technician I hired, so [laughs].”

The Research Institutes had many external links, as was seen in the previous chapters through regional projects such as *Zorg en Technologie* and the Technologie Kring Twente. In a number of cases these external links helped with the formation of new spin-off activities. The university did act to support some of the spin-offs through investing in them, and it is hard to distinguish which of the networks were most important in establishing the spin-offs.

Another good example of this was the TOP programme, which at the time of the research was being revitalised and expanded; they had been involved in a number of entrepreneurship promotion projects outside the region (*inter alia* in Groningen and Curacao) which were hived off into the independent TOPSpin International Foundation. The idea was revived in the late 1990s when a local agricultural bank had funded NIKOS to run an entrepreneurship promotion project (Kansrijk Eigen Baas) for non-graduates in a remote rural region adjacent to Twente (*cf.* Groen *et al.*, 2002). When an Ericsson R&D facility announced its closure in 2002, then a special TOP stream was created to help with the outplacement of staff. Two NIKOS staff members had been appointed to Associate Professorships for Business Development (“lectoren”) in the nearby Polytechnic, Saxion, and were introducing courses in entrepreneurship similar to TOP as part of that. Finally, staff from NIKOS were also

involved in the establishment of the Hengelo College (further education/ “MBO”³⁰) entrepreneurship centre, Campus Business Center. NIKOS was quite explicit that the key focus within the group was entrepreneurship in networks, and that their various activities hung round this core interest. Figure A below, reproduced from the NIKOS website, illustrates this quite neatly.

Figure 14 How NIKOS represents itself as an independent nexus of complementary networks spanning the university boundary



Source: http://www.utwente.nl/nikos/about_nikos/missionandvision/index.html

The one activity which does not sit as easily within this heuristic of the university as a loosely bounded set of entrepreneurship promotion activities is the Tissue Accelerator. This was much more closely connected to the senior managers within the university, with the board having the right to involve themselves in discussions over whether the university would ‘commit’ to the particular project, which was of course a necessary precondition for the establishment of the company. The university senior management were also keen to get involved to ensure the transparency of investment and the proper use of public funds. However, the total number of companies which could be produced through such a system remains comparatively low. The advantage from the perspective of the university senior managers was that it produced something separate from the research base, and something over which they

³⁰ *Middelbare Beroeps Onderwijs* (literally intermediate professional education) is the level in Dutch education immediately below polytechnic level for technician and craft occupations.

could more directly exert influence, in seeking to deliver the aim of bringing more commercial activities onto the university campus. Clearly, in the case of the tissue engineering accelerator, it appears that the university boundary was much more significant than these other more loosely bounded commercialisation nodes.

7.1.3 Reconceptualising the institutional configuration: the entrepreneurial university as an entrepreneurial field?

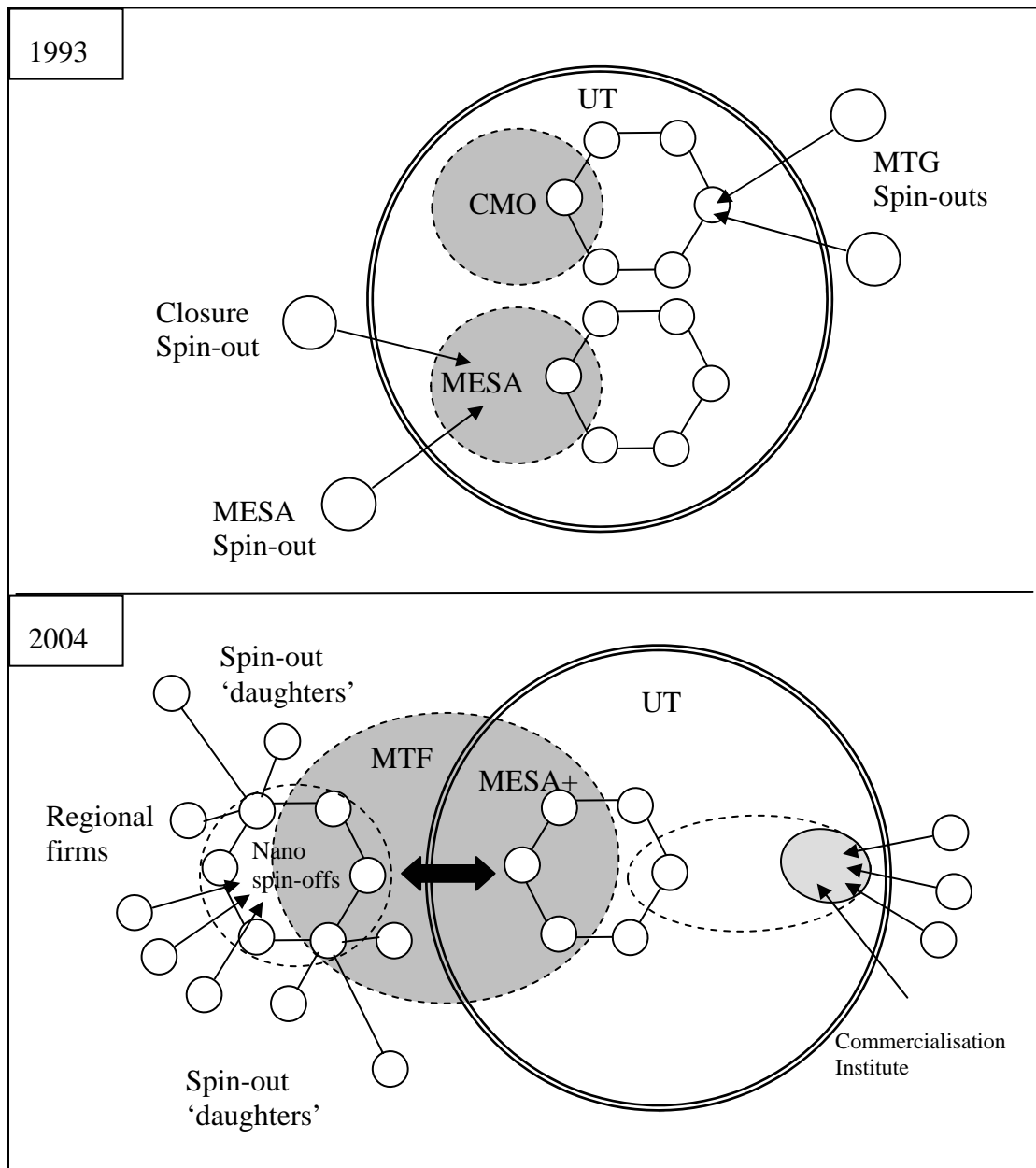
The question remains of how to conceptualise this arrangement of several highly entrepreneurial nodes – distinct commercialisation communities with their own routines, rhythms and rationales – within the university. All the nodes operated against a background of networks which help to support and consolidate their activities. The nodes themselves are certainly not entirely bounded within the university, so the TOP programme is heavily dependent on contact networks such as the Twente Technology Circle (TKT) but also the contact networks of the consultants delivering the TOP. MESA+ was successful because it was recognised as a centre of excellence by the national funding body, but also by external companies who placed their staff in the learning environment. These nodes were overlain with a series of networks that are internal to the university, which complement and support these partly-external nodes, such as the university investment in companies, and estates policies. Together, they create a supportive field within which these particular activities can emerge.

One way to think of this is that the particular nodes are incubated within the university and then emerge into the region when they are strong enough to survive the movement into the relatively weak entrepreneurial environment around UT. The three main nodes identified in figure 11 all have a long historicity associated with them; their current form is not what was originally created. BMTI dates back to the attempts noted in Chapter 5 to create a critical mass of biomedical activity as part of attempts to win the eighth medical school for UT. The TOP programme was created in 1984, and in its first year it provided the funds as a grant, whilst much of the business mentoring was provided by the lead consultants. By the time of the research, TOP functioned as a loan fund, and TOP commissioners in some cases were themselves TOP-pers. The MESA+ institute was created as an amalgamation of two spearpoint institutes which were moved into a single bespoke facility in 1997. There

was then a build-up of further activities around this centre, not only directly as an incubator but also as a research facility where university research could be done (and as we have seen, a cadre of future entrepreneurs trained). The tissue accelerator also fits the pattern of this narrative, although it was at a much earlier stage of the process, namely as a risky, high stakes activity kept close to the university, to reduce exposure to risky outside partners, before progressing outwards into the wider environment, and also having a broader regional impact.

The particular case of MESA+ is interesting, because it demonstrates how the particular activity built up within the university, and then became more outward facing, and then developed a stronger regional footprint. This is shown in figure A below. In 1993, there were two spearpoint institutes within the university, and each were associated with a number of research groups, again within the university. Each centre was involved with a limited number of spin-off activities around that time, but the core of the activity was located wholly within the university. By 2004, the time of the research, there was a clear sequence of innovation around nanotechnology, with two firms forming their own daughter companies, a not-for-profit organisation managing the MESA+ facility to ensure its openness to academics and business researchers, and a commercialisation institute within the university, undertaking work with commercial partners.

Figure 15 The building up of a new 'node' within the university field – the case of MESA+



This suggests in terms of conceptualising the internal dynamic within the university, there is a recurrent process where new commercialisation activities emerge, are tested, and if successful, then drift to the fringes of the university consciousness to continue their activity. There appears to be a core management who are responsible for controlling this early phase of the particular activities, then as the activities drift further outwards, they are controlled by individuals who attempt to embed them in the regional innovation networks, and then finally, if they succeed in becoming embedded, they have to continually sustain and renegotiate their position. The

commercialisation community in the university appeared therefore to involve creating new activities and then pushing them outwards to the fringes, but terminating them if they drifted too far from the core purposes. Indeed, there did seem to be an indifference (and at times hostility) within the centre to some of the older activities, whilst recognising the roles that they, and Van den Kroonenburg had played in transforming the culture within the university, and increasing its regional impacts and benefits. To further explore this issue, we now turn to look at the best developed example of this, the case of Liaison Group and TOP, and how it became a story of mission creep which necessitated the creation of new approaches and relationships for commercialisation.

7.2 The TOP programme in a historical perspective: from core to periphery (and back again?)

The basis for claiming that UT has had a positive impact on the regional economic environment seems to lie on the fact that the various technology transfer activities within the University of Twente appear to have formed a set of networks around themselves. These networks have provided a diverse set of opportunities for new entrepreneurs to plug themselves into, and formed a series of layers around the university, with early versions of these networks forming at the heart of the university. Once established, these activities have then moved to the fringes, but still leaving behind the benefits – via the networks that have been created. In this section, we focus on the TOP programme to show how a particular set of networks formed close to the centre of the university, and how the activity moved from being core within the university to being peripheral. This in turn is useful in illustrating what we are talking about when we refer to the idea of the university as an “entrepreneurial field”, allowing new activities to form, but then allowing them also to partly progress away from the university, to give the set of surrounding and supportive networks seen in figure 11.

To explore this, we look at the different groups within the university who have been involved in the TOP programme, and their differing perceptions of the scheme and its relation to their own activities. We broadly segment actors into four classes depending on their perspective on the changes. The various communities were aware of this conflicting set of perspectives – as one interviewee specifically noted, with

TOP, “And also the, it was history is always difficult, it is depending from the person who tell it”. In the course of the research, we noted that throughout the course of interviews, the TOP programme was one of the most contested and most referred-to activities within the university.

We can identify four main groups involved in this transition process, including the earlier pioneers involved in the establishment of the TOP, there were a group of alumni who took advantage of TOP, there are the current university senior management who are attempting to develop other complementary activities, and there are the business development community within the university. Alongside this, there were interviewees who had also been involved in the transition process, as well as external stakeholders all of whom had perceptions about the value of the TOP programme. In this section, we look at how each of these four main groups in turn has developed their own narratives about the TOP programme. Such a set of narratives in turn allow us to highlight the processes through which TOP progressed within the mental conceptions of various key groups within the university. This in turn provides a more general heuristic to understand what the university is doing with its technology transfer activities, creating a set of layered activities within the university that have an external impact.

7.2.1 The pioneers: reacting to crisis and confluence

The TOP programme was created and delivered by a quite diverse group of individuals, including a consultant, and university employees, an enterprise agency and a regional development agency. According to these interviewees, who formed what could be regarded as a “pioneer group”, its basis was an economic crisis in textiles in Twente, which in turn created a crisis for the university and other members of the economic development community. The reinvention of the university was undertaken by senior university managers, with the intention of increasing the university’s regional economic impact, transforming it from an “ivory tower” institution into an applied regional entrepreneurial university. Within this conception, TOP was something which specifically helped the university to achieve its own goals. Central within this narrative told by the pioneers was the role played by the Rector Magnificus at the time, Professor Van den Kroonenburg. He himself articulated the relationship between TOP, the reinvention of the university and the reinvention of the

region in an article published in 1983. The article stressed the general point that the economic success of the Dutch economy was dependent on the success of SMEs, and it would take a special type of university to get their technology effectively into such firms. The article noted that

“SMEs are a clear market for the university product, and SMEs are vital for creating employment opportunities for the Dutch economy. Figures from the USA show that whilst large firms are losing jobs, the SME sector remains the engine of employment creation. Hence the increasing importance of SMEs. The *Transferpunt* is a key component of our engagement strategy, but equally there is a need to ensure that blue-skies research is blended with market-led research in planning our future research strategy. Doing that will require novel and entrepreneurial approaches from THT staff ... Research shows that this has been very important ... Launching entrepreneurs and incubating them at the heart of the university is becoming a “Twente speciality”. These high-technology spin-offs are building up a regional industrial base that is making Twente more attractive as a region, and UT is now working to support this.” (Van den Kroonenburg, 1983, reprinted in Van der Kroonenberg 1996, pp. 21-22, authors’ own translation).

This core team had a very particular view of Professor Van den Kroonenburg as the key figure in the reinvention of the university. All of the members of this group had had personal contact with the professor, and also had a very complimentary view of what he had achieved. A key part of the way that this group regarded him was that he helped them to achieve their own particular ends and goals ; we have noted that the members of this group had very different backgrounds, so each saw Van den Kroonenburg as playing a vital role towards their own efforts towards delivering their own goals. The consultant, for example, saw that Van den Kroonenburg made the Ministry of Economic Affairs more willing to commission research of interest to him as a consultant. The enterprise agency employee saw that Van den Kroonenburg’s involvement literally opened doors for him in the university, making dismissive professors more willing to spare the time to talk about technology transfer. A general view of Van den Kroonenburg in the pioneer group was that he had indeed successfully encouraged the university to make the change into an entrepreneurial

university, although the rationale through which the various pioneers justified it to themselves was quite different.

“Van der Kroonenburg, as I already said, was a visionary man, and he saw that a very good mechanism for bringing know-how from the university to the market was using spin off companies”.

This was the second element of the pioneer story, that TOP was a critical – arguably the most important and enduring – signal of a cultural shift within the university. One interviewee noted that his own work routine shifted in response to Van den Kroonenburg’s efforts from him having to approach unwilling academics, to the academics “more and more came to me and said ‘hey we have this in our hands, is there a possibility, do you know of a company that could be interested in this?’”. There was a consensus that the TOP programme was successful on a variety of levels, from hitting its target of 15 companies per year, to transforming the university culture, to making the region more attractive, to increasing the esteem of the university in the eyes of the professorial technology transfer community. One interviewee specifically ascribed the success of both the Business and Science Park and the attraction of the Ericsson R&D plant to the TOP programme. Another interviewee noted that by the 1990s, they had placed Twente firmly within what could be considered as the spatial imaginaries of industrial liaison officers.

“We were getting more and more of name for the things we had done. Others came to us and said, ‘well, this is interesting, can we come for a day or two?’ And so we started to think, ‘well, we could be busy the whole week entertaining [such guests] and showing them around, so we became a bit more business like, we asked a few [payments] for that”.

The third element of the pioneer story is associated with this success, and that was that as the programme became more visibly successful, the project and the team ‘drifted’ into other areas. In the eyes of the pioneer group, these were a set of activities that were developed as an adjunct to TOP, often in other regions. The pioneer group regarded them as valuable, because they had generated knowledge about commercialisation, and they were now exploiting and extending their ideas and this knowledge. One individual specifically named the follow-up programmes to TOP, including “Kansrijk eigen Baas” and the “Campus Business Center” projects

(qv) as good examples of this transfer of “TOP knowledge”³¹. There was a consensus that although the project was seen externally as very successfully, as the interests of the university shifted, there was a decreasing amount of internal support for those activities. One interviewee summarised this rather succinctly.

“I think that the trouble with the TOP now is that the TOP has not the good support from the board of the university, the real good support. It is also financially not attractive any more for the faculties, and always with new activities on the long run, people are so accustomed to that that there is nothing new, that is difficult with innovation and new entrepreneurship. At the end, you get fed up with the same system, and that’s not any more the sparkling new idea. I know I have not a good solution for this”.

The final element of the story was that all the individuals had moved on to new positions where the networks that they had built up could continue to be exploited. There was a generational issue, in that some of the pioneer group were approaching retirement age, and one noted that the passage of time was eroding their own knowledge of the business networks in the region. However, at the time of the research, three of the four interviewed within the pioneer group were still active in work, and were involved in entrepreneurship activities in Twente (all three had offices in the BTC in the Business and Science Park). All interviewees in this class were clear that the TOP programme had survived, one interviewee arguing that it was significant because it was the only element of the *Transferpunt*/ TRD/ Liaison Group structure which still endured. The optimism and belief which the pioneer group had in the past, present and future of the TOP programme stood in quite stark contrast to some individuals within the university who believed that the TOP programme was less successful than hitherto (*cf.* Chapter 6). At the time of the research, the interviewees noted that the TOP activities had been re-embedded within NIKOS, with sufficient staff and resources to run them, even if there was concern over the importance the university attached to what they believed was still a very important

³¹ As the research project was being completed, the “Kansrijk eigen baas” team had created an alumnus organisation, “Successvol eigen baas” (Successfully your own boss) to try to create some of the benefits that the TKT had to the Achterhoek region, and creating a set of contact networks which were also an asset which could more easily be drawn upon by subsequent cohorts of KEB-ers.

activity. The pioneer group therefore believed that TOP would continue to be successful into the future.

7.2.2 The user community: TOP-pers experience of participation in the scheme

The second group which had a kind of internal cohesion in the ways that they talked about the TOP scheme were the alumni of the scheme, the so-called TOP-pers. In some senses it does not make sense to talk of them as a “community”, because they passed through the TOP scheme at very different points in its history, from the earliest ‘guilder grant’ periods, to the euro loan used in part to buy services from accredited providers. In that sense, they as a group are what might be termed after Benedict Anderson an “imagined community”, although that does downplay the extent to which they did know one another. Some of the senior TOP-pers had served as mentors to more recent TOP-pers, at least two generations of TOP-pers sat together on the TKT board (the 1990s and 2000s, *cf.* 7.2.4). There were 11 alumni interviewed in this research, and the stories that they told about the TOP had perhaps a greater deal of coherence than might be expected given the differing experiences that might be expected. The stories they told tended to dwell on four main aspects of their opinions and experiences of the ‘TOP’-life, reflecting that the TOP process was not represented by them as limited to a fixed twelve month window in their company life, but as something of which they were aware before they embarked on the entrepreneurial process, and with which they remained involved after the initial one year intensive-entrepreneurship period.

The first element of the generic narrative was that the TOP system was portrayed as a timeless and unchanging entity. Although the scheme had clearly evolved – something the pioneer group recognised – the TOP-pers appeared to acknowledge that the TOP process, with the committee, the academic mentor and the loan was a shared experience, and the similarities of the experience outweighed the cosmetic differences between the different deals enjoyed by successive cohorts. A number of entrepreneurs had known about TOP from their time within the university, and used it when they decided to become entrepreneurs. There was not a great deal of spontaneous criticism from the entrepreneurs of the TOP scheme, which suggests perhaps that it was relatively fit for purpose. Three of those interviewed had had difficulties in arranging the scheme, but recognised that those difficulties arose at

least in part because they did not directly conform to the intentions of the scheme. To the extent that there seemed to be this view that the scheme was 'concrete', not something which could be shaped or negotiated with, suggested they regarded it as an independent institution, autonomous from the pioneer community who were in reality responsible for delivering it.

The second element is that the TOP was never seen by those entrepreneurs as an important part of the story of the establishment of the business; none of those interviewed said that they were stimulated directly by the TOP to go into business. The story was more that the TOP programme lubricated what they were already doing. Each of the entrepreneurs found particular elements of the package of most use, whether the location within the university, the business advice or the loan. This is not to downplay the value of the TOP scheme, because it clearly did permit all kinds of opportunities to be exploited in the form of stand alone companies. For several of the entrepreneurs, they argued that TOP set them on a path where they came into contact with people who could help them find successive rounds of finance. Again that meant that for them the TOP process did not last precisely one year, but the contacts that they made lasted until they had been superseded by other contacts. The speakers tended to acknowledge the limits to what TOP could achieve, but that it was a developmental process for them, and helped them as part of a pathway towards commercial sustainability of their spin-off enterprise.

The third element of the stories that they told about the TOP was that the TOP was there for them as required; although it was not necessarily a stimulus for their entrepreneurship, when they did encounter the stimulus, then it was available for them to establish a business in the region. There were a range of predominantly negative stimuli, including problems with one's boss, the business or branch being closed, and boredom or stress with their job. On those occasions, the TOP programme permitted the individuals to choose an already available option in a way that made it more feasible – and more attractive – than had the TOP programme not been present. At least two respondents noted that the loan element meant that their partners were happy for them to spend a few months trying to make their idea work, in ways that would necessarily have been the case had there not been the regular (if small) income provided through the loan. The effect was to provide some continuity in activities within Twente, so that for those people that wanted to remain locally, often for

personal reasons, they were able to find alternative employment without having to look back to the core regions of the Netherlands to do that. They were encouraged by the committee to access other networks, the most frequently mentioned in connection with TOP were Innofonds, the TKT, the personal contacts of the TOP commissioners and the various infrastructure facilities on the university campus.

The final element of the stories that the TOP-pers told about TOP was that it was itself a means for them of actively creating new networks. One of the TOP-pers noted that the university actually did very little; he just moved into the university, and began building linkages with people using the university as a fixed base; he was able to draw on the knowledge of people within the university to make the contacts, but he was the active person in drawing the networks together to make the new business. One investor noted that after the TOP scheme, there remains further work to be done in rounding out the knowledge and the expertise of the companies.

“What you see is the spin-offs of the university, you see a lot of young management. After they finish their study they start up directly with a company. We have a solution for that. It’s what we call the chairman formula, is that we have a supervisory board member who is an experienced entrepreneur, who is in a lot of cases acting as being a chairman in the Anglo model, not really active participating in the management, but he is joining meetings with key customers, he is sitting in the management team meetings, weekly, important propositions are seen by him.”³²

He then went on to note that in the case of TOP companies, the chairman formula could conceivably involve using former TOP-pers as these Anglo-style chairman. He had invested in two companies, and had placed chairmen in both of them, and the chair of one was the executive director of the other; both were TOP alumni, but one had been through the process a decade before the other.

³² The Dutch commercial governance system has a dual board structure, an executive board of three or five members who take the operational decisions, and then a board of oversight, the *Raad van Toezicht* who are responsible for holding the executive board to account against the stated interests of the shareholders.

