FROM FARMING KNOWLEDGE TO KNOWLEDGE FARMING

the contribution of innovative entrepreneurship and networking to agri-food and other technology clusters

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Mijnheer de Rector Magnificus, dames en heren,
Mr. Rector, ladies and gentlemen,

From farming knowledge .....

You can take the boy out of the farm but you cannot take the farm out of the boy, to paraphrase an old saying. It certainly applies to me: after I grew up on a farm near Ommen in the eastern part of the Netherlands, I left for the big cities of Amsterdam, Florence, Brussels, Brighton and Rotterdam, to return last year to the area in between the Randstad and Germany, at Wageningen University & Research Centre (WU&R), previously known as the nation's Agricultural University. Although on a part-time basis (one day a week) and twenty-five years too late, I find myself at a place where I should have started my academic career, at least that's what my dad secretly believes. In spite of the detour that my career has thus far been as far as my parents are concerned, my professorship in innovative entrepre-

neurship at Wageningen University has made them happy. As far as they are concerned my achievements thus far are all very nice, but it was time the prodigal son came home. And so I did, even though it is still quite a drive from Wageningen to Ommen.

When I told my dad, a retired dairy farmer, about the professorial job I was asked to apply for almost two years ago, I asked him if he saw himself as an innovative entrepreneur. His answer was crystal clear: although of course he was the self-employed owner of a small business, he did not consider himself an entrepreneur since he did not have a major drive for innovation and growth. He explained that he felt he had always worked under conditions that were relatively predictable: both demand and supply were stable, with fixed milk price and quota arrangements, and over the years only a small number of process and product innovations were introduced to our farm. The biggest changes had probably been the shift from small scale mixed farming towards specialized dairy farming (i.e. dropping arable farming and pig farming), the purchase of milking machinery and the regular replacement of our John Deere tractor. Make no mistake, my dad was by no means a sloppy farmer. In fact in the local village he was considered to be among the more innovative farmers, and his increases in milk production were remarkable. In his younger days, when Western Europe was rebuilding itself after the Second World War, he brought innovations to the attention of farmers and instructed them how to use new milking equipment.

Probably without realizing it, my dad was engaged in knowledge transfer and agricultural extension, one of the key topics of this address, by facilitating the diffusion of new

agricultural practices and technologies from the university and the agricultural experiment stations to his fellow farmers through education and training. Thus, he embodied the principles of the Dutch agricultural innovation system, which has been successful in modernizing the nation's horticulture and farming methods. In a way, he symbolized the achievements of the Dutch agriculture and agri-food sectors in the post-World War II period: the large-scale production of low-innovative and competitive goods (commodities) and the effective sale of bulk products all over the world, backed by a national knowledge infrastructure and an excellent logistics and distribution system with effective supply chains connecting suppliers and customers globally (Peper, 1996).

The best example of this successful practice is probably the thriving cut flower industry in the West of the Netherlands, with one cluster located around Aalsmeer (close to Schiphol Amsterdam International Airport) and another around Naaldwijk (the Westland area, close to the Rotterdam harbour). In fact, it is so remarkable that even an economist like Michael Porter (1990: 85) mentioned it in his quest for the origins of the competitiveness of nations, and dedicated half a page to it. What Porter probably did not realize is that these wonderful Dutch tulips did not originate in Amsterdam or the Amsterdam-Haarlem-Leiden (AHL) triangle (with de Keukenhof Lisse as its main tourist hot spot and Aalsmeer as its commercial centre), nor in the Westland (the Rotterdam-The Hague-Hook of Holland triangle), but in Wageningen (and, for those among you who enjoy a bit of history, before that in Turkey!).[1] Despite certain disadvantages (e.g. a grey and rainy climate), the Dutch cut flower cluster, with its research hub in Wageningen and entrepreneurial firms predominantly located in the AHL and the Westland triangles,

has managed to carry out a number of process and product innovations, ranging from new glasshouse growing and cultivation techniques and new strains of flowers, to improved energy conservation methods.

Furthermore, the flower cluster is continuously being upgraded to seize new opportunities and adapt to shifts in global demand. The sustainable competitive advantage of the Dutch flower industry was initially built on a set of mutually reinforcing mechanisms, such as domestic rivalry among growers and local auction houses, supported by a strong domestic demand for flowers throughout the year, dedicated flower cultivation research and testing organizations, and an abundant supply of cheap natural gas for the glasshouses. Although in terms of quality improvement, process innovations (through mechanisation and automation, and streamlining production as well as distribution), and overall cost savings, the achievements have been remarkable, there is a continuous threat that a large portion of the total Dutch horticultural production may be relocated to Southern Europe (for instance Spain and Portugal) if energy consumption per product is too high (Pannekoek, van Kooten, Kemp & Omta, 2005). Because of this, there is an urge, or better a need, to cut back systematically on energy consumption and to introduce innovations and alternative concepts like the closed and intelligent Greenhouse system. After an effective international marketing campaign and subsequent exporting successes, the Dutch flower production system became more heterogeneous, and when home-based suppliers of glasshouses and other specialized knowledge institutes like the Sprenger Institute and the Aalsmeer experiment station (e.g. for packaging and shipping know-how) became further in-

volved and a highly efficient flower-handling and air freight infrastructure was put in place, the dynamic cluster entered the stage of high-tech engineering.