7.2.3 The view from the core: the current key decision-makers

The third group who talked about the TOP programme were a core group of those involved in commercialisation policy within the university. The view of the pioneers of this third group was in that sense correct, in that this group were not particularly keen on TOP, and felt that it had perhaps outlived its usefulness. The criticisms of the TOP programme tended to cover three main areas, and all the respondents in this area raised at least one version of each of these three points. The first was that the TOP scheme had been useful in its time, but had outgrown that usefulness. As one such core interviewee responded, “the textiles industry was diminishing and diminishing and then gone, and people didn’t have work, and there had to be a new impulse in this region and that is why the university is put here”. Although none of the commercialisation policy-makers had been at the university for more than a few years, they all had a strongly historical version of the scheme. Common to all three was that TOP was a vital part of the reinvention of the university under Van den Kroonenburg, but it had gone through what one interviewee called “a dead decade” in the 1990s. Consequently, its current incarnation was not delivering what the university desired, and so there was a belief amongst senior board members that alternative approaches were necessary.

The second related element of the senior management narrative was that the TOP scheme was not necessarily the best way to commercialise the university’s technology portfolio, and so it was better not to try to revitalise the programme, but instead to develop alternative methods which best met the university’s needs. According to one respondent, “the past problems were that the process of scanning and screening was more run by accident than by professional activity”. The respondents recognised that TOP was a passive scheme in which the university was opened up to entrepreneurs who were then allowed to do whatsoever they chose with assets in the university. There was no way to ensure that the needs of the university were aligned with those of the company, unless the university were to take an active participation in the business (which as we saw in chapter 6 was not entirely unknown).

“One of the big problems is that on this development side, a lot of our start-off, our spin-off companies are growing slowly to a certain amount of people that I call them lifestyle companies - not growing further. So I say to them, how many people do they have? ‘Twenty’. And how big is the market?”

Well, there could be one hundred people. So why don't you do it? "It's easy, it's nice like this", so we have to make it professional".

The third was the financial dimensions of this, in particular the fact that the TOP scheme did not reward the university directly, and as one interviewee pointed out, it was actually a cost to the university that they had to fund themselves, which was traditionally done for the good of the region. The financial situation tightened for the university because of the general savings policy of the Government (*bezuiningsbeleid*) which had impacted quite severely on higher education as a whole, alongside the specific problems faced by UT in having to raise the costs of a full campus redevelopment. The TOP programme was consequently seen by some of the university senior managers as being a luxury which the university could not necessarily afford, particularly if better, actively managed approaches to technology transfer could yield better and more sustainable rewards for the university. There was the idea of a "TOP+" scheme which intended to create a second phase in which the university invested in the companies, but at the time of the research, little progress had been made with that.

"There is an issue with the TOP programme, there is no contribution back to the university; they are all graduate start ups, so they may be computer services or bakery businesses, they are not directly linked to the university. There is a 100% focus on start ups at the university rather than looking at models which bring money back in."

The fourth element of this particular story was the idea of the "tissue engineering accelerator", which was seen as being a "Great Hope" for the university, which would solve these three problems, promote entrepreneurship in a way that the university directly controlled and which in turn directly yielded a profit for the university. The idea of the tissue accelerator was to select ideas which could be turned into companies, then fund a research associate to produce a proven concept. The idea had some external approval, and had been written into the *Kennispark (qv)* strategy as the first step in creating an extended science park across both sides of the Hengelostraat, covering both the Drienerlo and Business & Science Park sites. What was interesting from the narratives was the degree to which the Accelerator concept had displaced the idea of TOP in the minds of this particular community. It appeared from the interviewees that what was most appealing to them was the fact that the accelerator

was within their control, and if the model would be proven with tissue engineering, then it could be extended to other areas where the senior management felt that there was insufficient progress around valourisation.

“TOP was a really passive scheme, there was a notice on a board, and it said that if you could fill in a business plan and were an entrepreneur then they would support you. We are now looking more actively to product/ market combinations, building up the accelerators”.

7.2.4 Neither in nor out: the work of the knowledge transfer professionals

The final group who were involved with the placing of TOP within the university were the business development and commercialisation within the university who were responsible for valourisation of the university knowledge base. Their views on TOP tended to be the most pragmatic and the most ambivalent, and it was their continuing use of TOP that meant that it remained as a project within the university. It was clear that other peripheral technology transfer programmes had been abandoned by the university board when they were able to argue that those kinds of activities were not the kinds of things that a university, even an entrepreneurial university such as UT, should be doing. However, that case had not been advanced for the TOP scheme by the time of the research, and in part it was because although the core policy team might have felt that TOP had passed its peak, there clearly was still value to the university in having such a mechanism for university entrepreneurs to be able to exploit. In particular, the networks that had built up around TOP, even if not directly valued by the university, were still being used by the BDMs in building up the larger networks that allowed a wider regional mobilisation in their technological area. The stories that this community told are perhaps then the most indicative of how this constructed peripherality that the TOP programme found itself in was sustained. They show how the activity came to be within the university, but not central to the university itself.

The first element of the stories that the business development managers within the university related were that the TOP companies were an element of what they did. The spearpoint institute, such as MESA+, BMTI and CTIT all had commercialisation targets which had to be addressed. TOP companies were a means by which they met those targets. The significance which the spearpoint institutes placed on the TOP

companies can be seen in the case of MESA+, which in its annual report, places a short report on its commercialisation outputs in the same section of the report as other elements demonstrating what the British researcher might refer to as esteem indicators, such as royal honours, prestigious awards and fellowships³³.

Figure 16 The representation of spin-off companies (and TOP companies) as key elements of the MESA+ family and as an 'honour' for MESA+

GENERAL

<p>MESA+ accommodates hightech companies</p> <p>On May 1st 2003 MESA+ opened her new building. This new accommodation, directly adjoining the Mesa laboratories and the clean room, houses three types of companies:</p> <ul style="list-style-type: none">• starters and more mature companies with a strong tie with MESA+ and/or her facilities• companies that have their management and sales operations elsewhere, but keeping a space at the university for technologists• about 1/3 of the new building is for the central management of Mesa+, enhancing the thinking process about commercialization and new opportunities.	<p>Entrepreneurship in microsystems or nanotechnology requires highly advanced facilities, like a clean room to fabricate and test minute structures. The new MESA-building mainly houses companies developing sensors, chips and advanced technology in particular. This is a development the institute wants to stimulate to even a larger extent.</p> <p><i>"It is the best way for the mutual exchange of knowledge and the development of new ideas in business and science", technical commercial director Kees Eijkel says. "We look at it in the way of making successful commercialization of knowledge accessible. Besides aiming to be the scientific top in this field, we also want to translate our knowledge to economic development."</i></p> <p>Towards the end of 2003 MESA+ has 26 spin-offs of which 10 have offices in the new building .</p>
<p>Royal honour for Piet Bergveld</p> <p><i>Professor Piet Bergveld, up till February 2003 professor of Bio Sensors at Twente University, received on 1st April the royal honour of Ridder in de Orde van de Nederlandse Leeuw. He received the royal decoration from the hands of the Enschede mayor J. Mans.</i></p> <p>Professor Dr. Ir. Piet Bergveld (Oosterwolde, 1940) has been the initiator of medical biological research from the very start of Twente University. He is renowned for his invention of the ISFET-sensor.</p>	<p>Scientific contributions about the ISFET of fellow scientists in conferences and publications worldwide. This led to a professorship on a personal title", as states the recommendation for the royal honour.</p> <p>Professor Bergveld, together with his colleague Professor Jan Fluitman, also stood at the cradle of the present MESA+ Research Institute. In the eighties of the last century they started a Sensors and Actuators Group and equipped the first modest cleanroom laboratory for the fabrication of sensors. The present</p>

Source: MESA+ annual report 2003³⁴

This is not just true for the MESA+ institute, but also for the other spearpoint institutes interviewed in the course of this research. CTIT, the telematics research institute uses its success with spin-outs to argue that they are one pathway for a university to commercialise its research.

³³ The other "Helene Andersson: top of the bill in MIT's Young Innovators", "Kobus Kuipers receives NWO-subsidy for excellent researchers", "Niek van Hulst receives the Körber Award for a molecular motor" & "Innovation subsidy for advanced biochip for protein interactions".

³⁴ available at: - www.mesaplus.utwente.nl/library/Annual%20reports/mesa_annual_report_2003.pdf

“All these research activities also contribute to innovation. Currently, more than 30 spin-off companies of the University of Twente have strong bonds with our research activities. Facilitating a natural flow from knowledge to products and services. In the years to come this number will further increase”
(from http://www.ctit.utwente.nl/about/progress_report/index.html)

Figure 17 The placing of TOP companies in the CTIT annual report, 2003

Temporary Entrepreneurial Positions and high-tech spin-off companies
The University of Twente characterises itself as an entrepreneurial university. This is reflected by its close ties with industry and by the special connections with high-tech start-up companies. In the past ten years, more than 500 high-tech companies have been set up in the Twente region, employing over 3,500 staff members. CTIT also has a special link with start-up companies in the high-tech sector, many of which have set up shop at the Business and Science Park bordering the University of Twente campus. Currently, more than 30 of these spin-off companies have strong bonds with our research activities, facilitating a natural flow from knowledge to products and services. Some of the TOP (Temporary Entrepreneurial Positions) and spin-off companies with links to CTIT are: Realise b.v., B-SIM, MAG Productions, Talking Home, Carp Technologies, Imotech b.v., Aemics b.v., Tuna & Donuts Webdesign VOF, Utelus, Borbala Online Conference Services, Travel Service International, FLEX, A&R Management Consultants, Atsmart, Keypoint Consultancy, Technomatics, FACT, OpenFortress, CAALMA b.v., Cintus, Forward Thinking, Index Society, Neuro-Fuzzy Centrum, Sightline, Controllab Products b.v., C2V, Yucat b.v., Emaxx, Internet & Database Technology (I&DT), Cohesys.

The environment in Europe for wireless and mobile experiments
In cooperation with IBM/Cisco Systems and Intel, the University of Twente has built a Wireless LAN (WLAN) infrastructure of unparalleled dimensions in Europe. It consists of 650 wireless access points, is used by more than 8,500 staff and students and covers all of the 140 hectares of the university campus, two local railway stations, part of the city centre of Enschede and part of the nearby Business & Science Park. A wide range of infrastructures, applications, expertise and users have been brought together to form a WLAN / GPRS / UMTS testbed-environment in Twente for wireless applications and mobile services. Example applications are the MobiHealth mobile health system and the TeleTOP tele-learning environment.

Awards and specific scholarships in 2003:

- Asker Bazen: NWO VENI-grant for the research project 'Passport on a fingertip',
- Sonia Heemstra de Groot: Marina van Damme award 2003,
- Patricia Dockhorn Costa: Civi Industry award 2003 in the

Source: http://www.ctit.utwente.nl/about/progress_report/progress_report0304.pdf

What was perhaps most significant was that the TOP companies were part of larger regional mobilisations and projects. Consequently, the TOP companies played a role in helping to deliver projects with a more significant regional footprint than a handful of new high technology companies with perhaps a few hundred employees. Consequently, TOP companies were mentioned as part of what was being achieved by larger regional activities in which the university, and particularly the spearpoint institutes, were taking a leading role. In the case of the *Zorg en Technologie* project, the local municipality paid for a twenty-page insert to be included with the weekly news magazine, *Elsevier*, spin-off companies were used to make the point that there were a wide range of collaborators in the partnership, and that was significant in the

way that external governmental agencies viewed the development. Likewise, MESA+ argued that the spin-offs were vital to give the whole clean-room activity a critical mass; there was not enough internal demand within the university for a state-of-the-art clean-room, but working with the TOP companies, they were able to assemble a large project with the capacity to transform the region. In both these cases, interviewees noted that the TOP companies, and their role in the successful larger projects, were used by the institutes in a symbolic way in negotiating their future existence within the university.

The second element of the business development managers was that they had a higher degree of uncertainty over the tissue accelerator and the extent to which it could become generalised, as others believed, into a more general mechanism for managing the university IP portfolio. The business development managers appeared to realise that it was an innovative idea itself, and might potentially not be successful, in which case other concepts and ideas would have to be trialled. One business development manager noted that the accelerator concept was not directly applicable to the way that firms in his own area were established, but that they were experimenting with it nonetheless. One interviewee noted that if the accelerator could be made to work more generally, then it would help to attract other commercialisation institutions, such as the Dutch leading technology institutes, because it was an idea that no one else had developed. Another interviewee noted that their particular institute had already trialled the idea of an accelerator but it had not been able to find investment funds as a consequence of the bursting of the dotcom bubble after 2000. Thus, it seemed to them that because the accelerator was not a firmed up and stable object which met all of their criteria for technology transfer needs, there was still value to them in the idea of the TOP programme, which complemented the accelerator concept, which in turn became stabilised and made concrete in particular ways.

The final element of the narratives that the business development managers told about the TOP was that it still had value because it was intertwined with other networks with which they were involved. One business development manager, who had worked with both the biomedical engineering and the IT spearpoint institutes, was also involved with the TKT, which had its roots in a post-TOP activity for successful TOP-pers. Iddo Bante, who had worked as business development manager at both BMTI and CTIT was on the board of TKT, because of its value in helping professors

to commercialise their ideas by helping him identify young entrepreneurs with a capacity to collaborate on commercialisation. Table 6 below shows the seven TKT board members who have been involved with TOP; only the co-ordinator, Richard Fok, was not a TOP alumni, the other seven were all involved, six as TOP-pers and one (Jaap van Tilburg) as a ‘pioneer’.

Table 6 The TKT board members who are also TOP-pers³⁵

TKT member	Company	Year in TOP	Comments
Jaap van Tilburg	(original concept)	1979	
Nijssen	First design	1987	
Dieleman	Axis M. O.	1992	does UT website
Bonenberg	B-SIM	1997	links to CTIT
Posthuma	Indialoog	2000	
Verhoeven	Mag Productions	2001	links to CTIT
Wijgerse	Keep-it-simple	2003	

Source: www.tkt.org, www.utwente.nl/nikos/

There were other networks which the university business development managers were involved in, and which they attempted to influence, and in which TOP companies also played a significant role, although in none of the cases was the influence as active as in the TKT. In PPM Oost, for example, the regional venture capital company, the university and the business development managers had links to the managing board, which were validated in terms of the fact that a significant number of companies in which PPM Oost had invested had emerged from the university. However, these links also allowed the university to raise finance for its newer ventures, including in 2005, the “Tissue Accelerator” company³⁶. PPM Oost also invested in the Campus Business Centre, which was trying to introduce the TOP concept at the craft college level (ROC) at Hengelo.

³⁵ Sources for this are:

http://www.tkt.org/ventura/engine.php?Cmd=see&P_site=735&P_self=81096000&PMax=0&PSkip=0
<http://www.utwente.nl/top/TOP-companies/TOP-Lijst%20140305.doc/index.html>

³⁶ “Tissue Engineering Accelerator B.V. invests in start-ups and early stage businesses (to €25, 000 per company) in the fields of regenerative medicine, technical life sciences and tissue engineering. The share holdings exploits knowledge in these fields developed within the University of Twente.”

7.3 Opening the university to regional entrepreneurs?

In the previous section, we have presented the perspectives from four quite distinct communities within the region who were involved within the TOP programme. From those somewhat divergent stories, it is perhaps difficult to get a clear view of the significance of the TOP programme. In the introduction to this section, we noted that we were interested in understanding how the ‘university culture’ had changed in the last twenty years, and become more open in the course of building an entrepreneurial university. The case of the TOP programme gives an interesting case study for how this change took place, and what the key tensions in achieving those changes were. In this section, we present a synthetic version of the TOP story and its key features, to reconceptualise the other technology transfer activities within the university. From this, we look at what kinds of processes this suggests by which the university improves the quality of its external environment.

7.3.1 Introduction: the shifting entrepreneurial culture of UT

There has been a clear shift within the University of Twente in the last 20 years; perhaps the clearest sign of this shift is the developments around the Business and Science Park, which have filled some 40 hectares of formerly vacant land to the south of the university. In a quite illuminating paper, Peter van der Sijde *et al.* (2002)³⁷ explicitly chart the expansion of the BSP in parallel with the number of companies coming out of the TOP programme, and the number of jobs they created. The TOP programme has been involved with those physical changes fairly intimately; it was a flagship project of the Rector when the change was made from Technische Hogeschool Twente to “UT-the entrepreneurial university” in 1986; the BSP also houses a large number of alumni of the TOP scheme and the scheme is currently run from an office block on the Science Park. However, the case of the TOP scheme presented in 7.2 seems to obscure understanding the ‘changing university culture’, because the stories related above suggest that there are many different cultures and

³⁷ Sijde, P.C. van der, Vogelaar, G., Hoogeveen, A., Ligtenberg, H. & Velzen, M. van (2002). Attracting high-tech companies: the case of the University of Twente and its region. *Industry and higher education*, 16(2), 97-104, issn. 0950-4222

communities within and beyond the university. Moreover, within the scheme, each of the communities was involved at different points at very different times.

Relating this changing nature of the TOP project back to the tangible outcome, there was significant economic and physical change associated with the increasing importance of entrepreneurship around the university. The ‘university community’ was much broader after the first twenty years of the TOP scheme, with a network of companies surrounding the university, and with a variety of linkages to those companies. The university clearly benefited from being seen by its partners as an entrepreneurial university, a position which the TOP companies helped to demonstrate. The *Kennispark* project drew heavily on two existing activities, TOP and the Knowledge Accelerators. This raises questions about whether the TOP experience, and the way the project passed through – and was experienced by – different communities at different points in time – has more general lessons to help understanding the impact of universities on their regions, particularly in less successful environments. We therefore start to produce a more synthetic and singular version of the “TOP story” emerging above to develop a conceptual lens through which to re-examine university technology transfer activities. This then enables us to offer a more general – if very tentative – explanation for how UT achieves its regional impact within the various communities of the university. From this, we can then briefly discuss the implications this has for orthodox analyses of technology transfer communities and activities within universities.

7.3.2 The TOP story: towards a synthetic perspective

The stories presented above seem to suggest – when taken together, and reconciled – that the TOP programme went through four stages within the university. The first was that it was created, and was virtually ‘weightless’ to the university, because of the subsidy; by allowing entrepreneurs to come into the university, it produced a large number of companies very cheaply, giving it a kind of ‘magical’ or talismanic nature. The second stage was that senior management attempted to draw on these ‘magical’ powers in the 1990s to solve particular problems with commercialisation, and – because it was not actually magical – it could not solve those problems. This led to the third phase, in the mid to late 1990s, where the scheme was not valued at the centre, and then finally, by the time of the research, the scheme was regarded as one

project amongst many, and other things dominated the senior management agenda. However, TOP was still strongly valued by external stakeholders in the region, especially those involved in regional development and the regional development plan. In part, of course, this placing of the scheme is dependent on the central management requirement for control over its technology transfer. With TOP, its early results were so impressive at that time that it was not required to be under control. As one person involved noted, “it is not too ambitious to say that the TOP programme really was the starting point for the development of the science park.” As soon as the early sheen dulled, management brought the scheme under control and rejected those parts that were not seen as belonging within the university.

In essence, then, the TOP scheme consisted of a central kernel that built up within the university. What this kernel did was provide easy access to people establishing new businesses, to a set of assets vital to entrepreneurship. We have noted that the entrepreneurs did not regard TOP as particularly important, but it was interesting that many of the criticisms that are often made by entrepreneurs of universities were not heard in the course of the interviews. David (2005) noted that often entrepreneurs complain that they have difficulties finding funding, or getting the university to take them seriously. With the TOP scheme, there was a high success rate for its firms for achieving funding, the entrepreneurs were able to negotiate innovative deals to access staff and equipment, and ultimately, the entrepreneurs seemed to believe that the success or otherwise of their business was down to their own qualities. Of course, having that belief fits with not wanting to grant too big a role in the “entrepreneurial story” to a third party, such as the TOP scheme. This is the first key element of the TOP programme, the idea that it created an entrepreneurial field. The idea of an entrepreneurial field is that it is a microcosm of a munificent regional techno-economic network in which entrepreneurs can more easily access resources that enable them to realise their business visions.

The second element of the story was that the TOP programme was not entirely created from assets within the university; although university staff often tell the story in ways that suggest the TOP was entirely the work of Twente University (*cf.* Lazzaretti & Tavoletti, 2005), what this perspective hides is the way that the TOP pioneers used the concept to bring in external resources, i.e. finance, knowledge and legitimacy, which were then invested in helping to create the “free entrepreneurship assets” noted above.

The TOP scheme was originally funded by a MINEZ grant (f. 750,000), which was cleverly turned into a more permanent fund. The consultant originally involved in the scheme was an external consultant, and was involved in developing the scheme through its life. The TOP commission approach meant that a network of business mentors built up around the university, putting their efforts into helping others create new businesses. As we have seen, it does appear that they helped to make the overall process easier by eliminating some of the niggles faced by new entrepreneurs.

The third element of this story is that the TOP programme has embedded the activities within the region, or at least been involved in the activities being more permanently embedded in the region. Although the TOP scheme has always been a “scheme” in the sense that the university could kill it and it would disappear, the benefits that have been produced are tangible. There are other universities projects that have not had a strong regional impact and outlived their project life, but TOP clearly has – through the evidence in the BSP – been successful. The local development partnership seemed– on the basis of those past successes – willing to believe that the university could extend and develop that success through the *Kennispark* programme into the future. Thus, TOP was a programme of regional benefit, because it has brought in external resources, then embedded them in autonomous activities and networks. These activities have moved outside the university, and have had a transformative effect on the region, at least in terms of becoming independent growth centres, like the cases of Axis or Demcon.

Thus, although the TOP programme drifted to the periphery of the university management, it remained a conduit which brought external assets into the university in ways that they could be used by local entrepreneurs to establish their own businesses. These external assets then became embedded within those businesses, or helped the entrepreneurs to circumvent the barriers they would otherwise face. The TOP programme has since been handed on to a new management team, and so there is evidence to suggest that it has become more generic than a particular network bundle associated with the pioneer group. However, the activity itself is not that stable – it has experienced a range of disruptions during its life. This is a fourth important feature of the story, that what was important were not the “entrepreneurship projects” undertaken within the university, but the activities that they created outside the projects but within the region.

7.3.3 Reconceptualising the technology transfer activities and the cultural changes

The TOP story suggests that the successful activity had a number of features. These included bringing external resources into the university, then making those external resources available as more general – regional – assets. The second was that the activities and assets were more firmly rooted in the region and could be used to create activities of general benefit, although they were not independent of the university; they were easier to access than had they been externally held. The third was that the spin-offs formed within the university, or within the entrepreneurial field, which allowed them to access a range of external networks, and in the course of the year or so in the TOP process, they emerged into the region. Once the new firms had emerged, they were then able to produce a number of changes to the regional innovation system as autonomous actors, and they took the assets out into the region.

The source of those assets combined by entrepreneurs in the university is interesting; some of the external assets were provided by the university, but the university also allowed the entrepreneurs to bring their own external assets in, and some of those assets later could be regarded as having moved back into the entrepreneurial field (the TOP-pers going on TOP commissions etc). This also helps to explain why the central support was so important in the earlier stages of the project, and why later projects – where support from senior management was more equivocal – were apparently less successful. Support from the senior management within the university allowed a critical mass of resources to build up around TOP, particularly the MINEZ investment, but also the various TOP firms. These assets coalesced into a large critical, which only fell out of favour when it was unable to deal with a number of time-specific problems (in the 1990s). Why was the central support so important? That is a difficult question to address, but the pioneers were clear that it was vital to their success; in part, it allowed the field to be more open and easier to build connections (Van den Kroonenburg opening doors into laboratories); they had the latitude to ‘do deals’ with research groups and entrepreneurs, and the pioneer group also brought their own contacts in, and critically, not all the pioneers were university employees. Without being placed at the centre of the university, there would not have been the capacity to fix fleeting, ephemeral assets within the region, anchoring them to other, more stable assets. Of course, some of those fleeting, ephemeral assets were things that emerged from negative events within the region (such as the

aforementioned plant closures or redundancies), that could be read as turning a negative “problem” into a positive benefit.

This idea of the ‘project’ as a mechanism to bring assets into the university is useful for reconceptualising the role of the university in the technology transfer process. The university appeared to create the microcosm of a techno-economic network within the boundaries of the university, and others then took these assets and embedded them within the region. It would be tempting, because of the fact that universities habitually participate in many international and external networks, to think that the university acted as a node for these linkages to come together, at which point entrepreneurs could draw upon them for overall regional benefit. Our argument is slightly different, and that is that in the case of TOP, the university senior management had to work very hard to pin those opportunities down within the university (such as the MINEZ grant funding). The activity had to be kept close to the core of the university until it had built up a sufficient dynamic of its own and could be released to the fringes. The whole process of project formation was highly experimental, and required a great deal of commitment from the university central management. This process provides a heuristic to reconceptualise the other technology transfer activities within the university and the region, to understand how UT leveraged its privileged position to draw and embed further assets within the region.

7.3.4 UT fixing global assets for regional entrepreneurship?

In the story given above, the TOP programme represented a growth node which was stabilised, at considerable effort to the university, within the boundaries of the university. This growth node provided stable resources which others were able to use to support their own activities. The role of the university was to translate resources, to bring them – temporarily – into the university and the region, and then others were able to embed them within the region. The effort required in many cases a period of concentrated input from the university, and the expenditure of considerable resources to achieve what would appear before the event to be quite minor changes. It was only once the project had embedded itself within the university and the region that the wider value of the activity, as a transformatory activity, became evident. This explanation is also useful for providing an alternative perspective on the other main

technology transfer activities engaged in by UT, particularly in understanding how single and one-off projects had a wider regional impact.

The case of MESA+ is quite interesting in illustrating the effort required to embed world-class academic knowledge within regional systems; the university put around €8m into MESA+ in the last five years to continue the development of the infrastructure and to encourage businesses to come to and form in the institute. There has therefore been quite a large implicit subsidy from the university to the firms located at the institution. Part of the subsidy is in reality an investment, in equipment and infrastructure that firms rent back at a profit from the university. But it is clear that the rewards that this investment has brought are far less than the total expenditure made in the centre. However, using the TOP heuristic developed above, it is easier to rationalise on what the funds have been spend. What has been bought in the case of MESA+ is a container for a set of assets that are easily picked up and used by people in establishing companies which then have a regional impact. A company like Lionix has become a growth node creating and being involved with a family of (admittedly small) other companies.

However, these activities take ideas and knowledge from outside the university and embed them in firms, which have a much longer durability in the region than when they are held, unexploited, within the university. Finally, the activities have acquired their own critical mass which is seen in terms of the fact that Nanoned, the Dutch nanotechnology commercialisation subsidy programme, is managed from the MESA+ facility (*cf.* 9.3). What the university provides (in part through the direct subsidy it has provided to MESA+ and in part through its permanence) is a ‘point of stability’ on which the entrepreneurial field can be built. Of course, the problem in allowing entrepreneurs into the university to exploit those assets is that they can sometimes take the university away from its core mission – and as we saw in chapter 6 with the disposal of TMP into what was to become C2V – those peripheral activities sometimes are discarded by the university. The effort and resources expended by the university make something like MESA+ into a ‘site of constructive ambiguity’, where things with which the university is traditionally uncomfortable can temporarily be held alongside professional and academic knowledges. People who were physically within MESA+ had – on occasion – different roles which allowed them individually

to produce bundles of resources which could be made into viable companies which existed outside of the university.

The Tissue Accelerator is at first sight quite a different type of institution to TOP or MESA+, representing an attempt by the university to formally manage its IP portfolio and create new companies in which the university owns shares. However, the accelerator was – at the time of the research – at a very early stage in its establishment, and even at the time of writing, the concept remains somewhat experimental in its nature. The particular companies produced from the Tissue Accelerator would not have been particularly strongly embedded in the region were it not for the activities of BMTI in creating a set of regional networks with which the new companies could engage. The university deliberately negotiated a set of external resources for the Accelerator, and deployed its own legitimacy in a number of ways to allow the good ideas to access finance that the entrepreneurs would not necessarily get “for their bright blue eyes” (as one successful entrepreneur described it). In particular, the university managed to persuade the regional economic development partnership to articulate their demand for a Knowledge Accelerator in the regional economic development plan, and then used their past successes with high technology investments to persuade the regional venture capital firm PPM OOST to invest in the accelerator.

What the various technology transfer activities therefore appeared to have done is to take three steps which could be regarded as densifying the techno-economic network. The first is that they have – at a central institutional level – brought external resources into the university and held those resources for exploitation. The second is that at a project or research institute level, they have created an environment in which the resources have co-existed with other sets of resources, some of which are also external (such as academic knowledge) as well as entrepreneurs available to exploit those ideas. Thirdly, the university boundary has been made sufficiently porous to allow those entrepreneurs to escape and take the resources with them, and embed them locally, whilst ensuring that the projects and research institutes are sustained and hold resources for exploitation by the next generation of entrepreneurs. All of that is predicated upon an internal culture which is heavily divergent in the sense that there is no common culture within the organisation. In one sense, the university is entrepreneurial at all levels, in that people at all levels of the organisation contribute

to the creation of particular activities which have a regional impact. However, it is clear that the necessarily complement of that is a bulwark of anti-entrepreneurial people who define what the university is, and hence when particular activities have transgressed that boundary and must be divested. That has been vital in ensuring that the university does not diverge into a plurality of activities and lose its capacity to undertake strategic change, teaching and research. This suggests that opening the boundary of the university is not a simple activity, because it risks allowing divergence tensions to take hold and undermine the corporate strengths of the university.

7.4 Concluding discussion

The implication noted above, if more generally true, would be an interesting finding relating to the impacts of the professionalisation of commercialisation activities. It has been assumed that professionalisation is a benefit to a university, but UT has clearly had a great deal of difficulty in successfully implementing such professionalisation. It is clear that what the university is not doing in all these instances is managing its IP portfolio for the best return; this would involve doing more licensing deals, and also forming more companies in the west of the Netherlands, where there is a stronger economic climate and innovation system where such firms would be more likely to succeed. What has been created is a hybrid form within the university, in which regional development goals can be pursued. What the university contributes is its stability and its reputation, and in return for that, it wishes to ensure that these two assets are not jeopardised. The activity is thus tightly bounded; at first, the necessary concentration from senior management ensure that the activity remains within the university, but then as regional benefits begin to emerge, the activity faces greater pressure to move outside the university.

With both MESA+ and the TOP programme, it has taken a great deal of effort to retain the activities within the university given the demands on universities. This highlights some of the problems faced in building stronger regional innovation systems in less favourable environments, namely that it is harder to build these collective knowledge assets because all of the actors who would wish to use them tend to destabilise those assets in using them. Opening up the university becomes difficult, because by letting people in to use those assets, the university faces a set of

risks that the users will deviate from the university's wishes. In using the assets within the university, the firms act to localise them and embed them within the region, and that helps to build a stronger regional network, which can accrue a critical mass over time to create new growth nodes outside the university. However, this process of growing away from the university is itself destabilising for the university – as the university is putting effort into activities which are expensive, not a core university mission, and from which it seems to get a very limited benefit. Of course, the university of Twente's existence today depends on its pursuit of that regional mission, and that also perhaps explains the lack of a core commercialisation activity within the university. The university's whole approach is built on a kind of *laissez-faire*, or at least don't ask-don't tell, ambiguity over ownership and use of assets without which they would not be able to function effectively as ambiguous institutions within the university's institutional boundaries. So perhaps a better metaphor for the university boundary is that these institutions blur the boundaries, rather than make them porous – the firms and entrepreneurs are not really 'within' the university proper, rather, they are in this entrepreneurial field that has settled around the core activities of the university, and which remains strongly bounded to the university through a series of tight linkages.

In this chapter, we have made repeated reference to the fact that what the university does is offer stability to those who want to assemble a bundle of resources and create their own activity (firm) which then moves outside the university. Our rationale has been that these activities and firms can then become other foci for activities which reshape the regional innovation system. In chapter 6, we saw that there were spin-off companies which had come out of the TOP scheme which had themselves gone on to be parent companies to a range of new companies, not least Axis, Aquamarijn, Demcon and Lionix. That is one example of the way in which USOs themselves can contribute to the regional knowledge pool by actively transferring technology and knowledge. There are many other mechanisms by which USOs can directly influence the regional economic environment for entrepreneurship and innovation, such as by creating cluster organisations and activities, collaborative R&D projects, by winning and recycling venture funds, and by helping other companies to adopt university technologies. To complement this analysis in this chapter which assumes that creating these ambiguous institutional arrangements helps USOs to become these

external growth nodes, we now in the following chapter turn to consider the role of university spin-outs in actively transferring and embedding technology from the university into the region.

8 University spin outs as active technology transfer

A third way in which the literature suggests that USOs improve their local innovation environment is through the direct provision of innovation resources to other innovative SMEs. There have already in the previous two chapters been a number of examples of this working in practise. A number of the spin-out companies interviewed were actually consultancy companies which put together proposals for European-funded projects, and between them they had delivered a range of forms of support for innovation in regional businesses. Rosalind Klein Woolthuis (1999) wrote about the TIMP cluster organisation in Twente, which was a cluster activity which was initiated by a number of companies who were spin-offs, and other non-spin-off companies participated in the activity. There have been a range of so-called Technology Valley organisations which have tried to implement their own version of this cluster model in particular technology areas, and we have highlighted one, Mechatronica Valley, which was driven quite aggressively by one particular TOP-per. This seems to suggest that - at a very basic level - spin-offs are actively transferring technology.

However, we have already seen a number of examples where spin-offs have become involved in activities which have strengthened the overall technical base of the region, and other firms have benefited from this increased strength. USOs have become involved in new activities, and on some occasions, they have taken a key role in ensuring that those activities are created in the region. The example of MESA+ is an interesting case where spin-offs are an integral part of the rationale for the organisation; it exists as a commercial activity partly because of the spin-offs, but their presence enables the commercial activity to sustain its momentum, which includes supporting a set of clean room and laboratory facilities that can be used by both academic and third party users. Likewise, Demcon has been involved in sponsoring and supporting a range of activities, including buying troubled high-technology firms, and establishing its own green-field technology campus in Oldenzaal. Demcon's Chief Executive, Dennis Schipper, also sits on the board of the Twente Technology Platform, established to develop and implement a set of technology promotion policies for the region. Unlike in the comparator region of Newcastle, therefore, there are at least a few examples where spin-offs are active in

shaping the regional environment for entrepreneurship and innovation. Of course, we have already seen that one of the cultural peculiarities of Twente is that there are a lot of networks, so the question remains of whether the entrepreneurs have created, or been co-opted by, those regional networks.

In chapter 2, we suggested that the basic concept for this process was that the USOs would take ‘ideas’ out from the university, apply their ‘entrepreneurship’ to them, make them available to local businesses, and thereby help to improve those firms’ productivity through the innovation process. The argument in Chapter 2 was that the USOs in the model could do this more effectively than universities because as companies they had to be closely aligned and responsive to their customers’ needs. A heuristic for this process is given in the example where some of the consultancy companies were working to help local companies keep ahead of the challenges of competitive global markets, such as the threats (and of course opportunities) of nanotechnology for the chemicals industry. However, we have already seen in the two previous chapters that the naïve mechanism we envisaged in chapter 2 does not work smoothly or straightforwardly. In this chapter, we therefore begin to unpick some of the complexity surrounding the contribution made by spin-outs from the University of Twente to technology transfer – and hence to regional innovation, competitiveness and economic development - in Twente and the east of the Netherlands.

8.1 Introduction

In this chapter, we aim to look in a little more detail at the various ways in which spin-outs have contributed to the building up of collective innovation assets (the idea of a shared knowledge pool), and have made Twente a place with a better innovation environment. It is clear from the research that the spin-off promotion activity has had a broadly beneficial impact on the regional environment for innovation, and part of that has come about through the way that technology has been moved into, and implemented in, regional companies. As one interviewee from the regional development agency noted, spin-offs had a fundamentally different attitude to technology transfer from universities, but also enjoyed advantages over other non spin-off firms from their relationships with their ‘parents’:-

“.”They come out of the university, they know how it works, they have good contacts there ... And for them it is easier to know if there is interesting

research going on at a certain group, or that there might be business opportunities in a joint project. So I think that those companies have an important role in technology diffusion that can hardly be played by a university solely.”

One of the interesting findings from the research was that linkages from spin-offs to third party firms seemed to be relatively limited in their scope. With the exception of the consultancy businesses, there was relatively little ‘pushing’ of knowledge and expertise from spin-outs into other regional companies. Even if there has not been much immediately direct technology transfer from spin-outs into companies, there are clearly relationships between spin-outs and regional companies in ways that do have positive regional impacts. Part of the problem in identifying the particular contribution made by spin-outs is the dominant role played by the university in the regional innovation system. A number of the high-technology entrepreneurs in the region that were interviewed had come into contact with the university for the first time in attempting to establish their companies using the TOP programme. There were examples within Twente of where the university had helped those entrepreneurs to set up their companies, and so what we call “third-party” firms, which originally had no clear link back to the university, moved to the university in their establishment, and thereby became spin-off firms. Thus, the ‘family’ of companies that has an association with the university is much larger than in the case of Newcastle, where spin-offs played a critical ‘bridging’ role in working with other companies who also had relationships with the university.

The case of 3T is illustrative of this trend; the Centre for Micro-Electronics at Twente was formed out of a number of researchers active in micro-electronics applications work that was already underway within the university. When the centre was established, independently from the university with Governmental funding, it grew rapidly, and not all the employees came out of the university. When the company reorganised, following the discontinuation of state funding, a number of further spin-off companies formed, and some of those entered into relationships with the university via the TOP programme. The question in that case is to what extent have the spin-offs transferred technology into the regional environment; clearly the successor to CME and its spin-offs are active in the region, and have had repeated

contacts with regional companies, but they are not clearly functioning as a simple one-way knowledge bridge.

There is a wider question, and that is to what extent is there a rigid boundary around the university 'family' of companies. Is the university a unique point of passage for regional technology companies because it is a source of unique and valuable assets – an entrepreneurial field – that it makes sense for other companies to try and exploit? Or is the converse true, that the spin-off activities are failing to make an impact on the real or 'ordinary' economy of Twente? Although they are in Twente, they might not necessarily be 'of' Twente, and the knowledge economy remains quite distinct from the real economy, with the attendant economic and social problems that that produces. That is the focus of this chapter, to understand the broader regional significance of the impact that the spin-outs are having on the wider economic environment.

We could conceive of a variety of mechanisms through which this could potentially contribute to improving the regional system; USOs can work directly with other innovating firms to help them solve the problems they face in their innovation processes by creating knock-on chain innovation effects. USOs might also be involved collaboratively in co-evolutionary innovation activities (collective knowledge pool), and they might also represent demanding customers for other regional firms, thereby representing a vertex of the Porterian 'diamond' (*qv*). USOs can also work indirectly, and strategically, to help create the kinds of general collaborative or networking activities which benefit other similar firms in the region, including both formal institutions such as cluster groupings or speciality groups, or informally, networking meetings and activities. They can also work to 'seed' new regional activities, creating sequences of innovation outside the university, but which also increasingly move to be positioned outside the scope of their organisational boundary. This can in turn make very specific assets and advantages more generally available, and consequently contribute to upgrading the overall regional innovation system. Finally, they can have a wider, cultural effect on what could be termed (after Lundvall, 1998), the regional 'style' of innovation, helping to make the region a place where particular high technology activities are done, and thereby increasing its attractiveness to outside investors who further reinforce the status of the territory.

USOs may not always play a lead role in the issues that are dealt with these analyses. The story of the rise of Silicon Valley, for example, is often told with reference to the

role played by Fairchild Semi-conductors, which was a spin-off of Shockley Laboratories, itself a daughter of the AT&T telecoms firm, rather than Hewlett Packard, which was a spin-off of Stanford University. Certainly, Fairchild Semi did ultimately produce a large number of spin-off companies, which contributed to the development of the high technology complex in the Santa Clara Valley. The university subsequently adjusted itself to the emergent technology base, to increase the role it played in the regional environment. The literature is ultimately clear; even if this point frequently remains unemphasised – that USOs do not have to lead the activities, they can still play a role in shaping them (*cf.* Kenney & Burg, 2000). In this chapter, we look at each of these areas in turn, and then turn to consider whether they can, *in toto*, be considered as an improvement in the regional innovation system.

In this chapter, to answer the broader question of regional impact, we use the discussion above to segment the way that spin-outs have contributed into three quite distinct areas. In the next section (8.2), we look at how spin-offs have worked with other regional companies (and companies in the region) on particular innovation projects that have had a broader regional consequence. We then turn in 8.3 to look at the role played by spin-outs in various entrepreneurial and innovation networks in the region, which have contributed to the creation of shared knowledge assets on which others can draw. We then finally look at the contribution that spin-offs have made to regional economic growth, focusing on two elements. Firstly, the way that they have begun to stimulate and initiate sequences of growth outside the university, extended the scope of the regional knowledge economy. Secondly, we look at their role in beginning to blur the boundary between the university-focussed regional knowledge economy and the traditional industrial ‘ordinary’ economy which still suffers from low productivity and high unemployment.

8.2 Formal technology transfer between spin-offs and other local firms

In the Chapter 2 model, we envisaged that there would be a close relationship between spin-offs and other local firms in terms of technology transfer activity, in that spin-offs would place technology into local firms. There appear to be a range of problems in this heuristic for understanding the relational dynamics through which the knowledge pool is created and sustained. The first issue, which we have already mentioned, is the dominant role played by UT in the regional innovation system.

Many high technology activities seem to exist in an interdependent orbit around UT, out of necessity, and so many activities which might in other regions be more free-standing are already associated with the university. Our heuristic framework suggested that USOs would play a key bridging role between the university and other high technology firms, much as Van den Kroonenberg envisaged in the 1970s when he was promoting spin-offs from his energy technology research group. This conjures up images of young engineers telephoning local companies to ask them what problems they have, and where their university-developed knowledge can help solve those problems. This business model was indeed reported by at least three of the USOs interviewed.

However, this model is very passive, and the university in effect privatises the responsibility for technology transfer to those young engineers and entrepreneurs who push the technology into local businesses. One consequence of this lack of strategic oversight of the process has been that there are far more technological opportunities that exist within the university than can be exploited, and so it appears that spin-offs are not necessarily a coherent way to manage the process, relying on entrepreneurs *wanting* to exploit pieces of university technology; as one academic entrepreneur within the university noted,

“There have been many activities here at the university to stimulate commercialisation and collaboration with companies. They are successful, we seem to be the best one in the Netherlands, but still, it is a low level, and still, lots of ideas we have, things that might have been commercialised over the years were not”.

Thus, in this section we look at a slightly wider set of relationships and exchanges than the rather simplistic notion of “technology transfer”, not just how USOs place technologies in third party firms, but other, more collaborative, heterogeneous and interactive sets of relationships. In some cases, spin-offs are working with large firms in ways that help embed those large firms more completely in the region. Thales (*cf.* 8.2.3) and Urenco are examples of large R&D intensive firms in the region that are working both with the university and local spin-off firms. They also have a role to play in the attraction of inwards investment; as one regional development practitioner noted,

“I was also involved with the first contracts with Ericsson from Sweden, who came here from Lund. One of their key decision factors was they wanted to be in the vicinity of small high-technology companies that were working in their [technological] area, so they could involve them in their research activities.”

In all those examples, the idea of “technology transfer” as a simple movement of knowledge from university to third party firm via a USO is much more ambiguous. Not least a cause of this ambiguity is the fact that there are other transfers of knowledge bundled up into the main exchange, notably from third party firm into the university, to access problem solving capacity, rather than vice versa. Consequently, in this section, we focus on three types of flows of knowledge between spin-offs, the university and third party companies, so-called “direct” technology transfer, collaborative interaction, and reciprocal knowledge exchange between USOs and regional innovators.

8.2.1 Direct technology transfer from USOs into local companies

The first element of technology transfer was the formal knowledge bridge role that USOs played in terms of making university technology more accessible, corresponding to the revealed lack of willingness of the university academic staff to actively commercialise. As one associate professor noted, “If a company wants to use our research then we are quite pleased by that ... [but] we don’t do [commercialisation] ourselves”. There were two observations about the types of direct technology transfer activities that went on from USOs to non-spin off (so-called ‘third party’) firms. The first is that they tended to be of a fairly routine nature where they existed, selling routine consultancy and services (such as IT bureau services and web-site design); in the case of IT companies, a number were selling technology embedded in their services, but the customers did not learn interactively from that technology about IT knowledge. It would certainly be stretching a point to claim that these kinds of expert service delivery corresponded to the kinds of co-innovation of Muller & Zenker (2001) which could in turn build up a shared knowledge pool.

The second was that there was a fairly low level of interaction at a regional scale – there were no companies who had revolutionised the local production system with their technologies – in many cases the benefits of their innovation were absorbed in

higher productivity regional production systems elsewhere (particularly Eindhoven, the Dutch R&D ‘hotspot’ (*qv*)). However, that rather negative picture does obscure a number of explanatory factors which in turn helps to nuance the significance of the direct technology transfer function.

Firstly, there were relatively few spin-offs that had grown to be large enough to really begin to reshape the innovation environment in a way that benefited them. There was evidence from this very limited sample of more successful and growing firms (2 of the 11) that they *were* developing external clients, and were helping to *push* technologies out into the region. As a former spin-off employee now working at a regional development agency noted:-

“think the spin off companies have an important bridge function. Not just starting spin offs, but the more developed ones. They don't have the starting problems, they have quite a few people working there. And yet, because they have come out of the university, they know how it works, they have good contacts there”.

There was very little evidence that there was strong innovation system-building activity by spin-offs around USOs, namely identifying new companies as potential customers, then working closely with them and as a consequence of that work, bringing them into the orbit of the university. In part, this was because there was rarely within Twente the critical mass necessary to provide a match between companies, spin-offs and other available technologies in the university. As someone responsible at a regional level for a mentoring project noted:-

“In my opinion one of the best ways when you have a new idea you can match with already, companies that already exist and that you know, innovative companies, then the level of success can increase hugely. However, getting those links sorted is very difficult, and there are fewer of those links [in Twente] than you might expect”.

What was much more common was collaboration between two or more spin-off companies, and between spin-off companies and companies that were already closely associated with the university. The first of them, collaboration between spin-offs, covered a fairly broad range of activities. In some cases, more experienced companies worked to mentor less experienced TOP companies, sometimes mediated

through the process of the *TOPcommissie*. In other cases, spin-off companies of similar pedigrees and cohorts were working together in a more collaborative way. Many of the companies within MESA+, for example, worked closely together with one another. As one company that had collaborated with a number of other MESA+ companies noted:-

“Generally speaking, I don’t know, I have good contact with actually all of [the companies in MESA+]. I mean, part of it is that most of them are not in competition, so they really kind of benefit from each other and work together”.

This was by no means an isolated instance; many of the MESA+ companies reported working closely together, although some that were directly in competition did not. Another entrepreneur noted that connections built up and deepened as a result of this mutual collaboration:-

“For instance, there is a company ... we work closely together; on some of the projects he uses parts we provide in his technology, and we do some joint technology development, ... I already knew him from his former job, so he has now become a very good friend as well, so that is good.”

A final category of collaboration between spin-offs was between long-established firms that worked together well on a supply basis. There were web design companies who worked with IT consultancies to provide IT solutions for third-party businesses (again with very little knowledge exchanged between consultants and clients, so the bulk of the knowledge was exchanged between the collaborating spin-offs). There were a number of established mechatronics companies who worked in a similar way, closely together on joint projects for external clients, particularly where they had complementary expertises. The problem in terms of evaluating the economic development impact of these activities is that they did not broaden the scope of what was already taking place in the region. In a number of cases, they were working for external clients – Philips and its daughter companies in the south of the Netherlands are a good example of this, and this makes it much harder to assume regional development benefits from these impacts.

One very significant set of activities and relationships that did push technology out from the university into the region took place within the public sector. A number of the consultancies benefited at the time of set-up from winning contracts with public

sector organisations. One of the most successful of the TOP-pers was PNO, a “no win, no fee” subsidy consultant, which developed a particular set of expertises around winning regional development funds. Other web design companies won significant public sector contracts. The UT website was at the time of the research maintained by *Axis Media Ontwerpers*, a TOP alumnus, which has also developed web-sites for a number of other public organisations and projects. One of the more interesting of these is for the “*Hart van Zuid*” regeneration project in Hengelo. This has embedded a great deal of virtual reality technology (developed in part through the company’s participation in the Virtual Reality Valley activity). This has allowed the website to visualise the development plans and has been a key part of Hengelo’ efforts to increase its residents more actively in the planning of the project.

The main area of the public sector which has been influenced by the university and spin-offs in Twente has been the health care sector. We have already noted that a strong public-sector health coalition has emerged around the University, the Hospital (Medical Spectrum Twente) and the Roessingh Rehabilitation Institute and its affiliated innovation institution, Roessingh R&D. There is a strong inter-connection between these various elements, which was forged, as we saw, in the 1970s debates over the “eighth medical school”, and which has continued to this day both around trying to persuade the central government to award Enschede a teaching hospital and in the emergence of clusters of technology in the medical field. The Twente Technology Valley has become rationalised through the Care and Technology cluster (so-called *Zorg en Technologie*), and spin-off companies have played an important role in the way that this cluster has emerged (*cf.* 8.3.2). The public health sector is an important client for university technologies, and spin-offs from the university (particularly in the field of ICTs) have been instrumental in helping the public health services to develop new services, both generally (important given the relative poverty of the region) and specifically in the field of rehabilitation technologies. Given the relative poverty of Twente in the national context, and the existence of pockets of extreme urban deprivation against the background of the general austerity measures implemented in the Dutch public finances, innovation in health care is making a key contribution to sustaining the quality of life for Twente residents. Moreover, USOs are clearly involved in the processes of public sector innovation which underpins the emergence of new high quality health care services.

8.2.2 Collaborative interaction involving university spin offs

The second area where spin-offs were involved in ‘technology transfer’ was through their engagement in collaborative research, development and innovation projects between the university, third party firms and spin-offs. Rather than acting as the mechanism for the knowledge transfer, all three groups were contributing to creating shared knowledge pools which all were able to use for their own benefits. It appeared from the interviews that this was much more common than the bridge mechanism, and also in a few cases provided the stimulus for the formation of ‘clusters’ (*qv*). The problem with USOs was that they were in many cases much too volatile to be good sources of technology and expertise to reliably transfer ideas into other firms. In 8.2.1 above, the examples of where USOs did transfer technology effectively relied on large public sector clients able to compensate and account for the spin-offs own vulnerabilities.

Likewise, networks of new USOs lacked the stability to work effectively collaboratively to maximise the benefits of their collaboration. However, there were a number of examples of collaboration from the Twente case study where the mix of spin-off companies, third party companies and university academics provided a sufficient balance of stability and dynamism to begin to have a transformative effect, and genuinely create new, more accessible knowledge assets.

A recent example of a collaborative exchange of knowledge which achieved a high degree of publicity was the recently launched Sparta ION bicycle, developed for the Dutch cycle company Sparta³⁸. The bicycle contains a very lightweight battery which provides assistance to the cyclist, in contrast to other powered bikes in which the cycling motion is used to regulate the power provided by the motor (and hence the speed). When the power is exhausted, the bike can be cycled in a normal manner, unlike many powered cycles. The bicycle company, Sparta BV, are based in Apeldoorn, just outside Twente (across the IJssel from Deventer), and Sparta worked with three partners in the development project, with 3T for the embedded systems and power control, and Demcon and Indes performing industrial design (a corporate

³⁸ All this information was placed in the public domain by 3T, www.3t.nl/references/projects/sparta.htm

spin-off from the Huka wheelchair company Oldenzaal). Demcon is itself a university spin-off, and 3T had historically close relationships with the university; the expertise in power management for embedded systems (which is what they contributed to the Sparta project) is also an expertise within the CTIT research institute. These companies had already collaborated together on a range of projects, including TIMP, but clearly, the collaborations resulted in university knowledges becoming embedded in tangible activities that extended what other partners not necessarily associated with the university were doing (in this case Indes). This collaboration has also featured as a lubricating factor in the creation of broader co-operative networks which have added to collective regional capacity (*cf.* 8.3.1).

One important factor in encouraging collaborations was the role of subsidy projects; there were a number of cases where universities established research projects and one of the research foundations funded a multi-annual piece of research. A number of firms might provide a small share of the costs in return for sitting on an industrial users' committee. These users' committee were (problematically) unable to shape the direction of research but were able to use any findings from the project. In some cases, these projects brought spin-offs, who knew the managing professor, into contact with larger firms who were involved through their own research projects more formally with the professor; those contacts were useful for the spin-offs in finding industrial partners and funders for their own product development. The spin-offs were important in some of the projects that were bid for, not merely for the legitimacy that they brought to the projects as users, but also because they had been involved in antecedent research and possessed important tacit knowledge (in this project particularly in the field of micro-fabrication). Thus, the collaborative knowledge pool that built up around the university was – at least to some extent – reliant on the effort and impacts of the spin-offs (and likewise with the other industrial users).

One interesting case was of a company which came to the region specifically to work with the university on a set of research projects, and this also meant that there were a range of other collaborating companies involved with which that company could work. The company itself was a classic development company, an individual with an idea for a domestic appliance that could potentially have a market of tens of millions, but which required uptake from domestic appliance manufacturers. Working with the university has helped to progress his own (and the company's) development trajectory

towards a market product. Hence, it has also contributed, somewhat indirectly, increasing the firm's capacity to collaborate with these other firms. Thus, in this particular case, the idea of the USO as a technology bridge is clearly wide of the mark. The company spun-in to the university in order to borrow the university's prestige to present the development as a sensible potential investment for others, and to then attract resource (cash and knowledge) flows from outside the region, and embeds them in the region. A second feature which further muddies the idea of collaboration between university spin-offs and third party firms is that so many of the regional innovating companies already have some kinds of link with the university, which we noted above in 8.2.1.

The big disadvantage for organising collaboration involving USOs and regional SMEs is that they are not the most stable of partners. Although the problem is not as severe as it was at the height of the internet bubble, spin-offs are often very tightly focused on solving a set of their own problems, and the internal logic of those problems might make it very difficult for them to collaborate effectively. Although none of the spin-offs interviewed themselves admitted to being bad partners for others, a number of the spin-offs believed themselves to be better partners than the value others placed on them as partners³⁹. The other element of this was that USOs found it difficult to transfer technology into regional SMEs through collaboration, because those SMEs were themselves poor partners for collaboration. One firm noted that the only really reliable partners for collaboration were large firms, because they almost inevitably met their contractual obligations, although they could halt development projects with very little notice. With small firms, it was impossible to tell how much cash they actually had because they tended to burn it so quickly, and even with medium firms, one development company manager noted that it was hard to work with certainty with such firms, because

³⁹ It would be possible to construct a table of what how spin-offs described a collaboration and how partners described their collaboration, but that would be possibly very unfair, almost certainly not confidential, and could further undermine the confidential nature of some of the other quotations provided. For that reason, it is not possible to present much direct evidence of that.

“they have a very small horizon, they are doing a lot of work to keep their business going, so new developments are always difficult for them, especially”.

Another spin-off interviewed regularly used the Chamber of Commerce (KvK) to check the annual accounts of potential partners before even discussing an idea with them in anything more than outline terms – the managing director would estimate a project development cost, then check that the company had sufficient resources for the development, and if not, then the firm would be met with a polite refusal until they had managed to arrange the full costs of funding the development. The difficulties that small firms had in working together is also demonstrated in 8.3.2, where there were a number of subsidy projects developed to promote collaboration, but in the cases where they involved a number of small firms, in a number of cases there was evidence that they had not delivered the outcomes for which they had been developed.

8.2.3 Other technology transfer between USOs and regional innovators

The final area to explore is other technology transfer between USOs and regional innovators which involves any kind of co-evolution of knowledge between the companies which in turn draws on knowledges held in some way in the university. Not surprising, because USOs tend to be small, knowledge hungry and inexperienced companies, they do not have much to offer directly to large innovating firms, and so – if they can manage that process correctly – then the USOs have much to gain in terms of how that collaboration can allow them to access scarce assets for innovation. Spin-off companies may therefore have a role to play in taking knowledge out from large companies and embedding it in the local region. We have already seen that the Twente economy suffered in recent years from the loss of a number of large inward investments, and so spinning out these activities may help to increase their sustainability in the region. There are a number of spin-offs from plant closures, which we have highlighted elsewhere. We have already seen in chapter 7 that what the TOP programme provided for these corporate spin-outs a stable berth to move to; this facilitated the process of moving out of a large company, reducing some of the barriers to entrepreneurship faced by people enculturated into large firms. Moreover, there have been at least three examples of “spin-ins” – where spin-out companies have hired whole teams from larger firms that were being divested, and helped to

retain that knowledge within the region. At least six of the 11 TOP companies interviewed had been involved in directly anchoring something tangible from a large firm within the region.

The problem was that process relied heavily on businesses facing particular problems and being *forced* to divest activities. There was no way to develop a mechanism which allowed ideas within companies to be taken forward outside those companies without the hostility that a spin-off process generally involves (to ensure due diligence and no conflicts of interest). Although the RDA had considered developing a mechanism to invest in the peripheral activities of business that they would not themselves take forward, they realised that that created an adverse selection mechanism, so that firms would fund the most likely projects themselves, and only seek RDA funding for riskier projects or ideas less likely to succeed. Isotis is an interesting example by which those particular problems were avoided – the company was formed as a spin-out from Leiden Medical School, and established itself near Utrecht. A group of the original founders then moved back into academia, after a merger with an American competitor, back to the University of Twente, and began collaborating with the establishment of the Tissue Accelerator (*qv*). This appears to suggest a third manner of university/ spin-off/ third party knowledge pool relationship, that the spin-offs emerged from a relationship between the university and the third party, in which the third party moved into the university.

There were very few examples of large companies pulling together large networks of spin-offs around themselves as a means of accessing university knowledge, and thereby also creating a shared knowledge pool on which others could draw. Ericsson had invested in Twente in 1990 to work closely with small firms, but only a small kernel of the R&D staff (the research team) were ever actively doing that. Had that succeeded, then working with the small firms could conceivably have leached knowledge out from Ericsson into the region, to the general regional benefit. Likewise, there was an intention in some of the University Research Institutes to use links with large firms as a means of providing small firms with the access to their knowledge which they could re-embed within the region. Again, there were relatively few tangible examples which emerged through the course of the research.

One of the very few examples of a large firm relationship with the university providing a solid axis around which to build a network of smaller companies,

including spin-outs, was in the form of a development project known as the “technology exchange cell” (TEC). The French defence technologies contractor Thomson (now Thales) had bought in 1990 one of the Philips group companies specialising in defence and aerospace, Hollandse Signaalapparaten. The “Signaal” factory in Hengelo, some 20km from the university, had previously been involved with R&D for the launch of a Dutch infrared satellite, but was primarily involved in defence electronics. Through contacts with the university established through the Hengelo site, members of Thales R&D (based in the Randstad town of Delft) became involved in the Virtual Reality Valley project. One senior employee of Thales was aware of those developments, and he personally had an idea for implementing a new approach to rapid product development drawing on simulation techniques developed at Delft for defence platforms.

The indeterminacy of the idea had left the individual unable to realise it internally through the company’s own assets. The idea was also not exclusive to the defence sector, rather it was a set of dynamic techniques to feed often contradictory information and conflicting signals into product development and design processes whilst avoiding path dependency and to optimise designs to these complex contexts. One example which had been worked through in rationalising the project was the case of healthcare, where biological sciences, insurance companies decisions, national health policies, shifting demographics and individual preference all shape in an interactive way the way the ‘market’ will respond to any innovation.

Thales were already involved with UT through their work with VR Valley (*qv*), a collaborative association in which the university and a number of spin-off companies were involved. One of the projects involved establishing a company (VREST) in which HTT had a shareholding, which has already been mentioned in chapter 6. A number of spin-off companies - Axis, Kunst & Leerdam, B-SIM and VREST were involved alongside Thales in the VR Valley organisation. VR Valley was also supported by OOST, because they had enrolled it as a means of developing regional expertise in the use of virtual reality in particular areas, and it formed a key element of the Twente Technology Platform and the Triangle strategy. It was the VR Valley project which had suggested to Dick Arnold, the project *animateur* at Thales, that the partners involved in VR Valley could also perform a similar role in a putative Technology Exchange Cell, as the project became called. By providing

complementary services in helping to translate ideas into product designs, they would be able to provide the resources that Thales were unwilling or unable to provide internally. The project also attracted around €4m support (out of a total project value of €1¼m) from the Ministry of Economic Affairs, as part of a contribution to making Enschede in the language of the national economic development strategy an “innovation hot-spot” (cf. 9.3). As figure 16 below suggests, Thales did appear to be taking the project quite seriously; alongside describing Dick Arnold as a top executive, they were also hiring some six staff for the TEC, in knowledge-intensive positions, to be located at Hengelo.

Figure 18 The announcement of the Technology Exchange Cell on the Thales website



Source: www.thales-nederland.nl/nl/t-xchange-cell/t-xchange-cell.shtml

<Downloaded 28th June 2005>.

There is an interesting reading of the Technology-Exchange cell in terms of building up a regional capacity and then using that to lever in external funds – this issue will be dealt with at more length in chapter 9. What is more interesting perhaps in the context of chapter 8 is that this project also demonstrates how large companies can be used to anchor clusters of small firms around the university, and so contribute to the

creation of a more generalised regional knowledge pool. The large company – in this case Thales – provided access to a well-developed knowledge infrastructure which exists well beyond the Twente region. However, particular individuals bring elements of that knowledge into the region. They also provide copper-bottomed guarantees that they will fund the participating small firms properly – as a multi-national and with a government subsidy providing the funding. At least one of the firms mentioned that working with large firms made collaboration easier because of certainty about the availability of funding. Consequently, tying the project to a large firm appears to be a sensible way to bringing new ideas into the region and ensuring that the benefits are at least initially exploited by a cluster of proximate SMEs.

8.2.4 Spin-offs as active agents for collaborative technology transfer

This chapter has helped to highlight some of the limitations to the UT model for technology transfer involving spin-offs, namely the small size of many of the spin-offs means that despite good intentions, they are not necessarily good partners for collaborative innovation. That is one criticism which was made quite explicitly by the university senior managers. Indeed, one previous scheme to try to encourage TOP-pers to grow (the so-called TOP+) had not been particularly successful, because the companies did not need the funds because they lacked ambition to grow. Interviewees questioned the motivation of many of the entrepreneurs who had set up businesses; one interviewee in particular summed up neatly the criticism that could be made of many of the firms, although speaking about a specific example:-

“[Company] is a research company, it is not a production company, they do research, they don’t produce products ... it’s just one office, they do all the administration from there, and they use [facilities] at the University of Twente, they use the whole Netherlands public research infrastructure to work. And that is a very smart way of working, they have a very low budget, they don’t have much high expenditures, and mostly, the universities aren’t aware that [Company] are there, and they don’t mind too much that they are. But the problem with [Company's]commercialisation strategy is that their business model is selling licenses to third party companies, to do the production, preventing the universities really getting anything much back in return.”

His criticism was that they had enjoyed being in a university more than being in a company, and despite lacking the research pedigree to be formally accepted as university staff, their idea was to find a niche around the university in which they could undertake comparable tasks. That is a specific example of a more general criticism which can then be made of policy towards spin-offs. One of the rationales university managers gave during the interviews for the focus on spin-offs in preference to licensing was that a licensing deal would have little regional impact, because there were few large companies in Twente who were active in the kinds of fields where UT were producing patents. From the interviewee quoted above, however, this suggests that that decision has effectively been a privatisation of the licensing process, creating small spin-offs in the region that then license the technologies to firms outside the region, again failing to produce a significant regional footprint.

However, another interviewee implied that such a criticism overlooked the realities of establishing a high technology business in a field many years from the market. He noted that the purpose of the company's R&D was frequently to come up with something sufficiently convincing to bring in another round of investors, whose investments funded the next round of research, creating a cycle of investment→research→investment until the product hit the market. If this process could be successfully managed, and sufficient investment received, then the slow accumulation of tacit knowledge in the research group would make Twente the natural location for a product-oriented business in the future.

“In the field of bio or life sciences, [the idea] is very often a long way from proof of principle, to making a product. And they often work to get the money out of projects as soon as possible, so this was also one of the things we are now are discussing with them”.

What this section also highlights is the extent of the disconnection between the knowledge economy and what we have termed the ordinary economy in Twente. Many of the links and relationships that have been created have been outward facing. The third party links that USOs built up were often with large firms located and managed outside the region. Consequently, the regional asset building was somewhat one-sided, focused around what the spin-offs and universities were able to make out of the resources they accessed in these external partners, rather than building up a

mutually-reinforcing three-way knowledge pool. However, because the relationships that brought in those resources and assets were outward-facing, the spin-offs exist in a compartmentalised, centrifugal space rather one where networks and relationships have been built into the real economy. Spin-offs do not seem to be playing a substantial role in forcing technologies into non-innovating regional SMEs, which is a significant part of the regional innovation problem. The assets that are being brought into the region are mainly being embedded in spin-off companies which are extremely volatile, and take a long time – around a decade for those two spin-offs that really made the transition to dynamic node – to really establish themselves as viable partners in innovation for other regional businesses. All of this casts some doubt on the extent to which the spin-offs from UT are really overhauling the regional economy more generally.

Perhaps the issue more is one of tone than the substance of the contribution of spin-outs. The message from this section is that the regional benefits from spin-offs take a much longer time to develop than the immediately evident examples of employment and business creation. Moreover, in Twente, only a relatively few spin-outs have actually progressed to the point where they have made a material impact on the regional knowledge pool. These are the same companies that were identified in Chapter 6 as making a contribution in terms of representing genuinely dynamic centres of growth, in contrast to the ‘lifestyle’ – or at least low growth – spin-offs which were found elsewhere. It might be interesting to segment the contribution made by different types of spin-outs to the regional innovation system, although it is clear that direct technology transfer is just one mechanism by which spin-outs influence that system. It is to another mechanism – the creation of new networks (and potentially institutional thickness) – that this chapter now turns.

8.3 *Creating collaborative institutions and activities in Twente*

In this section, we shift from looking at specific collaborations that build networks, to networks that have emerged, and in some cases, been deliberately constructed, that provide access to resources for innovation and entrepreneurship. New regionalism has placed a great deal of emphasis on the importance of networks to regional innovation systems, because what they can potentially do is lower the barriers to participation in regional knowledge pools. The idea of “institutional thickness”

(Amin & Thrift, 1994) emerged as an abstraction explaining the value of these networks; when someone need to find an asset, they have many routes and hence more opportunities and a higher chance of success. However, a focus on networks and collaboration is also highly contentious, because networks are themselves not an outcome. Lovering (1999) was particularly scathing in the case of Wales of the RDA's decision to establish what were basically supplier circles around inward investors, and claim that they were building a new interactive innovation system analogous to that on Baden-Württemberg. The problem was that although a huge amount of effort was put into the state-supported networks, what was not stimulated was co-operative innovation; although the participants could have co-operated through meeting at the networks, the new regionalist advocates of Welsh regional renewal at that time (1999) were unable to produce any evidence where it had actually happened. Likewise, although Amin & Thrift developed the idea of institutional thickness, no serious case studies have been developed where the concept has been worked through and evaluated, and networks, associationalism, and institutional thickness were left in abeyance as other more fashionable concepts emerged into the new regionalist discourse.

To avoid that particular problem in this section, we use the resource-based approach to interpreting the significance of the regional networks – the more dynamic the consequent achievement, the more significant the network. Our argument is that networks can have value if they enable developments that were not possible before, by enabling access to resources such as finance and knowledge. In chapter 6, we have already seen that many networks built up at the edge of the university, and in chapter 7, we explored in more detail how this process took place. We have argued that many networks began as projects which were created intensively within the university, and then drifted to the edge of the university; the TOP programme has survived because it has managed to remained anchored to the core interests of the university, whilst other, more peripheral programmes, did not. We argued that this process extended the cope of the university into the region, and these networks helped to provide resources that other external entrepreneurs were able to use in developing new growth nodes. The research in Chapters 6 and 7 has been very centred on the role of the university in this process, and USOs have been seen as a consequence of university policy, rather than focusing on the role of USOs as active agents shaping the regional innovation system.

In this section, we now look at the role played by USOs and their founding entrepreneurs in building networks which are a key part of the development of a strong regional knowledge economy around UT. The main focus in this section is the involvement of entrepreneurs in regional networks, and we consider two areas where this has happened. In the first section (8.3.1), we look at how USOs have been involved in building networks *de novo*, either as initiators or as part of a public-private team which have developed formal structures or informal meetings which have delivered the scope extending features in which we are interested. In 8.3.2, we turn to look at areas where USOs have involved themselves with extant networks in ways that have reshaped the capacity in those networks, and have improved accessibility of regional innovation assets. From that, we then are able to discuss briefly the overall role of USOs as actors shaping the various interacting and overlapping networks that form the Twente regional innovation system.

8.3.1 Direct involvement in establishing new entrepreneurial networks

There are cases in this research as well as more generally in the literature where companies have been key *animateurs* in creating networking organisations which have mobilised companies and public sector organisations and increased co-operation. Medicon Valley in Öresund, Semtech in California and the Leeds Financial Service Initiative are all well-known examples where leading companies have approached governmental organisations for help in collaborating to deal with collective problems and challenges. In the case of Newcastle, there was little evidence that spin-off companies were a major source behind establishing these type of networking organisations, although other companies such as Non-Linear Dynamics and the large legal firms had played a role in establishing such shared innovation activities as the Bioinformatics Institute and Service Network. This was ascribed to the predominance of the Professor model for spin-offs in which professors established firms as interdependent parts of an extended research group (leaving them with little time for networking activities). Conversely, in Twente, where there is a much higher level of independent entrepreneurship, there have indeed been examples of where particular entrepreneurs have worked to establish collective responses, and in some cases those collective responses have become embedded in organisations which have taken over some of the effort required to maintain links, establishing secretariats, organising

meetings at a mundane level without requiring the active energy from individual entrepreneurs.

Possibly the best example of what can be achieved is the case of the Mechatronica Valley Foundation. The public version of the story is extremely impressive; UT employed a professor on an industrial chair who had significant micro-electronics experience from the Philips family of firms near Eindhoven. His *leerstoolgroep* was a significant source of benefit for a range of micro-fabrication companies in the region, primarily as a source of trained mechatronics graduates but also for research and development support. When the professor retired, the university decided not to reappoint to fill the post. One of the firms which employed the graduates of that professor was also a spin-out company which had formed after the principals had been involved in doctoral research in that Professor's research group. The CEO of that spin-off, contacted the other companies in the east who also employed graduates from that research group. He persuaded these companies, who he did not know previously, to contribute collectively to underwrite the cost of a chair and to channel that funding to the university through a not-for-profit organisation, the Stichting Mechatronica Valley. The chair, Hermann Soemers, was duly appointed in 2001.

The existence of a foundation allowed the hiring of staff, or at least to buy out part of an administrator's time, to ensure that members paid their subscriptions. This created an organisation which had links into the university, and out into the region, and with a capacity to undertake routine organisational tasks. One of those tasks which the SMV began to undertake was a series of annual conferences at UT, which were open more widely than the membership of SMV alone. The total regional impact, creating a network as well as supporting a research group within MESA+, is therefore 'significant' in the terms established above, of increasing regional accessibility to resources – particularly knowledge – for innovation and entrepreneurship. The autonomous success of SMV led the RDA to come looking to SMV when it was looking for activities which exemplified the ideas of Twente Technology Valley it was developing in 2003/4. Although OOST had not at the time of the research funded SMV, it had provided a time input to support the surrounding activities, and in particular, as one RDA employee noted, "to open up the foundation, because at the moment it is rather closed".

Beyond the particular case of SMV, it is harder to find examples of networking initiatives directly created by spin-off companies. One activity mentioned by many of the interviewees was the Twente Initiative for the development of Medical Products, which formed the subject of a Ph.D. thesis at UT in 1999 (Klein Woolthuis, 1999). According to Rosalind, TIMP was created when two USO entrepreneurs approached an organisation (which we presume to be OOM). They inquired whether this organisation could do something to stimulate co-operation between companies in Twente that were active in the medical devices field. The thesis documents the growth of TIMP to 1999, but since then, the TIMP organisation has continued to develop forwards. A number of interviewees from this project mentioned that it was a significant route through which they met partners which helped them work together – in the case of the Sparta ION bike (*cf.* 8.2.2), the principals involved with Sparta all had significant expertise which came from collaborating together through the TIMP network. Part of what TIMP successfully did was help to co-ordinate a set of commercial activities in the field of medical products at the same time that the university was developing its expertises in biomedical technology and engineering. This can be seen in figure 11 on p. 111, in which TIMP is seen as part of a series of mechanisms by which the university inter-relates with regional players in the field of bio-medicine. The role of the TIMP can be seen as slightly different, providing a centre of gravity to attract ideas and support individuals emerging out of the university. OOST, the RDA, note that each of the clusters has its own history and organisation, and therefore both contributes differently but is also being supported differently within the regional development framework.

A third area where firms have been directly involved in establishing new entrepreneurial networks is around micro-technology, and in centring and embedding a subsidy programme around the UT, making Twente a key place on the nanotechnology map of the Netherlands (*cf.* chapter 9). There have been two successive programmes that the Dutch government have used to try to stimulate micro-technology (and nanotechnology) in the Netherlands, Microned and Nanoned. Although a collaborative research programme involving universities, it is remarkable the extent to which SMEs associated with UT were involved in the management and delivery of the work packages with Microned; the project is about the identification of market opportunities and product areas, and funding R&D in those areas. The

scientific management of Nanoned are located in MESA+, and UT spin-offs are work package leaders and also have been in the receipt of significant R&D awards. We have already noted that the market approach of many of these businesses is as development companies (*cf.* 8.2.3), and what this has done is provide funds for a number of spin-offs (and other companies) around MESA+ to take the next step in the development cycle; thus although it has not let yet to a large cluster of activity being centred around UT, it is clearly a positive step forward, and the various entrepreneurs involved in the programme appear to have been active in lobbying and shaping the research agenda.

This does cause problems in interpreting causes and outcomes in the region, because by attracting subsidy funding, there is a deadweight effect, and it is possibly to argue that the networks which are created are not genuinely new, and will not outlive the funding. TIMP and SMV seem to provide examples of genuinely new activity, whereas there are other projects which have not made such a difference. One ambivalent organisation is VR Valley, which we encountered in 8.2.3 as a network which persuaded Thales of the viability of investing in the Technology Exchange Cell (*qv*). Thus, there are a large number of public sector partners in VR Valley, and there are subsidy projects undertaken through VR Valley. One spin-off has created a subsidiary to deal with virtual reality which is currently dormant, because the VR Valley activity has not generated enough work to justify the company being fully established. One of the spin-offs is also closely tied to one of the projects, and is more a mechanism for the university to engage with subsidy projects than a potential source of future entrepreneurship. In this case, however, there does seem to be evidence that the network capacity/ potential was real, in that Thales regarded it as having value.

Alongside these activities in which entrepreneurs have created successful networks, there are also examples of where entrepreneurs have tried and failed to establish new networking organisations. Although the failed organisations were not mentioned frequently in the course of the interviews, in the late 1990s, the university and RDA did put a lot of emphasis into various collaborative industrial research centres. Some of these manifested themselves as “Twente Valleys”, the idea that they could create entrepreneur-led cluster organisations. With the benefit of hindsight, the Valley approach was clearly part of UT’s search for a new model of entrepreneurship

promotion beyond the TOP programme to consolidate or at least anchor more firmly within the university the drifting Liaison Group⁴⁰. The approach also represented the *zeitgeist* – the generally strong economy and the ready availability of seed capital for new concepts for things like “cluster organisations”. UT even published a book in which the “Valley” concept was set out in some detail (Van der Sijde & Ridder, 1999). What is evident from looking at that book today is how little of the Valley concept successfully survived to 2004. The Valleys did not collapse as catastrophically as did Flanders Language Valley following the Enron-style implosion of Lernout and Hauspie, but their general failure did highlight the limits to what could be achieved with a ‘clusters’ or ‘Valley’ approach, even where there was a strong technological base and a number of companies active in the particular field. Even what had been described existed in quite a different form to the direction of development predicted in the book.

The key message emerging from these cases is that what the networking organisations were doing was in building a size asset for the USOs to draw upon. In 8.2, one of the key issues which emerged was that USOs were poor partners for collaboration because they could be hugely erratic because of the array of problems and disruptions they faced. What the networking organisations was provide some stability for the USOs to make stronger contributions; SMV drew on large firm resources to sustain an anchor for regional mechatronics companies in the university; TIMP created a routine where a set of firms worked very closely with each other – and what built up was if not trust, then strong collaboration routines. VR Valley used Thales and the university as a strong axis for a set of projects with which USOs could get involved. Where Membrane Valley and Laser Technology Valley failed was that they remained as isolated projects; they were not able to attach themselves to a stable structure, or embed themselves in the region, and so when the funding expired, there was no rationale for their continued existence.

⁴⁰ This is acknowledged to some extent by Van der Sijde and Ridder (1999); Van der Sijde, \. & Ridder, A. (1999) *Commercialising knowledge: examples of entrepreneurship at the University of Twente*, Enschede: Twente University Press.

8.3.2 *Contributing to institutional thickness: USOs, academic entrepreneurs and the knowledge economy.*

We have already seen that there is a significant propensity in Twente to respond to uncertain situations by creating new organisations which struggle between mobilising collective innovative responses and fuelling inertia and lock-in. The various urban partnership organisations created in the 1960s and 1970s were unable to seriously manage industrial restructuring in Twente until the crises of the 1970s forced a collective institutional response through the creation of the OOM. One role which spin-outs could potentially play in Twente networking organisations is to revitalise and refresh existing organisations, and ensure that they continue to retain their organisational salience and avoid the “Jao, Jao” mentality highlighted elsewhere.

There are a number of examples, to which we have already alluded, of where spin-outs have become so involved. One of the clearest examples of these was the *Technologie Kring Twente*, the TKT, which was originally created as a ‘project’ within the university under the auspices of the *Transferpunt*. It was inspired by the TOP ethos that it was better to give a company a strong sales lead than a subsidy, and its progenitors organised a series of meetings between small local entrepreneurs and the purchasing departments of larger organisations. When it was created, it was (as with the chapter 7 model) central to TRD and UT’s commercialisation activities, but as the activity matured, it became increasingly peripheral, and ran the risk, as a project, of being abandoned by the university. What the managers then running the project did was to engage entrepreneurs (some of whom had been involved with spin-outs) to revamp the organisations. According to one individual involved, by 1990, the time had come for them to make a decisive break:-

“We said, we shouldn’t do this, this is now a mature association with about 50 or 80 members, companies. We should ask the entrepreneurs to make their own board and manage the TKT by themselves. Immediately we have three or four really good entrepreneurs who started this board, and wrote the business plan for the coming four or five years, really good. We should do this, and that and that and that and that. So you have a total new approach, and after this five years, you got a new board, and so we have new three times a total new board and each new board made a good five years business plan, with a good theme. So that is one of the solutions, to always to bring the

responsibility to these entrepreneurs, but always give them some financial support for this, because they do also work for the community. If they start a project, that they can finance that, these projects”.

As part of that, they hired an middle-aged engineer to run the secretariat for the organisation to ensure that it delivered against its goals; when the first organiser retired, the organisation was sufficiently bedded-in to demand the recruitment of a successor. However, reading a description of TKT in Van der Sijde & Ridder (1999), it is easy to be sceptical about the idea of TKT, because it sounds as if it could easily be an example of Lovering’s “organisations without outcomes”:-

“an entrepreneurial network of knowledge-based enterprises, in particular the TOP-firms, that maintain close relationships with the university. It stimulates co-operation among its members and brings them into contact with potential customers” (p.10).

The case of TKT demonstrates the successful departure of a ‘project’ developed in the university, and also success in re-embedding it into the local economy. What seems to have been instrumental in that success in re-embedding it was the presence of a large number of firms who saw some value in the organisation, and also willing to commit themselves to the organisation. In chapter 6, we saw the role that TOP companies have currently taken on in the running of the TKT. The organisation managed to survive independently of the university, and for a period recently, the university were apparently indifferent or hostile to the TKT. However, with the appointment of Iddo Bante, commercialisation director of (firstly BMTI and now) CTIT to the board, the university appear to have recognised the value of TKT as an autonomous entrepreneurship support type of activity. This seems to suggest that the TKT has made progress from a one-off, high attention-requiring project to a more recurrent, action-at-a-distance institution delivered through the network. What is less clear however, is the particular reasons why this particular project succeeded, whilst other projects which were handed back to their members did not.

A second set of activities in which entrepreneurs became involved were a set of other subsidised collaboration projects. The RDA became very interested in developing and support such projects in the mid 1990s, when the Province became involved in a European Regional Innovation Strategy project which emphasised the importance of

mobilisation of territorial research assets through collaborative research projects. A number of these projects were developed, then disappeared after the end of the funding; TIMP (*qv*) was a more durable success. One of the projects that was developed at that time using Provincial Funds - that illustrates the benefits and risks of the approach - was the “Netlab” project. The idea was that there were groups of high technology SMEs in Twente which could collectively do the work of large design houses and sell that expertise on at high value to large clients. The project was organised through TKT, and initially, a number of potential sectors were identified, meetings held and action plans drawn up. One of those was a biomedical group, building on the university’s BMTI as well as the success of TIMP and the presence of a number of medical technology companies. The project continued with relatively few successes because it was an open project, in which eligible companies could choose to participate.

As time passed and few outcomes were delivered, the TKT management decided to restructure the project around the one successful, biomedical, sector. They picked two collaborative projects that would produce something successful by the end of the project life, then organised a final conference to gain some publicity for the idea in September 2004. The consequence of this re-orientation was that the successful project was enrolled within the Triangle/ Twente Technology Valley process as part of developing a suite of activities around medical technologies in Twente. At the time of the research, the organisers were trying to sustain the cluster group beyond the life of the subsidy, and get the products developed in the two collaborations to the market. The Netlab project illustrates the limitations to institutional thickness or capacity; although the TKT organisation was successful in its own terms, that did not mean that its participation could guarantee the success of a risky collaboration promotion activity. The collaboration built between members was not the same as creating an infrastructure for collective action which could be steered by an outside agency. Thus, although in chapter 6, we represented the connections between various organisations as determined and stable, Lovering’s critique is a good reminder that many of the activities and organisations are very limited in their scope, and are an improvement on a bad situation rather than a miracle cure.

A third area is the contribution that the entrepreneurs are contributing to creating specific high-technology spaces and places, and the impacts that this has had on the

willingness of developers and policy-makers to identify new places to be made as high-technology. One of the great criticisms that was made of science parks in Chapter 2 was that they fail to deliver in less successful regions because they are property development ventures. According to Masey *et al.*, 1992, the only businesses that can afford their high rents tend to be established businesses – and if established businesses were high technology and innovative, then the region would not be in trouble. This means that the small high-technology firms that need to be close to the university are unable to locate on the science park. In the case of Twente, these problems have been avoided; it is notable that MESA+ and the BTC have both managed to acquire a high level of occupancy from the target group of companies; a number of residents of MESA+ noted that the facility did have a pleasant atmosphere from large numbers of interacting entrepreneurs, students and researchers. At BTC, they had managed to ensure that at least 70% of the staff were what one interviewee called “geeks” who would not be comfortable with large, more formal premises. At the level of the Business and Science Park, there was a number of growing companies on the park who had been spin-offs or who strong links to the university like 3T. The success of these experiments in building high technology places in an old industrial area seemed to be a major factor in explaining why the province and municipality had become so committed to the Twente Knowledge Park project (*qv*).

A fourth contribution that regional entrepreneurs – and spin-offs – have made is through the access to and availability of finance to regional companies. Access to seed capital was not the problem for companies around Twente that it was in the case of Newcastle. The university, RDA and government had all provided risk capital; HTT was founded in 1989, Innofonds in 1995 and Twinning in 1999 meant that seed had been available for several years for companies with good ideas. What these funds also ensured was that investments were made by large institutional organisations which were well connected and could help young entrepreneurs to make the connections to identify mentors and directors who could support their business development. PPM OOST explicitly had what they called the “chair model”, to use experienced entrepreneurs to support new start-ups. These experienced entrepreneurs also brought access to their own networks – many had experiences of working with venture capitalists, and some had made the progression into business angels. According to one interviewee, there was one such informal capital network in Twente

in which particular participants were also involved in university spin-offs, providing precisely that maturity and insight in support of young entrepreneurs.

What the finance issue appears to be in the case of Twente is that it is a resource issue to be solved, and people draw on the networks to which they have access. These networks are not all financial networks. When one company encountered financial difficulties and was forced into a restart, then he was able to use the chairman as a source of access to financiers to ensure the survival of his business, alongside investors that he knew as collaborators (who naturally did not want to see one of their development partners fail). The story about the finance networks is not a functional story, rather it is that there are a set of overlapping networks and in some business areas, there is sufficient dynamism that the networks which exist for one ostensible purpose allow contacts to be made and resources accessed for other purposes. However, it is hard to tell from where this feature derives; it would be too cute to think of it as a modern form of *noaberschap*, or as the consequence of stimulating development activities from an archetypal Mode 2 (team-working) university.

The final area where entrepreneurs were involved in regional institutional activities was in their involvement in 'public life'. We have already seen that an important factor in winning UT for Enschede was the lobbying work of *Stichting tot bevordering van Hoger Onderwijs en Hoger Technische Onderwijs in het oosten en het noorden van Nederland*. This group effectively marshalled the support of existing businesses in the region behind the idea of a new university, under the chairmanship of Dr. Kroese, chairman of (now Koninklijk⁴¹) Ten Cate. Entrepreneurs can have an important role to lay in marshalling business support in the interests of the region, particularly given the emphasis within the central government on promoting business competitiveness. Certainly, the regional economic development plan was developed by Paul ter Reile of Urenco, a uranium enrichment company based in Almelo. Although there was a cohort of high technology businesses that the university worked with – including high technology local businesses such as NEDAP, Grolsch, Vredestein and Bronkhorst, these businesses did not appear to have moved into a

⁴¹ *Koninklijk* (lit. Royal) is an honorary prefix given to companies which have made significant contributions to the Dutch economy, such as Royal Shell or *Koninklijk Luchtvaart Maatschappij* (KLM), or which reach one hundred years of age.

position of lobbying for the region with the national government. The Queen's Commissioner for the Province did work hard to try to create a group of regional ambassadors from the business community, who could present the region in a good light when they attended meetings in the West. The *Kaderverhaal* report argues that the problem for the region is that there are not opinionated entrepreneurs who speak their mind in the east, but rather there are a group of company men who do not want to 'rock the boat', just as the professionalisation of Mayors has reduced the number of 'angry men' in leadership positions (*cf.* Chapter 4).

8.3.3 *Concluding discussion*

There does appear to be some evidence that spin-off companies are contributing to building new networks. The university impact model suggests that these networks are contributing to the regional economy by helping particular one-off projects and activities become regularised into territorial innovation assets. There has been some evidence of that happening, although the clearest example where spin-offs were the prime motivator was the case of Stichting Mechatronica Valley, which was for a variety of reasons quite a unique situation unlikely to be replicated. There was a particular problem that emerged, along with the kind of "opinionated entrepreneur" referred to in the *Kaderverhaal*, and he worked to solve the problem. The solution was then co-opted by other regional actors who wanted to try to further generalise the benefits produced. However, there have been very few examples within this research of where the spin-off entrepreneurs have led the process, although Klein Woolthuis does suggest that the TIMP project was another such example, and clearly by the time of this research, the TIMP network had to some degree become a repeatable and shared knowledge asset.

A second area where entrepreneurs did make a difference to regional institutional development was in terms of embedding one-off projects, and helping to anchor external resources in the region. The TKT and Netlab were both projects that were not created by spin-offs, but were developed by consultants and regional development professionals and then handed on to the spin-offs. Even after hand-over, the activities continued to succeed. In each case, it cannot be argued that the spin-offs were not a precondition to success, but that they contributed to a successful outcome. The outcomes each appear successful by representing a densification of the TEN,

particularly helping small companies access more easily the necessary resources for innovation. Thus, the TKT does offer a support mechanism as a consequence of the way that it has evolved, but, as was discovered in the late 1990s, success is very hard to replicate.

The contribution made by spin-offs to the entrepreneurial environment is very hard to codify. The OOST project “Technostarters” attempted to achieve this, to identify when new high technology firms needed the kinds of mentoring contact that TKT provided, to help innovation agencies signpost “technostarters” to the appropriate mentors. However, as one interviewee noted, this was a very difficult process to manage because it was not a rational process. The entrepreneurs did not encounter problems, then identify potential solutions for those problems, and then identify which ‘networks’ could offer particular solutions. Rather, the networks were used at the point of identifying the problems, so these contact networks shaped the way that the problems were defined and then the solutions were developed. This is borne out by a range of other interviewees’ experiences with the TKT; one USO joined the TKT before spinning off to get feedback on the business plan, and that then helped with the later raising of finance. Another TKT member introduced one of their contacts to the TKT because he believed it would help the two (already co-operating) firms work better together. This means that the purpose of the networks is not providing the support – the networks exist for other purposes but they become a means through which support was accessed.

This finding does help to highlight the value of the networks for regional development, and in particular, what benefits are brought to the development of the regional economy by the networks filling what we believe to be a previously empty space. The networks do not correspond to a simple resource based model, where a firm lacks a required resource for innovation, and the network provides access to that resource. Rather, the network helps to shape the activities of the members – the networks are an intrinsic part of the resource provided, and they help to condition the outcome. So in our model, the innovating company actually ends up at a different position after the innovation process because they accessed an innovation resource through the network rather than through another mechanism (e.g. through internally generated funds). The fact that the firm is then at a different point then means that the next innovation processes starts from a slightly different position. Of course, we are

implicitly assuming that the network innovation asset is more effective than the stand-alone asset, and the case of TIMP and Netlab both seem to suggest that more can indeed be achieved through collaboration than without it.

The other element of this is it sharpens the understanding of the accessibility to the territorial knowledge pool. In our heuristic model in chapter 2, the idea is presented that the knowledge pool can be accessed by all companies who are in the region. In this situation, the knowledge is actually held within the network, and so firms have to participate in a network which provides a linkage to the network. Of course, knowledge is not exclusively in one network or the other – what seem important in the networks are the people that make decisions and differences, like Dennis Schipper or Rob Dieleman. But what that does then mean is that the knowledge is not open to all firms in the region. The networks are unlikely to ‘push’ technology into firms in Twente that are not already innovating. Thus, the networks are not generalised assets, but at best, are part of a knowledge pool which is only really accessible by elements of ‘knowledge economy’ rather than the ‘ordinary economy’. This seems to leave important questions about whether these activities can build an interface with the ordinary economy, and how this affects the overall economic trajectory of the region. It is to these issues that this chapter now finally turns.

8.4 USOs as initiators of new regional sequences of innovation

In the preceding three chapters, a significant amount of evidence has been presented that appears to show that spin-offs have been very successful in creating a new economy around UT in Twente. What is more problematic is that evidence has emerged in this chapter there remains a division between the university and regional firms – our suspicion is that there has never been a strong connection between the university and non-innovative firms. Although UT was created to boost the textiles industry, the industry at that time never really engaged with the university in any significant way, although the university is a minority shareholder in the Expertex textiles industry research centre in central Enschede, and Ten Cate does have some research links with the university. The problem that has repeatedly recurred is that there is a split between the “knowledge economy” that the university has created, and the “ordinary economy” on which a large proportion of the Twente residents are dependent for their quality of life. This has both advantages and disadvantages; in

Chapter 7, this division means that high-technology activities that are anchored around the university are not subject to disruptions from the poor regional innovation environment; in that sense, the separation has allowed the university and its associated networks to emerge.

What we have seen in this chapter is that despite the creation of territorial assets, they are not readily available to other regional companies, especially those companies which see themselves as non-innovators. Although the RDA and university have both professed to believing that spin-offs will force technology out into the regional economy, that has not happened extensively, not least because spin-offs are not the stablest of partners for companies experimenting with innovation for the first time. Moreover, the variety of subsidy projects which the university and development agencies have developed to try to stimulate entrepreneurship appear somewhat ineffectual. There are ‘usual suspects’ for these projects, and new suspects are emerging from the ranks of companies associated with the university. In some cases, particular firms have made the leap from the ordinary to the knowledge economy of Twente through a spin-in process. Part of the medical sector is a very conservative rehabilitation devices sector, and from that sector have emerged a Knowledge Intensive Technical Services sector around medical product design (in part embedded within TIMP). But what has not happened in a serious way is the upgrading of branch plants owned either by foreign investors or domestic companies. In this concluding discussion, we reconsider the regional impact of the UT spin-off economy on the wider Twentish economy, and consider whether it has materially affected what could be considered the “style of innovation” in Twente.

8.4.1 The role of spin-offs in upgrading existing industry

In the previous sections of this chapter, we have seen some elements of where spin-outs have contributed to the upgrading of the industrial base. Twente, as much as the other regions of the Netherlands, suffers from relatively low rates of contacts between universities and firms, and correspondingly low of business innovation. Because of the methodology, we did not interview large numbers of firms, and were unable to identify firms who had overhauled their business practises or product range in response to contacts from spin-off firms. However, where local SMEs had been affected by the presence of USOs was through the spin-offs’ involvement in a set of

networking activities. One of these was the TKT, which existed to help all high-technology firms build links with their peers in the region, and included many more firms besides just spin-outs. Spin-offs were also involved in the development and refinement of the Technopartner support programme which had been created by the government as an instrument to support innovation in SMEs. Building on the experience around Twente USOs, Overijssel had chosen a very proactive approach to “Technostarters” to help bring innovative starting companies into contact with potential customers, mentors and collaborators to try to replicate the benefits of the TOP scheme outside the university. Conversely, Gelderland (the other province within OOST) had decided to use a much simpler and reactive “signposting” or dissemination approach for their Technostarters programme.

A second element of the regional economy in which spin-offs had arguably been involved in upgrading was in improving the quality of the inwards investment base in the region. There had undoubtedly been a number of high profile IT R&D companies attracted to the Enschede Business and Science Park, and a number of them were attracted by the dual charms of the University and the Telematica Institute. There is a question about how permanent these firms were, because a number of these investors who had come to the region in the 1990s had departed during the recession of the 2000s. USOs were still important to regional partners in their attempts to attract new inward investors to the region; we were told that spin-offs formed a vital part of the “bid books” that were prepared for investors, and helped to convey some “feelings” about the region alongside the “facts” and the “figures” that they compiled in their presentations for investors. Spin-offs were also an important part of the portrayal of Twente as a high technology region in the Twente Technology Initiative, which was another more specific attempt to attract high technology investment to the region. Around €150k was provided to help university research institutes, the TKT and other high-technology organisations to promote the region to outside investors. It is debatable whether those initiatives had been able to attract sufficient inward investment to make good the jobs lost with the closure of Ericsson and other IT firms which ‘shook out’ in the bursting of the telecommunications bubble.

A final element of the upgrading is the contributing that USOs have made to upgrading the public sector in the region. In common with many peripheral regions, public sector employment remains important for the region. The recently announced

closure of the Twente Airbase is seen as being a real disaster for the region because of the lost jobs that will result. Spin-offs have played a number of roles in upgrading and supporting investment in the public sector in the region. They have of course provided justification for funding to the university – particularly from MINEZ – for commercialisation activity, which has strengthened the university’s financial base. We have seen that they have begun to play a significant role in upgrading the region’s healthcare sector, both by developing new approaches and techniques to healthcare through the *Zorg en Technologie* and antecedent programmes, but also by helping to build a case for a new Medical School in the region, which would add a further dimension to health services currently offered. Spin-offs have also played a role in validating other forms of National government investment in the region, such as in the Telematica Institute (*cf.* chapter 9). These investments themselves help to create a bulwark for the knowledge economy in the region and create points of stability around which clusters of economic activity can begin to coalesce.

However, it is important that spin-off companies, and what they deliver for the upgrading of the regional economy, is not overclaimed or oversold. What the activities have yet to do is significantly alter the trajectory of other activities in the region, or bring in large inwards investors that would make knowledge-based activities a significant proportion of economic activity in the region. Spin-offs have begun to configure a limited number of institutions for their own needs, and helped to embed some projects more formally as institutions in the region. However, it is the university which has done much of the work in changing strategies and the perceptions of partners and stakeholders to the economic capacity of the region. Of course, spin-out companies are being enrolled within the work done by the university, to legitimate the university as itself an entrepreneurial actor (a status that is not always fully accepted internally). Unlike Van den Kroonenberg’s original conception of spin-outs, the direct technology ‘push’ transfer has only limited applicability; rather, spin-outs are part of a more general, and slower, evolution of a technological sector in Twente.

8.4.2 Producing the infrastructure for a new innovation sequence

In the previous three chapters, we have seen that spin-out companies have become part of a set of networks of activities that appear to suggest that there are new growth

centres within the regional innovation network. We have seen a number of interesting examples where spin-offs have done things that suggests that there is an overall coherence to activity that could warrant its description of a sequence of innovation:-

- Failed technology firms have been rescued by spin-offs,
- the TOP programme has been used to re-start firms hitting financial difficulties,
- Spin-off and other companies have worked together on new joint venture companies,
- Spin-offs have been formed from negative situations, such a plant closures, employee conflicts and cash flow crises,
- Spin-outs have bought and sold pieces of themselves to other spin-offs better positioned to grow them within their business.
- Spin-offs are placing demands on the university for new research and infrastructure that can help their own R&D needs.

This suggests that there is a regularly functioning economy with a degree of internal dynamism and vitality. But the issue remains that the scope of activity is extremely limited. There has been little shaping of other activities within the region, particularly the embedding of projects within the regional economy. Regional firms have not widely reconfigured themselves to avail themselves of the opportunities arising, and there is an issue about the extent to which the projects currently being developed to try to consolidate activity do reflect real technology capacity. Certainly, in the past, projects were developed which set ambitious regional visions which were impossible to realise at that time in practice. The regional vision for a *Kennispark* is reliant on the creation and attraction of large numbers of knowledge-intensive firms at the same time that some flagship clients have faltered within the Business and Science Park. There remains the risk that the *Kennispark* (*qv*) will provide pleasant office accommodation for routine business service firms and help the university to redevelop its campus without achieving the key aim of creating a cluster effect where there are tangible knowledge spill-overs which create a real unique competitive advantage for Twente.

8.4.3 *UT's spin-offs and the regional 'style' of innovation in Twente*

An emerging element of the Twente style of innovation appears to be an acceptance of the persistence of the division between high-technology and low-technology elements of the economy. The rationale behind the HBO-level campus business centre is, in the words of its manager, because high-technology start-ups will never account for more than 3% of all new firm formation. The low rates of firm formation in Enschede require action therefore across a broad front and not merely concentrating on “technostarters”. This could potentially be problematic in the light of the importance of the health care sector to the future development of the region. The *Zorg en Technologie* activities have come out of two sources, a region in which there is a high employment in health care (in part because of low employment in business services), and a university which has spent thirty years trying to ‘win’ a Medical School. What a lot of the new firms emerging in this field represent are the kinds of technical services associated with health care. They are the closest that the region has got to knowledge intensive business services emerging out from traditional manufacturing strengths, because the those traditional strengths disappeared and undercut the demand for anything other than a vestigial level of knowledge production for textiles (Expertex and Ten Cate). So in that sense, Twente does have a regional style of innovation influenced by its history, but it is very different from the styles of innovation in other parts of the country which are much more strongly linked to historical strengths around logistics, shipping and civil engineering.

The question which remains to be answered from this chapter is whether the region has been able to fulfil its wider national role and to become the second national R&D hotspot for the Netherlands. In contrast to Eindhoven, there is notably the lack of a large leading R&D-intensive company developing the industry – and consequently the region – forward, and creating new spin-off companies which help to sustain the regional economy against outside competition. However, there are some elements which suggest the region may be developing the antecedents of a tech-based economy. But can this make it an R&D hotspot in the Netherlands at the same time that other regions are attempting to make the same transition; Maastricht is developing closely links with Leuven and Aachen in an attempt to build regional critical mass across national boundaries, and Nijmegen/ Arnhem seem to have a much stronger regional innovation system with the presence of innovative actors like Akzo

Nobel, the Radboud University, and the Radboud University Hospital. Clearly, repositioning the region is entirely dependent on the shifting position vis-à-vis other regions, and the way the region is regarded by key national bodies in allocating infrastructure spending, as well as the perceptions of private investors whose decisions shape the future economic structure of the region. Given that the previous three chapters have been so focused on Twente, to address this issue, it is necessary to look beyond the region, to the way that the activities of UT spin-offs are involved in reshaping relationships with external partners. It is to this final issue that this report now turns.

9 UNIVERSITY SPIN OUTS AS PARTNERS IN IMPROVING EXTERNAL POLITICAL RELATIONS

We have thus far considered examples of the ways in which the University of Twente has improved the regional innovation system, as the contribution it has made to regional economic development. However, it is clear that such development is not purely an endogenous process, but involves improving the relative position of the region with respect to external actors. In the language of Yeung *et al.* (2002), the situation of the region improves in the particular production chains in which it exists. It is possible to conceive of a variety of mechanisms through which such a process could take place. At the most economic level, the attractiveness of the region to inward investors may be increased, and particularly, the quality of existing investments can be upgraded, such as evolving into research and development plants from mass assembly operations. Of course, in all developed economies, a significant share of total expenditure comes from the public sector, and so USOs can also increase the attractiveness of the region to ‘public sector inwards investments’, particularly in those types of investment that represent investments in high value added knowledge capital.

We have already seen that the creation of the university was a consequence of a significant lobbying effort directed at The Hague from regional partners who worried about the impacts of the absence of higher education in the east. Likewise, a number of well-connected Rectors Magnificus have ensured that despite its comparatively small size, UT has been rewarded for its pioneering work in commercialisation. Professor Van der Kroonenberg was instrumental in persuading MINEZ of the viability of the TOP approach, and consequently funding for the experiment, which allowed the university to build up the ‘revolving fund’, which has been the foundation of the scheme since its inception. Interviewees were generally of the opinion that such political connectedness was an important asset for a university senior manager.

“[Van der Kroonenberg] was successful in getting money to start this TOP programme, getting money from the Ministry of Economic Affairs, ... he said ‘we can give it a boost, we will produce 15 companies every year, and that

will have an impact on the regional economy in Twente'. So we received money for 5 years to stimulate 15 new companies every year. Which we did."

In this section, we consider the extent to which evidence was found in this research that spin-off companies have upgraded the position of the region in the various networks in which it exists, predominantly in terms of public investments. In particular, we focus on two elements of public investment, how spin-offs have been used in changing national policy-makers opinions of the region in the field of scientific as well as regional development policy.

9.1 Introduction

Twente is undoubtedly a peripheral region within the Netherlands, remote from the Randstad and the new growth centres in the South. The traditional role for the region was as a second manufacturing heartland alongside Noord Brabant, and the original campaign for the university argued that the university had a role to play in strengthening that position. The Neher Commission (*qv*), which laid the foundations for the University of Twente, reported

"We shall work with all our available energies to establish this new third technical university, in the hope that future generations will testify that good and competent engineers come out of the east". (Sorgdrager, 1981, p. 23, authors' own translation)

However, economic decline undermined this traditional role for the region in the 'national project' to some extent, although conversely neither did the region benefit from the temporary subsidies provided to the northern provinces [due to end in 2006]. This appears to have left the region somewhat adrift and in an ambivalent position, in part caught up in lobbying for the provincial status that never arrived, and in part not wanting to further undermine its position and prestige by claiming the special deprivation status of the north. Part of the problem of peripherality for the region is of the lack of control within the region, and provincial status would have restored some degree of control. However, given that the region has been so enthusiastic in its attraction of inward investment, a further element of the peripherality problem faced by Twente is a classic branch plant problem, that local firms with potential for growth are bought out and downgraded, and so never achieve that growth. Conversely, new inwards investment lacks the control functions to allow it to grow significantly *in situ*.

USOs could clearly have a role to play in that situation, and as we have seen, there was some evidence that Ericsson made significant investments in the region precisely in response to a desire to access the knowledge held within local spin-outs.

However, the closure of the Ericsson facility meant that it was not possible in this research to address scientifically the efficacy of the narratives told about high-technology investors, and the extent to which it has been possible to upgrade their activities, to *veranker* them, in the language of the RDA (OOST NV). However, evidence was found in the course of the research that the spin-offs were making an important contribution to improving the attractiveness of the region to the government. Just as with private investment, the region of Twente can be considered to suffer from a lack of control over its public sector investment potential. In chapter 4, one particular element which emerged was the ambivalence within which the region is regarded, or ‘imagined’, by the development arm of the state, principally the ministries of VROM (spatial planning) and MINEZ (economic affairs).

The first element of the problem is that although Twente is seen as having potential at the national level, that potential is not seen as being significant enough to prioritise investing in the region *at the expense of flagship projects* such as the Maasvlakte or the Triple-A motorway construction project. Where Twente is seen as being successful, it is conceptualised as a stand-alone success, despite the apparent (and some would argue largely illusory) connections to other places put forward in the Triangle plan. Little emphasis is made on strengthening the region by building links to other places, particularly where that would facilitate access to complementary assets elsewhere in the East. Little priority is placed on developing a rapid connection between the urban core of Twente (Enschede/ Hengelo/ Almelo) and Arnhem/ Nijmegen; public and private transport links are focused through Deventer, to the west of the region. Despite ‘Triangle’ (*qv*) arguing that the three universities are regional (Eastern Netherlands) assets, the physical infrastructure hinders (for example) Grolsch collaborating with the Agricultural university at Wageningen, or biomedical research groups working with the Radboud Medical School in Nijmegen.

The second issue is that the University of Twente is a relatively peripheral player in the Dutch science system, and according to several of the senior managers at UT, appears to face invisible barriers to improving that situation. These interviewees argued that from the late 1980s, the Dutch government felt that research in the

Netherlands was too diffuse, and efforts were made to concentrate research funding into internationally excellent research centres, to improve the profile and critical mass of the Dutch science system. Part of this was to create a series of national research institutes, to which university research groups can affiliate, such as iBME, integrated Biomedical Engineering for restoration of Human function. The government is also nominally committed to concentrating research spending in research institutes which are acknowledged to be excellent. In table 7 below, we show the allocation of research funding by geographical location of the research institute, and the University of Twente does appear to be a centre of concentration in terms of this figure of research spending in institutes. The figure is somewhat inflated by the budget of the Dutch commercialisation organisation TNO, whose budget in 2003 was around E600m; removing TNO from table 7 below shows that Twente, as much as Utrecht, Delft and Rotterdam, is a centre of institution-focused research activity.

Table 7 Spending in “research institutes” 2003, by Dutch city, all research institutes

City	Spend /€n	City	Spend /€n
Delft	730	Dwingelo	21
Enschede	141	Ede	17
Utrecht	121	Rijswijk	17
Rotterdam	110	Nieuwegein	14
Petten	94	Sittard	10
Amsterdam	87	Gouda	9
Wageningen	80	Groningen	3
Lelystad	64	Maastricht	3
Eindhoven	45	Total	1566

Source: Technische Weekblad, 2004, authors’ own calculations

The problem for Twente in this regard is that research institutes only receive a fraction of the total volume of funding provided to universities. The total spending by research institutes includes resources provided from the government as well as provided by third party collaborators. Considering income figures to universities provides quite a different picture of the geography of higher education in the Netherlands. In table 7 below, we show the income of the 14 public universities in the Netherlands (plus the Dutch OU) from all sources, including government grants and student fees. The table shows that the older established universities receive significant grant incomes from the government despite a lack of real engagement by those universities in the research institute concentration strategy.

We would identify three policy decisions that have meant that UT is inadvertently held within the smaller group of universities despite its enthusiastic pursuit of the institution-formation strategy. The first is that UT does not have a medical school (*qv*), which does bring in significant resources to the university. UT does have financial responsibility for the International Institute for Geo-information science and earth observation (ITC), but that is a much smaller responsibility. The second is that the ‘ancient’ universities including Utrecht and Leiden receive conservation grants from the Government to help with the upkeep of their historic estate. The third is that the university is small in terms of student numbers and so that this means that the university receives a smaller contribution through student fees.

Table 8 Dutch university sector income, 2002 or nearest available year, m€

	Fees and government grants	Third party and other funds	Total
Utrecht *	465.5	177.0	642.5
UVA*	380.0	143.0	523.0
RUG*	334.2	132.7	466.9
Leiden*	293.0	122.0	415.0
RU*	279.9	117.4	397.3
TUD	313.2	70.4	383.6
VUA*	285.6	66.8	352.4
Erasmus*	222.8	128.9	351.7
UM*	188.0	72.9	260.9
Twente	161.7	74.4	236.1
TUE	159.0	47.0	206.0
Wageningen	134.5	67.6	202.1
Tilburg	77.8	41.0	118.8
Open	51.6	5.0	56.6
Total	3329	1255.1	4584.1

Source: university annual reports, compiled by authors

Note: * denotes an institution with a Medical School

‘Spin-outs’ have been conceived as answers to a number of these problems that the region is perceived to face; this is true both in terms of the national science system, but also the position of the region in terms of economic development policy. One of the interviewees noted that students with an entrepreneurial tendency might choose to study at Twente because of the TOP programme, which could help to increase student numbers. The plan to bring a medical school to Twente by creating a critical mass of biomedical research activity has been active since the late 1960s and spin-offs are a demonstration of that research vitality. Likewise, if spin-offs could make Twente more of a ‘place to be’ for research activities, then external actors would build their

own linkages from core areas to Twente, and create a demand for supporting infrastructures that the government could potentially acknowledge and act upon. There is not compelling evidence that spin-offs from UT have achieved a totalising change in the national science system or that they have recreated the region in the minds of key regional policy-makers – if they had then perhaps UT would receive more government income. In this chapter, we look at three key areas to look at how at a micro-scale spin-offs have been able to influence individual decisions to understand whether it is possible for spin-offs to have any kind of broader impact, improving the position of the region in national governance systems.

9.2 University spin-outs in bridging the city-regional governance gap

In chapter 4, we noted that there is a problem in Twente with the existence of city-regional government. Despite the existence of a significant local population (c. 600,000), the absence of a dominant city has meant that partnership between the municipalities has been somewhat limited. A variety of inter-municipality organisational arrangements have been attempted to overcome these problems. However, the issue remains that there is an unwillingness of municipalities to countenance activities which might create direct benefits for neighbouring local authorities. The aggregate effect has been to hinder the creation of a Twente urban governance space; this is particularly problematic in that knowledge capital has strong returns to scale, and knowledge capital tends to be highly concentrated, although the higher mobility of knowledge workers means that its benefits tend to be more widely spread. Twente has not built up a single conurbation which has sufficient critical mass to offer significant competitive advantage through urbanisation or agglomeration economies (*cf.* 4.1.4)⁴². This is highly problematic for creating a competitive modern economy, and has a variety of manifestations. In the foregoing three chapters, there has been evidence that the university has had to try to deal with these problems to create a more supportive host environment.

In this chapter, our concern is with how the university has worked with external stakeholders, or affected the perception of external partners in ways that create a more

⁴² Twente is in competition for knowledge intensive business services with the Randstad, and the strong urbanization economies in the west mean that Twente has problems in retaining KIBS firms.

supportive, munificent regional economic environment. USOs appear to have played a role in establishing a particular perception of the region by the national government, and the way the region has been (re-)presented in the national spatial strategy. This change in national perception and representation provided further resources for regional partners to achieve their own strategic goals. Spin-outs from UT have clearly been attractive to national actors given the ‘Balkenende’ approach to innovation we outlined in chapter 4. If spin-offs from the university of Twente have helped to redefine the region’s role in the national development project, as articulated through the national spatial strategy, *Pieken in de delta*, then those spin-offs are changing the resources that local actors can access for their own strategic development. In this section, we briefly reprise the case of *Kennispark Twente*, in which an idea originating in the university and drawing heavily on spin-offs for its justification and legitimation has managed to significantly configure the local and regional development agendas of others. It is important to note that nothing tangible has yet materialised from the *Kennispark* project, so those that engage with it are doing so on the basis of its future promise. In the course of its enrolment by others, the *Kennispark* concept moved upwards from groupings of local and regional actors to rework the way the region was conceived by the national government in its flagship economic development strategy, *Pieken in de delta*.

9.2.1 The emergence of the ‘Kennispark Twente’ agenda

The original idea for *Kennispark Twente* came in discussions between UT and the municipality around a successor development for the Business and Science Park whose covenant expired in 2002. The original discussions focused around an extension to the BSP, to be located on empty ground to the west of the current science park, and to the south of the western edge of the university campus. The discussions began in 1999 between the municipality, the province and the university, although they were somewhat slow in developing. The 2000 Strategic Plan (*Instellingsplan*) from the university makes no mention of the idea of the *Kennispark*, for example, and although the regional development plan argues that nothing really happened between 1999 and 2004, the idea did develop through a series of iterations. The first of these was that there was a formal concordat arranged between the three partners at a

meeting on 5th June 2002⁴³. The concordat, as reported to the City Council, accepted that despite the three partners entering into the concordat with very different intentions, there were benefits to be brought to all partners from participation, and the participation of all three ensured that synergies were created. As a consequence of this, the decision was taken to appoint a business manager for the *Kennispark*, to promote the business case and ensure that physical and business plans were formed and advanced. This gave some tangibility to the concept in the form of a project articulated through this manager, who could outline the promise that the *Kennispark* idea would promote economic development in Twente.

The next step in the process was that the project became enrolled in the ideas of Netwerkstad Twente. Netwerkstad was the latest in a series of iterations in attempts to build a common inter-municipal governance framework in Twente as a partnership of the four main cities in Twente (Almelo, Hengelo, Borne and Enschede: *cf.* 4.1.4). Netwerkstad Twente attempted to finesse the problems for collaboration which had plagued previous attempts to produce a city-regional government by starting by identifying a series of successful concrete actions and then evolving the most effective structure dependent on the problems.

“Netwerkstad Twente is a recipe for effective management in the urban heart of Twente. The emphasis is delivering effective outcomes through partnership rather than creating an elaborate organisational structure” (Netwerkstadtwente.nl, 2005, authors’ own translation)⁴⁴.

The imperative for Netwerkstad Twente was therefore to find projects which they could use to populate this concept, and *Kennispark* became very important in terms of providing a tangible idea around which the management of Netwerkstad Twente could crystallise. Consequently, *Kennispark* was enthusiastically adopted by the Netwerkstad as one such useful organisational project. In the strategic vision

⁴³ Gemeente Enschede (2002) “*Kennispark* Twente: aanstelling programmadirecteur” 10837/02S003593, 2nd Juli 2002.

⁴⁴ “Netwerkstad Twente is een formule voor effectief bestuur in het stedelijk kerngebied van Twente. Het accent ligt op de inhoud van de samenwerking en niet op de bestuurlijke structuur.” (Netwerkstadtwente.nl) < <http://www.twentenetwerkstad.nl/index.php?show=over> > <viewed 28th May 2005>

published in 2004, *Kennispark* was one of the twelve key projects which had been assembled to populate the otherwise empty concept of ‘Netwerkstad’. Likewise, in 2005, in seeking to realise their vision for Netwerkstad as a European city-region, *Kennispark* also featured as a mechanism which demonstrated the ‘European’ nature of Twente:-

“The largest concentration of high tech firms in East Netherlands is in the environs of UT, and a flagship European knowledge park is being developed to support this activity⁴⁵” (Netwerkstad, 2005, p.2, authors’ own translation).

The *Kennispark* concept was also adopted by – and to some extent shaped – in the regional economic development strategy (REOP) for Twente. This document was an attempt by regional partners (those in Networkstad plus the ten rural municipalities) to produce a common economic strategy for the region, drawing together existing projects with the attention of shaping them to a useful end point. The REOP had four action areas, knowledge and innovation, tourism, business parks and new entrepreneurship, and eight of 37 ‘projects’ in the plan involved the *Kennispark*⁴⁶. A second regional strategy was developed in response to the announced closure of a military airbase in Twente, employer of some 1100. This document – *New perspectives for Twente* – sought to make a case for more funding for the region. The approach adopted naturally fitted closely with the Balkenende II vision of light-touch promotion of investment in innovation, and the document argued that:

“Twente can make a relevant contribution in the realisation of national policy goals, and contribute to the growth of the national economy. Our goal is finally to develop Twente as a significant knowledge region” (New Perspectives for Twente: policy agenda, 2004, p. 1, author’s own translation).

⁴⁵ “De grootste concentratie van hightech bedrijven van Oost-Nederland ligt op en rondom de campus van de UT, waar een innovatief *Kennispark* van Europese allure in ontwikkeling is” (Netwerkstad Twente 2005, Concept for Eurocities Bid Book, authors’ private copy).

⁴⁶ REOP is very interesting because many of the projects that it sets out draw heavily on the success of UT in promoting spin-outs; one of the 37 actions for example is supporting the TOP programme (*qv*), one is supporting *Zorg en Technologie*, both concepts whose success is closely intertwined with the the success of UT in promoting spin-offs.

Perhaps unsurprisingly, the *Kennispark* featured as a mechanism by which NPFT claimed that the funds that it was asking for would make that change. The document claimed that the *Kennispark* would create significant numbers of jobs, a claim made more feasible precisely because of the past success of UT in creating spin-offs.

“Around the urban heart of Twente is a Twentish knowledge park being development to stimulate and house high technology businesses. The Knowledge Park anticipates the development of medical and technical laboratories and clean rooms with space for product development, prototyping, and testing. The Knowledge Park will provide space for at least 12, 000 new jobs” (New Perspectives for Twente, 2004, p. 7, author’s own translation)

As one interviewee noted, the adoption of NPFT acknowledged the inevitability of the closure of the air base and its associated civilian airport, and sought the funds to create something entirely new:-

“In the meantime, they asked for money for 12 projects in the area, to compensate for economic loss ... Also a project called in Dutch *Kennispark*, that means that they want to enlarge the facilities of the campus and also [the BSP and Ondernemershuis] to give more space to innovative companies. This is a political lobby, and in this political lobby, the situation of the local airport is filled in as a PM, *pro memori*.”

The concept of *Kennispark* has also been adopted at the level of the East Netherlands (Overijssel and Gelderland) OOST (*qv*), the regional development agency for the East has developed a knowledge-based strategy for the east is called “Triangle Vision”. Central to the triangle vision is the promotion of three clusters in the east, and it notes that part of the competitive strength of those clusters comes from their connections to the university base.

“These clusters have been formed in part by successful spin-off companies from the University of Twente” (Triangle, 2004, p. 15).

The Triangle Vision was very enthusiastic about what has been achieved at the UT, and advanced suggestions seeking to replicate the success enjoyed by UT in promoting spin-offs by attempting to create similar clusters around the universities of Wageningen and Nijmegen. Triangle at the time was very popular with MINEZ because it embodied a new type of spatial thinking, *landsdelen* (‘national parts’)

corresponding to functional zones of the country which are in turn enacted in the *Pieken* strategy.

The final administrative level where *Kennispark* has been adopted and accepted is at the national level, where *Kennispark* was formally launched by the Staatssecretaresse Karien van Gennip on 22 February 2005. Interestingly, the formal launch event was organised so that the government representative shared a platform with two spin-off companies and the commercial manager of the MESA+ facility (*qv*). The idea behind the launch event was, according to the university press release, to show that the Ministry accepted that *Kennispark* was the place where nano- and micro-technology industries would develop in the Twente region. The proof of this was the fact that two spin-off companies were moving from research and proof of concept activities into pilot production, using the MESA+ facility as their manufacturing activity. Again, this seemed to suggest that the university/ USO relationship was vital for the validation of the concept with policy-makers.

Figure 19 Staatssecretaresse Karien van Gennip at the launch of Kennispark with Cees Eijkel (extreme left), Ronnie van 't Oever, and Jeroen Wissink (right).



Source: UT Website

A second indicator of this adoption is through the spatial economic development strategy of the Ministry of Economic Affairs (MINEZ), *Pieken in de delta* (hereafter

'*Pieken*'). The spatial strategy explicitly recognises the unique role of the UT campus estate in the east of the Netherlands as a place where knowledge can be valourised. The document sets out a number of key national priority actions. In one of these national priorities ((business estate development), *Pieken* stipulated that the *Kennispark* project would enjoy a special status as a knowledge intensive business park:-

“Along with the leading business parks, the cabinet will pay extra attention to the completion of the following knowledge intensive business parks

- “Technopolis/ Schieveen in Delft/ Rotterdam
- Twente Knowledge Park in Enschede
- Bioscience Park Leeuwenhoek/ Rijnfront in Leiden/ Oegstgeest.

“They are too small to be classified as leading business parks (TOPs), but they will meet the other criteria for TOPs [in terms of environmental quality]. They are all located near to universities.” (MINEZ, 2004, p. 34, authors' own translation)

9.2.2 *Kennispark: national priority or empty concept*

In the previous section, we have shown how a concept founded on the outcomes of UT in producing spin-off companies has been spread through a set of regional economic development strategies at a variety of scales, from the municipal to the national. However, it remains a considerable step to show that changes in what has been represented in strategies have been reflected in policy implementation, and hence reshaped investment flows. There are clearly limitations to what has been achieved, even given the initial acknowledgement that such changes are limited by the relatively fixed position of the region in the national scientific system.

Perhaps as a first observation, there are of course limitations to what has been achieved in terms of reshaping the way that the central government (in this case MINEZ) 'imagines' Twente. The strategy *Pieken* is not a snapshot of what the Ministry thinks, or how it could be thought collectively to imagine places, although it does undoubtedly embody spatial concepts which if enacted, should revitalise Twente. *Pieken* was drawn up, according to one interviewee involved in the process, as deriving from MINEZ' territorially inflected policies. Its emphasis was more on

producing a narrative to explain existing flows, rather than a means to direct the investments to other selected areas. One interviewee from Twente was specifically sceptical about the relationship between the development of strategies by national and regional bodies, and the achievement of concrete results.

“The region is now entering the era of big plans, Triangle is a perfect example of that. *Zorg en Technologie* is also something like that. It’s a way of getting money flows to the region, but once you have established the money flows, you have to realise that there are results and you have to find companies wanting to participate there etc. And there is a problem.”

There are also other limitations to the way the concept has shaped national policy-making. The first of these is the extent to which that the policy will be realised in the future: another reading of the inclusion of *Kennispark* in *Pieken* is that it has been included precisely because it is so aspirational, vague and insubstantial; it could well be that in the future, national support would be discreetly abandoned if national priorities change, or the project in reality is too difficult to materialise successfully. Certainly, the ambition for the project, which makes it attractive to MINEZ, is also a future barrier for its realisation; the project has a target of creating 12,000 jobs in high technology businesses. In its first twenty years, TOP only created 3-4,000 jobs; likewise, although significant numbers of high-tech jobs have been created in inward investors, these jobs have been highly volatile, and attractions have also been accompanied by closures and redundancies.

The second issue is that *Pieken* does not merely imagine a role for Twente in the Netherlands, but also creates a role for it by the relative priority it places on the region in the other policy areas which are established as of a national priority. Despite the fact that *Pieken* does seem to value UT as a source of knowledge-based entrepreneurship, much of its remainder undermines rather than channels investment to the east and to Twente in particular. Despite a population and workforce of around 20% of the Netherlands population, the East (Overijssel and Gelderland) receive under 8% of the Dutch regional development budget (around half being absorbed by the special subsidy for the North, the so called *Kompas*). One of the main proposals in *Pieken* is the creation of around 50 leading business parks as a focus for promoting innovative business. These are extremely unevenly distributed around the Netherlands, with the north having 4, the east 10, 15 in the south and 14 around the

Randstad. This represents a fair share for the region, rather than trying to use them to rebalance business location in the region. Even within the Eastern *landdeel*, it is clear that *Pieken* favours the southern conurbation Arnhem-Nijmegen over the Twente region; all the infrastructure investments prioritised for the east in *Pieken* are to support the Arnhem-Nijmegen city region, including the A12-A14, the *Betuwelijn* rail link to Germany and the improvements along the Waal river.

Spin-off companies are not purely a benefit for the region in terms of securing a more representative share of investment in knowledge infrastructure; rather, they fit with a broader national concern in creating competitive and innovative businesses wherever they are located. Although UT has a strong record in spinning-off companies, viewed through the neo-liberal lens of *Pieken*, perhaps a better way to view it is not that it is attempting to channel investment to the economic potential demonstrated by Twente. Instead, it views Twente as an experiment from which other regions can learn. This alternative reading almost seems to be saying “if a region as poor as Twente can form spin-out companies, then imagine the potential that exists in the science base elsewhere in the country. Because these places are more successful,” such a hypothetical narrative could continue, “it would therefore be more rational to channel what limited resources that are available to core areas, to remove barriers to success in these places, rather than trying to ‘buck the market’ and taking the expensive route strengthening the governance arrangements and investing in infrastructure in Twente to use existing spin-offs as a motor of economic growth”.

The Casimir programme can be interpreted in this way; it is a subsidy programme which came out of the national innovation platform to deal with a nationally identified problem of poor career opportunities in research and development. The policy aims to remove the barriers to university/ firm collaboration and helping young engineers build careers in both universities and R&D businesses. Lacking a strong corporate R&D base, the policy seems to undermine rather than reinforce Twente’s technical labour market. It is therefore somewhat problematic to infer that *Pieken* does represent a comprehensive re-imagining of the region in the mind of national policy-makers. Too much of the other policy around regional development seems both implicitly and explicitly to favour other regions, and there has not been a comprehensive lobby redressing this situation to which spin-offs have been able to lend their legitimacy. Likewise, changes at a national level to the administration were

not always to the benefit of the region. A number of interviewees felt that changes to the RDAs, including the merger of the Overijssel and Gelderland RDAs, as well as proposed changes to the board of the unified OOST undermined its institutional capacity to support business development in the region.

9.2.3 Kennispark: national priority or empty concept

The *Kennispark* idea can be reasoned therefore to have taken the individual success stories for spin-off companies, and brought them together to produce a broader synthetic narrative about one particular institutional strength for UT, creating spin-off companies. This institutional strength (which is the aggregated effect of individual success stories) has in turn been used to make the idea of the *Kennispark* feel plausible. The *Kennispark* site is currently empty fields, and it takes some imagination to take the step to argue that by 2020, what are now empty fields can be home to an additional 12,000 high tech jobs. The *Kennispark* has become an artefact in which it is possible to see a number of elements of legitimacy come together. In 9.2.1, several layers of the legitimacy of *Kennispark* are evident:-

- UT bring their reputation as a creator of high-tech spin-outs,
- Netwerkstad bring their reputation as an effective innovative partnership,
- Twente bring their entitlement to recompense for the airbase closure,
- Triangle brings its popularity with MINEZ as an example for cross-border co-operation within functional economic zones.
- *Pieken* brings the fact that it is a policy paper from MINEZ and so implicitly support from the Dutch government.

Something has been created, but the issue is that it does not appear particularly significant, particularly in terms of really changing the way that policy-makers think about the region. Twente has been recognised, through *Kennispark*, as having a potential, and UT is the source of that potential, just as TNO, Delft Technical University, and Leiden Medical School are likewise being seen as source of potential. Through the regional economic development policy and *New Perspectives for Twente*, regional partners are trying to make the case that:-

“Twente can make a relevant contribution in the realisation of national policy goals and contribute to the growth of the national economy. Our goal is to develop Twente as a significant European knowledge region” (NPVT, 2004, p. 1, authors’ own translation).

Kennispark is one mechanism through which the region are trying to prove their commitment to national goals, as a rationale for better regional funding. Twente has developed a regional technology platform specifically mimicking the national technical platform, and indeed the former Rector of UT, Professor Frans van Vught sat on both the national and regional technology platform. But the region remains underinvested in by MINEZ in terms of regional development policies. Policies from Twente have been adopted by the Hague and rolled out more generally; in some cases, this has provided support for activities pioneered by UT, such as the *Transferpunt*. But in other cases, there is evidence that the Government tries to generalise these ideas to a national scale. This in turn suggests that the government really do not take seriously this idea that Twente is a place to do high tech business, or that it really has the capacity to be the second R&D hotspot for the Netherlands. In order to further explore this issue, we turn to look at a second dimension to this ‘external reinvention’ process, the way in which spin-off companies have been involved in reshaping national science, technology and innovation policy.

9.3 USOs repositioning the region in the national science economy

We have already seen in 9.1 that the University of Twente is a relatively small player in the national science system, but the argument has been made that the relatively small investments by the university and its efforts around commercialisation have played an important role in attracting other national investments. The first evidence of this was seen in the 1980s, when the national government decided to create three national centres for micro-electronics (CMEs) to help business adopt new micro-technologies. These three centres were created at the three technical universities, and consequently, UT received one such centre. Although they were located co-terminously with the universities, they were organisationally separate from the universities. In the case of UT, the initial kernel of staff were recruited from university computing and micro-electronics staff, but the centre itself was established as independent from the university. In Twente, CMET was established as CME

Twente, and then after three years, privatised – or at least made independent, as Technology Transfer Twente (*cf.* 5.4.1).

Professor Van der Kroonenberg was involved in the lobbying for CMET, which helped to bring national funds for promotion of innovation into the region; the university provided an initial incubator for the organisation, and this in turn allowed the activity to be stabilised, and then to go on and achieve independent success as 3T, which as we have seen is an actor in the Twente regional innovation system. His popularity with the Ministry at the time seems to have been a consequence of the commercialisation policies already adopted by UT. Spin-off companies were therefore an element of winning such a centre. We look at two further examples of large scientific infrastructure investments in which the university has been involved with lobbying activities. In each case, spin-offs have been involved, although not always as might have been foreseen, in those investments. The two investments are the Telematica Institute as well as the creation of a strategic investment programme for nanotechnology in the Netherlands, Nanoned.

9.3.1 UT as a successful and innovative experimental institute?

A comparable lobbying activity also took place around the attraction of a leading technology institute to the region. The LTI programme was developed by the Ministry of Economic Affairs (OECD, 2003b), by Minister Waaijer as a means of addressing a problem in the Dutch national innovation system:-

“One of the most important perceived weaknesses of the Dutch NIS is inadequate interactions between science/higher education and industry at a time when such interactions become an even more important vector of knowledge creation, transfer and commercialisation” (OECD, 2003b, p. 9)

The LTIs, according to the OECD evaluation report, were selected according to a robust criteria. They were created as nationally-supported virtual partnerships in a process which was intended to guarantee both scientific rigour as well as commercial application. The government invited expressions of interest, and

“The so-called “van Wijzen Commission” [‘Commission of the Wise’], a group of experts advising the Dutch government, received 19 outlines in 1996, of which it invited six to submit a businessplan. In 1997, four of these plans were selected to become LTIs” (OECD, 2003b, p. 21).

The outcome was, according to the OECD report, that they chose proposals that were either strongly grounded in a natural leading company or for which there was a strong leading research group. In the case of what was to become the Telematics Institute, it was undoubtedly valuable that:-

“The marked “bottom-up” character of the selection process probably gave greater chances to proposals that ... could be articulated by a pre-existing network or co-operative research organisation [including] the “Telematic Research Centre” in the case of Telematica)” (p. 21)

In this section, we consider how the university managed to win the LTI, which was set up as an offshoot of the university, but has since moved from the campus to be located in the city centre Roombeek site (*qv*). We use this to question the extent to which USOs are helping to create the idea that Twente is a high technology location, to provide an alternative perspective on the reimagining process in *Pieken* described above.

The origins of Telematica lie in the attraction of a predecessor research unit, the Telematics Research Centre, to Twente in 1991/2. The idea behind the research centre came from the national government, and two ministries, education and economic affairs, who sought to build a strategic research strength for the Netherlands in telematics applications. The TRC concept was backed by a number of the large Dutch IT intensive firms, including the PTT (KPN) and Philips. There was an announcement at a national level that this centre was being created and funded in October 1991, and bids were invited by December of that year. A local coalition emerged in Twente, from the then-Rector, Professor Jos de Smit, a leading telematics professor, Kris Vissers, the Mayor of Enschede and a provincial official. According to one interviewee, they lobbied extremely hard to win that proposal, and it was successful; UT played an extensive role in helping to establish the centre, which received national and provincial funds, although it was located on the university campus area. As the interviewee described the process:-

“TRC started in 1991 or 1992, and was if you like, and that's why it was partly a USO, it was a kind of political coalition between two departments, Ministries, at a national level, Economic Affairs and Education, and three leading companies in the Netherlands in IT. The four or five of us [lobbied] ...

and if you in that way like we won, so we got the TRC, Twente got the TRC, and that University of Twente as kind of a hosting party helped in the first year to get the whole thing off the ground..”

TRC was, in the words of one interviewee, a spin-off of the university; it was an independent institution funded by Government as well as industrial partners. The next stage in the development of Telematica was the decision taken by the Dutch government in 1996 that it was going to establish Leading Technology Institutes to fill a gap in the Dutch innovation system. The idea was that the LTIs would be private/ public partnerships, jointly funded by interested companies as well as the government. The selection of sectors was undertaken through an open call for proposals, from which 6 were selected to present full business plans, and four were then selected for full funding. The funding for Telematica provided for a core administrative overhead which would organise the management of research through separate projects, for which funding would be sought.

“It is a national scene, supporting not only institutional financial basis but also programmatic funding. So we don't get any institutional funding, we have to fight for what we get from the programme based money, via MINEZ in The Hague, and particularly assignments from industry. And so do similar groups in Wageningen, Eindhoven and Delft. All of them being appointed to work in strategic areas, for Twente it is ICT and telematics, for Wageningen it is food technology, for Delft it is new materials ... Eindhoven does chemistry and polymers. Telematica Institute happens to be fairly successful, covering some 40 participating companies and universities by now, getting 2/3 of its turnover from national programmes and industrial projects..”

The LTIs were seen as a highly successful knowledge exchange institutes, but what was perhaps interesting was that it suggested that to the government, and the Ministry of Economic Affairs, that they were more concerned with promoting innovation in large firms, in national champions, than in SMEs, or through promoting spin-offs. Whilst an interim report on the LTIs makes reference to the fact that Telematica has produced a number of spin-off firms, creating spin-offs does not appear to be a key part of the valorisation of research foreseen in the national policy agenda. Although companies are involved in the board of Telematica, they are large companies, a mix of national champions (such as KPN, ABN Amro and Philips Research) and

internationally active research businesses (Microsoft, Ericsson, and Lucent Technologies). This suggests that the Dutch innovation agenda, as pursued through the LTIs, is not particularly focused towards the SME sector as a driving group, but instead as a group to absorb the technologies and knowledges developed within institutions such as Telematica. Telematica is, for example, a member of *Stichting Innovatie Alliantie* (The Innovation Alliance Foundation), which has begun a project using networks of Hogescholen (universities of professional education) to push new technologies into small businesses.

There have been a number of research reports undertaken into the value of the LTIs, most of which have arrived at the conclusion that as a policy mechanism, LTIs are extremely valuable for the national innovation system (STW, 2001; SER, 2003; OECD, 2003; LTIs, 2004⁴⁷). None of the reports argued that spin-offs were an important consequence, driver or rationalisation behind the LTIs.

- STW (2001) noted that there was one spin-off from an LTI, from the National Institute for Metal Research (Delft), which had chosen to locate in Twente. However, despite identifying problems that companies had in absorbing the knowledge as one of the key barriers faced by Telematica, it did not argue that creating spin-offs was the best way to exploit technologies, but instead licensing deals.
- SER (2003) noted that UT was a leader in producing numbers of spin-off companies, but that was unrelated to the value of the LTIs, whose success was a consequence of being a partnership between government and business.
- LTIs themselves published a manifesto in 2004, in which they argued that their strength was that knowledge institutions and companies worked together, rather than creating new firms to exploit the knowledge.

It is quite clear that the role of the LTIs is not in promoting increased innovation through spin-offs, despite the Ministry of Economic Affairs clearly emphasising the importance of the commercialisation of research in its own policies. One explanation for the lack of spin-offs specifically in Telematica was given by one interviewee, in

⁴⁷ LTI (2004) was more of a lobbying document, but it was still interesting that this document did not attempt to argue that the LTIs were a source of spin-off promotion.

that the commercial partners funding the research did not want to create competitors for themselves, and the government were more keen that innovations were adopted by large firms with the capacity to diffuse them through the Dutch innovation system. This meant that spin-offs were a low priority for TI. Of course, Philips is a very important part of the Dutch national innovation system; the Netherlands's high levels of patenting reflect Philips' strategy, and it accounts for around ¼ of the country's R&D expenditure. Thus, given that spin-offs were not important to TI, that seems to limit the value that the university's record in creating spin-offs could have for the attraction and retention of the centre.

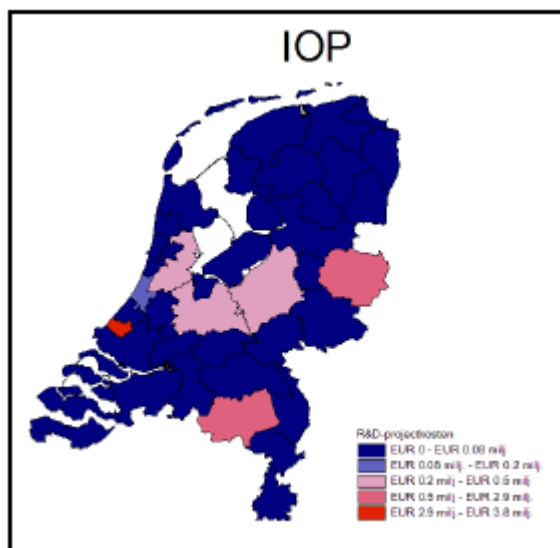
However, the interaction between spin-offs and TI is more complex than the 'no relationship' thesis. Firstly, TI has itself spun-off a company, in its incarnation as TRC, when three TRC employees entered the TOP scheme to create BIZZdesign, to commercialise an architecture application that was developed within TI. Secondly, Telematica moved in 2004 to the former Grolsch factory in Roombeek (*qv*), which was redeveloped following the 2001 fireworks disaster in Enschede. The municipality had set a target for creating 1200 high technology jobs in the building as the centre-piece of a mixed use redevelopment. The factory had space for TI as well as other businesses, and TI entered into an arrangement with the BTC (*qv*) for BTC to provide facilities management services. This allowed BTC to expand its scope from one business centre to a business management service with three sites, all three occupied by university spin-off companies⁴⁸. Thus, although TI itself had no direct impact through spin-off activity, through interacting with the existing spin-off networks (particularly TOP and the BTC activities) to provide a further set of support activities. These in turn were able to contribute to the rebuilding of the Roombeek suburb as a socially-mixed but technologically advanced suburb of Enschede by contributing to the 1200 high technology jobs.

The other contribution made to TI to spin-off activity came indirectly through the re-imagining associated with the *Pieken* process (*qv*). The Balkenende-II cabinet was avowedly anti-interventionist in all its leanings, and this extended to its innovation policies as well. We have already seen that there was a concerted attempt to shift

⁴⁸ Including according to the BTC website Keep it Simple and Monito (although they are a university spin off if not a TOP company).

subsidy support from the North, (Kompass) towards investing in excellence (*Pieken*). What *Pieken* did not attempt to do was to define a set of aspirational high-points in the Netherlands – for the obvious reason that so to do would be ‘interventionist’. What *Pieken* does is identify existing excellence, and then reinforce those places with further investment. One of the reflections of that excellence was the flow of government funds (subsidies) for innovation, and the LTIs are an element of those flows. Another element is formed by the university through the IOPs (innovative research programmes) scheme, and maps produced by MINEZ⁴⁹ show that Twente does perform well in receipt of innovation funds (which in turn contributed to the way that it was portrayed in *Pieken*) – see figure 18 below.

Figure 20 Twente as a national hotspot for the IOP (Innovative Research Programmes) grants⁵⁰



Source: Senter (2003) available at: <http://appz.ez.nl/publicaties/pdfs/03140.pdf>

We have already seen that the position of Twente as a high technology region has been important for the upscaling of the *Kennispark* concept to the level of a project of

⁴⁹ MINEZ (2004) “Beleidsgeld naar region 2004: een gebiedsgericht overzicht van het innovatie instrumentarium 2004”: Den Haag: MINEZ. (Confidential document viewed during site visit).

⁵⁰ This map is interesting because it shows the centrality of the three technical universities to the IOP programme; Delft (bottom left), Eindhoven (bottom right) and Twente (middle right) perform in absolute terms better than the Randstad cities of Amsterdam and Utrecht. The sixth hotspot is accounted for by the Agricultural University at Wageningen.

national excellence, and something that will further promote and reinforce spin-offs contributions to the Twente economy. TI also made a contribution to the national embedding of the *Kennispark* concept by helping to quantify the importance of the region in R&D terms through its receipt of subsidies for innovation. Through this and the role of *Pieken* in embedding *Kennispark*, TI became part of a strengthening of the environment for spin-off firms.

9.3.2 MESA+ as a successful knowledge institution

A second element where spin-offs have contributed to the building up of a knowledge economy in Twente is around national attempts to strengthen nanotechnology. In 7.3.4, we looked at the role of spin-offs in building up nanotechnology in Twente. From that chapter, we observed that spin-offs played several roles in a variety of material and symbolic manners. Spin-offs were used by the MESA+ institution to fund a variety of its activities, in particular in investing in laboratory facilities which were then also available to academics. The capacities of the spin-offs themselves were available to use by the centre if there were problems that needed solving. A number of the spin-offs were involved as industrial users for research projects. In symbolical manners, USOs also played a number of roles; their value in demonstrating commercial acumen for the Centre and the University was shown in Annual Reports. University central management also valued MESA+ because spinning off companies demonstrated to regional partners that they were commercially minded.

Spin-offs were also key agents in creating alternative growth centres in networks around the university that were nevertheless increasing in their independence from the university over time. We have also noted that spin-offs have in several cases been important drivers of these activities, and have had the capacity to do things which the university, either corporately or individually would not want to do, but had positive economic development benefits. These attempts have not been independent of attempts to persuade the Government that Twente is a place where it makes sense to make structural investments in the knowledge infrastructure in nanotechnology beyond the regular peer-review investments of the main scientific bodies, NWO and STW.

One of the key Dutch policy mechanisms for structural investment in science has been the BSIK instrument, which uses the *aardgasbaten* (windfall profits from sales of Dutch gas) to invest in development infrastructure. Under Balkenende-II, this has been increasingly channelled towards innovation promotion, although by investing in the highest quality research institutes. The latest round of BSIK programmes were developed in 2003 and 2004. A national call was issued to identify themes of interest, and a research framework developed. Consortia were invited to bid for funding for research projects to populate the framework, and the proposals were evaluated by an expert panel, taking soundings both from KNAW, the Dutch Academy for Sciences, on scientific quality and CPB, the Dutch Bureau for Economic Policy Analysis on societal impact. One of the criteria for societal impact was the effective mechanisms for co-ordinating between public and private partners, to ensure that the funding was for applied research activities.

Spin-off companies from UT were involved in two predecessor programmes, each of which made a definite contribution to making the case that Nanoned would meet government goals for producing highly commercialisable applied knowledge. The first of these was Micro-ned, a BSIK programme funded to promote micro-technologies in the Netherlands. The web-site for Micro-ned [www.microned.nl] suggests that of the twenty companies participating within the programme, 7 were spin-outs from the University of Twente. The second programme which made an impact on the selection of Nanoned was Nanoimpuls, which had been promoted by a previous government deliberately promoting particular sectors. Although the focus in the consortium membership was on large firms and universities, the Ministry were also keen on the capacity in the consortia to exploit their results. Spin-offs was one area where the consortium for Nanoned was able to score highly, as well as a track record of collaboration shown in the fore-runner Nanoimpuls programme, MESA+ had a national reputation as successfully producing spin-off firms. Indeed, considering the three main research institutes which comprised the Nanoned partnership, MESA+ performed best in almost all those indicators which relate to commercial engagement.

Table 9 The commercialisation indicators for Nanoned' s 3 lead institutes, 2004

Research Institute name	City	Budget (€M)	%budget - third stream	Patents reg'd	Employees into business	spin-offs formed
Mesa+ *	Enschede	34	20	17	40	3
Cobra *	Eindhoven	10	30	2	12	2
DIMES *	Delft	21	22	6	20	1

Source: *Technische Weekblad*, 2004.

Notes: * All these three research institutes were parts of universities, although the table from which this was drawn was not.

Likewise, when the Nanoned programme was launched in April 2005, one-third of the funding was allocated to the so-called “Nanolab NL”, which was further investment funding for these three large nanotechnology laboratories already present in the Netherlands. The purpose of Nanoned is strengthening excellence, and MESA+ is seen as excellent both in terms of the quality of its scientific output as well as its contribution to the valorisation agenda. Clearly, the upgrading of facilities at UT will have an impact – presumably beneficial – on the spin-out companies located at UT. The key point is that this suggests that MESA+ is regarded as a successful contributor to the knowledge economy in the Netherlands. That in turn has helped with bringing investment in scientific infrastructure into the region.

9.3.3 The hidden national scientific excellence perspective

In both those cases (TI and MESA+), it does appear at first sight that the activities of UT and its spin-off companies have been important in helping to establish and improve the position of the region in the way that national policy-makers regard the region as ‘a place where knowledge work is done’, or in the language of *Pieken*, knowledge concentrations are exploited. However, despite the fact that some knowledge concentrations are exploited, there are of course important limitations to the extent to which the region’ position has been improved in the national perspective. Although Twente is clearly seen by MINEZ as being a peak in the country in the way that the north is not, there are still a number of important structures which continue to remake the region as less significant for the Dutch economy.

The first is that the two cases shown above reflect the perception of the region in the eyes of one Ministry. Although the Ministry has become increasingly important under Balkenende-II, it remains a relatively small component of overall government

expenditure. In 9.2, we saw that the Transport Ministry for example remains critical in decision-making around transport expenditure, and the region appears not to be rewarded for its economic value through transport investment which would help to increase the productivity of assets in the region. This is also true for the Ministry of Education, Science and Culture, which provides funding for the Dutch universities, which has held to a traditional pattern of university funding, of course reinforced by patterns of spending from the Ministry of Health. We have already seen that in absolute terms, UT is a relatively small institution in Dutch terms, but the main cause of this is the allocation of government grants and student fees. The region has tried hard to develop a Medical School, and that would arguably bring more to the region in terms of funding than all the efforts around spin-off activities. Although the university rates 11th in terms of total income, UT scores much more highly for third party funds, even in absolute terms, and in proportional terms outperforms much larger institutions such as the universities at Maastricht and Delft (*cf.* Table 9 below). Thus, the success of UT to some extent seems to compensate for the under-appreciation of UT by the national funding agencies, rather than have changed the operation of the system so that more core funds are brought to the university.

Table 10 Dutch university third stream income, 2002 or nearest available year, m€

	Third party and other funds	As % all funds
Erasmus	128.9	36.7%
Wageningen	67.6	33.4%
Tilburg	30	33.3%
Twente	74.4	31.5%
RU	117.4	29.5%
Leiden	122	29.4%
RUG	132.7	28.4%
UM	72.9	27.9%
Utrecht	177	27.5%
UVA	143	27.3%
TUE	47	22.8%
VUA	66.8	19.0%
TUD	70.4	18.4%
Open	5	8.8%
Total	1255.1	27.4%

Source: university annual reports, compiled by authors

The second limitation to this picture is the extent to which the perception of ‘excellence’ within the Ministry of Economic Affairs allows Twente to build a wider image of excellence. The value of the status as a second knowledge region is

somewhat problematic given the Dutch government's constrained financial means. The case of the Horst centre in Eindhoven is an interesting illustration of that; the Holst centre is a joint venture of IMEC, a globally renowned mechatronics research centre based in Flanders and TNO, the Dutch applied research institute. Philips are also involved as the lead industrial partner, and the centre is being located on the Natlab site, the main Philips R&D location. The creation of the centre effectively finessed the discussions over the creation and potential location of a putative new micro-electronics LTI, and was undertaken without an inter-institutional competition because of the strategic nature of the investment⁵¹. In contrast to the LTIs, which were undertaken through competitive tendering with a thorough peer review and economic impact assessment process, Horst was created in such a way that only Eindhoven would receive those subsidies. This reflects a more general recognition by the Dutch government of the importance of Philips to the Dutch innovation system and the need to ensure that the environment is optimised for Philips to continue its R&D activities.

The third element of the weakness is the enduring lack of business innovation in the Twente region. Although the university spin-offs have played an important role in increasing the number of high-technology firms, what they have not been able to establish is single consolidated R&D funders. The MINEZ maps of innovation subsidies (qv), for example, show that the region does very well in terms of instruments which are channelled through universities, such as the Innovation Research Programmes and BSIK (qv). However, for instruments which rely on large industrial partners, such as Casimir, the region performs much more poorly. There are no companies in the region that really 'catch the eye' of science and technology policy-makers in the way that Philips or the G7 (the 7 biggest R&D investors) manage to do. One company interviewed noted that too much of the funding provided was going to universities, and not in ways that made it easy for them to work with firms (50% funding only). Although the region has managed to attract some large inward investors with R&D activities, these have been transient at best. The final missing

⁵¹ There are similarities between the UK cases of the Cambridge-MIT Institute and the DIAMOND light source investments, where strong UK and external partners were used to justify a decision with relatively limited consultation which went to support already strong regions.

element in remaking the region as a high-technology region therefore appears to be creating the industrial champions who also make the case that Twente is a place for high-technology activities.

It is of course important not to use this to argue that there has been no impact or change in the situation of the region. MINEZ did meet some criticisms from small firms that they were not stimulating universities to do useful research for them by creating the voucher system. This provides €7,500 to innovative SMEs which they can spend at any public knowledge institute, meeting the demands of the interviewee noted above that from his perspective, “They do the research, we dictate the subjects”⁵². Nanolab NL is investing tens of millions of euros in nanotechnology in UT, and the scale of nanotechnology activities is increasing at UT underpinned by the Nanoned programme, which emerged as a consequence of both scientific excellence at the university, and the excellent track record in creating spin-off companies. The significance of these changes at a national scale is therefore something demanding further research into the future.

9.4 USOs, Twente and the Balkenende Innovation agenda

These two examples in which UT – and its spin-offs – have been involved in increasing the attractiveness of the region are interesting in that they have two different currents within them. In the perceptions of some Ministries, large spending departments with significant budgets, the Twente region still seems to be at something of a disadvantage. The region has a relatively small Higher Education sector, and so receives a relatively small share of the budgets for universities and colleges; likewise, the region does not feature within any of the flagship transport policies for the government. As the *Nota Mobiliteit* makes clear, Twente does not suffer from transport problems such as acute congestion or dangerous routes, and there are no transport bottlenecks⁵³. Consequently, the region does not benefit from any of the flagship proposals identified under the €80bn investment programme for the following decade. However, conversely, the region does appear to have created a

⁵² E-mail dated 21st January 2005.

⁵³ other than three canal bridges and a lock which may be a problem if freight river transport increases (V, 2004).

strategic place for itself in Ministries which set the framework for territorial economic development, namely VROM and MINEZ in terms of representing a core economic area, and being a beneficiary of innovation subsidies. There is clearly an issue about how these two agendas integrate, and in particular the receipt of large infrastructure investments which support the region.

The consideration of these issues appears to have been somewhat undermined by the recent government interest in *landdelen* as the main focus of activity; in the East of the Netherlands, Arnhem-Nijmegen is the growth focus, and therefore infrastructure investment supports its integration with Limburg and the Randstad through the Triple-A (road) and Betuwelijn (rail) projects. Likewise, Arnhem-Nijmegen also has a considerable higher education sector, including the Radboud University, an associated Medical School, and a large Higher Education college. There therefore seems to be an interest within Government in learning the lessons from Twente and Enschede and applying them in Gelderland. The regional development agency is increasing its investment in high-technology start up businesses around Radboud University, and sponsoring the development of a science park ('Mercator') on land to the north of the university/ hospital site. This seems to suggest that despite the successes within the region in building a knowledge economy, the necessary steps have not been taken to convince the government of the need to invest in Twente to support its status as a high-technology region.

This is matched by what is seen in terms of private sector investments in the region. Although there has been some new job creation, much of the highest value inwards investment is still drawn to the east. Despite the creation of a Telematics Institute in Twente, its customers are located in the Randstad and Eindhoven, and only temporary and small support facilities have been created in Twente. There is a weakness in the Twente RIS that it is dominated by university R&D spending, with very little business spending, particularly from large firms who make significant impacts on volumes. The university may have created a lot of high technology firms, but very few of these have gone on to be large successful firms. Part of this may be due to their relative modernity; many of the large Dutch R&D-active companies date to the late 19th and early 20th century, and the spin-off companies are mostly less than 20 years old. Some companies are growing and are beginning to make that transition but they are

still not significant shapers of the regional innovation system, nor are the partnership and networking activities drivers for the RIS.

However, two things do seem evident that suggest a more positive situation for the region. The first is that there is much more activity than there was 20 years ago in high technology sectors, and the activities have become important in shaping the physical form of the Enschede-West area. On this basis, they have managed to build a broader regional partnership in support of the university as a genuinely regional asset, which may later lead to recognition of this fact by the centre. The second is that the region is in a qualitatively different position to the North of the Netherlands, and despite the economic problems of Twente, it has remained more dynamic might otherwise have been the case. On the basis of the interviews with MINEZ, it is clear that Twente has a visibility that is broadly speaking positive, although there do seem to be concerns that Twente should 'know its place' as a second R&D hot-spot at a much smaller, and less significant, scale, than the Randstad or Eindhoven. Given the current neo-liberal perspective of the government, this view would certainly change were Twente to experience some asymmetric economic success with respect to other regions.

Here we see the root of the problem, namely that Twente is seen by government as a 'tepid-spot' more than a 'hot-spot'; where there are subsidies to be shared around on the basis of excellence in research and innovation, then Twente is a recipient. However, if the subsidies are very lumpy, in particular around investments in project of national importance, then Twente seems to lack a compelling case to receive those projects. Of course, Twente did receive both a Centre for Micro-Electronics in the 1980s and a Leading Technology Institute in the 1990s. Thus, the region faces the challenge that future concentration of research and innovation funding (investment) might squeeze Twente, and downgrade the activities that are currently undertaken at the university. Were this to prioritise mass-teaching and consultancy over blue-skies research, this could potential downgrade the quality of the research base in the university, and lead to a corresponding downgrading of the position of the university in the national developmental imaginary.

A second risk the university faces is the degree of specificity of the way they have positioned themselves in policy terms. If the university is too optimised to the Balkenende-II agenda, then a future change of direction following an election in 2007

might see the region marginalised in terms of future policy direction particularly given that the Spatial and Transport plans are longer term than the White Paper (*Pieken*) which seems to be the main demonstration of the positive regard in which the region is held. Altering investment plans for education and transport seem to be a much less realistic option, and so the region appears to be dependent on internally generated resources for how the region will be able to rebuild itself as a knowledge economy.

Spin-offs have therefore had some symbolic impact on the way in which the region is conceived of by policy-makers. There are strong limits to this rethinking process, and it is not clear to what extent it would have taken place in the absence of those spin-offs, but with the continued presence of a strong research-active university. The key issue remains the 'stickiness' of the improvement in the conception of the region – for MINEZ although they are aware of the region and its successes, are yet to regard the region as successful. One obvious route by which this would happen would be for a Twente-based company to be of national economic importance, a prospect which does seem somewhat remote at the time of writing.

10 Concluding discussion

This report has been prepared as part of a comparative project looking at two less successful regions, to explore the extent to which spin-off companies have played an role in changing the economic status of the region. In one sense, it is hard to draw firm conclusions from the case study which allow the more general development of theory, because our generalisation is based on drawing across multiple case studies. However, the case study does appear to suggest that spin-offs have played a role in the economic impacts of the university in the region. Perhaps somewhat surprisingly, the key mechanism for this has not been the third party innovation mechanism envisaged by Van der Kroonenberg in the 1970s. Rather, spin-offs have contributed to the building of a set of innovation capacities around the university which have increased the overall innovation capacity of the region. This in turn has increased the attractiveness of the region to external partners, who have invested in the region to exploit those capacities. This investment has in turn contributed to the development of a stronger (if not strong) regional innovation system. As an early set of conclusions, we highlight six key dimensions of what we have seen in the Twente 'story'. We would of course note that the Twente story is not a model or recipe for success elsewhere, but is instead a post-hoc distillation of the key distinguishing features of Twente to facilitate a later comparison and conceptualisation.

Long term commitment: the first key element of the Twente model was the fact that the university has supported a range of the activities for long time periods. The university has promoted the idea of a university medical school for over thirty years, and the effect of this promotion has been to shape existing research activities towards a set of applications which have – luckily – become socially and commercially valuable. The TOP programme has likewise been supported for 20 years, albeit with varying degrees of enthusiasm, using different funding regimes; some successor programmes were funded for short-term periods and were not able to sustain their activity. Likewise, other commercialisation activities in Dutch universities were supported in the 1980s only for a brief period, which was insufficient to really achieve the change in culture. A key element in the long-term commitment has been its flexibility; the university has realised that its own survival depends on engaging with a set of external partners, regionally and nationally, and successive Rector

Magnificuses have applied themselves very effectively to this task. This has provided a great deal of **stability** for the development of technology transfer activities which other universities, and their associated activities have not been able to achieve. This is not unique in an international context – Leuven is a good example of another institution committed to commercialisation. But it has made Twente unique in the Dutch system, which has in turn allowed Twente to use this uniqueness to enhance its stability.

Multiple activities emerging from university: a second element of the Twente story has been the broad front on which activities have emerged with university support. There are a range of regional innovation activities which have been partly facilitated by university support, as well as those activities like TOP and the Tissue Accelerator which have been made strategically significant to the institution. The BTC, the Dutch-German Internet Exchange and Innofonds have all been actively supported by the university, and have helped to encourage the Polytechnic Saxion also to involve themselves. The university has of course had an interest in these activities, because they have helped the university to pursue its regional mission, but the university has invested hard cash in these activities for which the financial returns have been negligible. The corollary of that is that these second tier, more speculative regional development projects have not always been supported until they can establish themselves, although some, such as TopSpin International, were able to achieve independence of a form. A second element of this is that other parties have seen the university as a trustworthy ‘peg’ to hang other activities on, such as with CMET, the Telematics Research Centre and the Technology Exchange cell. These activities were not formally part of the university, but the university, and its expertise in creating spin-outs, can be regarded as being associated with why these activities, and their rather beneficial consequences, came to the region.

Gradual extension: the third element of the Twente story is that the activities gradually extended their scope over time. The case of TOP is a perfect example of that; using their alumni for the TOP commission creates a present resource based on past activities. The TKT in one way is a second iteration of TOP alumni (*cf.* table 6) which has created a network organisation. That network organisation then (in conjunction with TIMP) helped to take the Netlab project and turn it into something with a high enough profile to persuade regional policy makers of the validity of the

Zorg en Technologie concept. The idea of a Twente medical school has been faced with consistent denial from the Hague of the possibility of such an activity, but a set of activities have slowly been built up; there have been a series of steps, and each step has been dependent on the previous step, from the biomedical educational track (1967), through a biomedical engineering research school (1992), flagship research institute (1997), the Tissue Engineering Accelerator (2003) and the Biomedical Engineering laboratory centre (2004). Likewise, MESA+ built up to become the centre of the Dutch nanotechnology research programme as a number of high quality research groups developed dedicated laboratory facilities as well as strong partnerships with commercial companies, some of which were spin-offs of their own groups. The gradual extension of the activities helps to explain the necessity of the long-term institutional support for university/ regional interaction.

Mutual reinforcement, anchoring and support: the fourth element of the Twente story is that the various activities as shown in figure 11 have interacted and supported each other. Important within this have been the autonomous actors which have emerged from the university but which have stabilised and achieved independence. The Twente medical school, for example draws heavily both on research collaborations with the 't Roessingh rehabilitation centre, but also with micro-clusters of companies formed by spin-offs from the TOP programme who have collaborated through the TIMP programme and who have been involved with the TKT networks. The Technology Exchange Cell draws on previous collaborations between a micro-cluster of spin-offs around Virtual Reality Valley, primarily focused on mechanical engineering, but TEC is itself a supporting concept in the idea of a medical technology industrial sector. A very important element of this mutual reinforcement has been the political value of spin-offs, in helping to establish UT as a unique institution deserving of special consideration, particularly from the government. Another important element has been the fact that these mutually reinforcing and expanding networks help to deal with the negative features of the Twente economy, so the closure of Ericsson led to new firm formations.

New autonomous nodes: a fifth element has been the fact that new growth centres have emerged from the university, and this autonomy has helped to explain why certain activities have been able to work with the university and achieve what it could not achieve on its own (such as the Medical School or an LTI for nanotechnology). In

some cases, the university has nurtured these nodes then released them into the regional economy, such as with the TKT, which had become an important actor in its own right. In other cases, entrepreneurs associated with TOP and/ or the university have managed to achieve significant growth and begun to reshape the innovation environment in their own interests. However, it is clear that there is no company to have yet emerged from the university which has achieved wider significance that allowed it to lever in external resources. But there are new growth nodes outside the university, and these are working to mutually support and reinforce the university – the case of Mechatronica Valley, initiated by a TOP-per, currently fund a professor within the university (and hence underwrite a research group due to the Dutch). Likewise, Roessingh R&D have created – as a demanding partner and customer for medical technologies research – a stimulus for the development of medical trajectories in the university.

External attractiveness: the final element of the story has been the fact that these activities have increased the attractiveness of the region to external partners, and has levered in investments in ‘regional knowledge capital’. Some of the partnership projects in which the university has participated have had a high total investment, and the university has not had to make a significant contribution. The regional partnership between universities and firms demonstrated by the spin-offs has helped to show to MINEZ that the university is using its knowledge to raise national productivity, and that has in turn led it to be regarded as excellent for the allocation of innovation subsidies. Spin-offs have been a critical part of *Kennispark* winning its special status in *Pieken*, which in turn has added further investments to the regional knowledge economy. By being located with the university, these new investments are automatically inserted into dense networks, which helps local businesses and firms to access them, so ensuring that they contribute to a ‘knowledge pooling’ effect.

Of course, there are limitations and exceptions to the Twente Story as outlined above. Telematica has not been particularly open to access by local firms, but as we have seen, it has played an important role for spin-offs, both as a source of personnel and new companies, but also in persuading MINEZ that Twente is a ‘peak in the delta’. The more general criticism is that the total extent of this new knowledge economy in Twente remains somewhat limited. There have been attempts to expand the scope of what has been achieved at the university; the case of TOP is a neat illustration of how

the university has worked with other partners to bring their expertise and networks to other institutions to try to promote entrepreneurship from those institutions. In one case, in the rural areas, there appears to have been an ‘institutionalisation’ of the project into something more tangible, the creation of the alumnus organisation *Succesvol eigen baas*, although that of itself proves nothing. The HBO and MBO-level attempts have yet to produce real results, demonstrating Lovering’s point that it is not the networks but the tangible outcomes that they yield which are significant for regional economic development. The case of UT does hint that USOs can therefore make significant contributions to their regional economies, and help those regional economies to improve their relative position, and to move into the knowledge economy.

These six points – with the caveats above duly noted – suggest the basis for a revision of the model in chapter 2, which will be undertaken in future working papers in this series, and in conjunction with the findings from the Newcastle case study. The model lacks a strong **external topology**, but clearly in the six elements above are the global production networks within which particular production activities are articulated. Also important are the national (and also European) political-economic frameworks which still regulate state investments in all regions, and which spin-offs can play a role in shaping. A second dimension that this study suggests is that there are more than three key types of regional actors, universities, firms and state actors – the **hybrid network-institutions** (such as TKT) can become stabilised from networks into institutions, and begin to play a significant role in shaping RISs. The research also stresses the importance of **normal economic activity** as the motor for economic change – the turnover of company formation is a regular part of the economic cycle, but universities and USOs together help to retain more of what dies, and turn ‘bad’ outcomes into good. What we have not seen of course is that there have been strong links built between normal and high-technology university activities in the region, which in turn suggests that there may be unidentified barriers in the model, which in turn help to nuance our understanding of knowledge capital.

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