This personal introduction contains all the key elements of my inaugural address, namely:

- entrepreneurship, which can be described as the pursuit of opportunities and the realization of innovations, and eventually the creation of new organizations;
- networking and clustering, which at the local or micro-level refer to the search and partner strategies of entrepreneurs, and at the intermediate and macro-levels to the efforts of public research organizations, small and large firms, and local/regional governments working together to bring about growth;
- technology and knowledge transfer, which refers to the flows of technical and commercial information between universities, dedicated research establishments, industry and small businesses, and the way these processes are co-ordinated;
- the Wageningen University and Food Valley setting, the research cluster that has been built around the university and its extension services, strongly embedded in the nation's agricultural and agri-food sectors;
- knowledge farming, referring to the venturing into the unknown through the continuous (re-)use and cultivation of knowledge. This is the new concept covering a growing number of activities at Wageningen UR and other universities, and large companies;
- the last sections of my talk contain a list of things I want to do in the field of research, education and outreach at Food Valley, and a special thanks to all of those who have been helpful in the creation of my own venture, here at Wageningen UR.

..... **to Innovative entrepreneurship ....**

'To be an entrepreneur, or not to be an entrepreneur', that is a relevant question for aspirant entrepreneurs, investors and educators, one that assumes that some people are natural-born entrepreneurs whose personality traits have destined them for a life of entrepreneurship, while others simply do not have what it takes, and will never become entrepreneurs whatever the circumstances. Any attempt to divide the world into two camps in this way ignores the fact that there is a wide variety of entrepreneurial categories of individuals with various abilities and motivations and ventures with alternative forms and goals (Gartner 1989; Sarasvathy 2004). Neither entrepreneurs nor non-entrepreneurs are alike in every respect, and the process of new venture creation and the subsequent stages one has to go through are different for everyone (Gartner, 1985; 1989).

If we accept that there are no average entrepreneurs or new ventures, we should investigate the barriers to entrepreneurship *(why do some people want to become an entrepreneur but they do not)* and all its variations (Sarasvathy, 2004). For instance, one can make a distinction between 'nascent entrepreneurs', i.e. individuals who are actively trying to start a new firm but who have not done so yet, and 'actual entrepreneurs' who have already established a business that is up and running. The term 'nascent entrepreneurship' covers all the efforts that would-be founders, or aspiring entrepreneurs, carry out to establish their own business, from making technical and commercial inquiries, writing a business plan, taking business courses, putting a start-up team together, to approaching potential customers, etc. The gestation process of new ventures ('from conception to birth'), is still somewhat of a mystery, and one that is largely ig-

nored in most studies (Reynolds & Miller, 1992; Carter, Gartner & Reynolds, 1996). What is also often overlooked is the process of team formation, propelling the venture into the real world; there is a bias in existing studies towards lone founders and creative geniuses. Even though a large percentage of all high-technology start-ups is established by tightly-knit groups of founders, involving former colleagues and befriended specialists, and maybe complemented with friends and relatives, as far as most relevant literature is concerned the team has already been formed and assembled (Kamm, Shuman, Seeger & Nurick, 1990).

Management and organization studies have clearly overlooked the emerging organization (Katz & Gartner, 1988; Gartner, Bird & Starr, 1992): there is a definite bias towards established firms and institutions, and the emerging organization only plays a marginal role in the various theories and research activities. With the possible exception of the population ecology school (e.g. Aldrich, 1999; Hannan & Freeman, 1989), with its emphasis on the vulnerabilities of new organizations (because of their liabilities of newness and adolescence), most organization theories and definitions are based on the assumption that organizations already exist: this is the 'taken for granted world of the existing organization (Gartner, Bird & Starr, 1992: 27)'. Given its overemphasis on these taken-for-granted and legitimate organizations (either large or small), that are continuously reinventing and reengineering themselves (or ought to do so), one could say that existing entrepreneurship literature sheds little light on what could be called 'pre-organizations and sub-organizations': those emerging organizations that are still in the process of learning and experimenting, interpreting feedback from the marketplace, and preparing the

groundwork for a solid business, and that have a high propensity to fail.

Entrepreneurship has something in common with alchemy (i.e. the medieval form of chemistry aimed at changing base metal into gold): both start with (almost) nothing (scrappy materials, good intentions and an ambition to create something new), and whereas the alchemist tries to make gold, the entrepreneur tries to build a company that will generate loads of money and/or fun. In (innovative) entrepreneurship a remarkable transformation takes place from a situation where there is no entrepreneur, no organization and no business opportunity, to one where there is a new man (or woman), a perceived need for a new product, concept or service, and a new venture to exploit this business opportunity. Timmons (1989: 1) provides an apt description of the creation and development of a venture and the alchemy of innovation: 'Entrepreneurship is the ability to create and build something from practically nothing. It is initiating, doing, achieving and building an enterprise or organization, rather than just watching, analysing, or describing one. It is the knack for sensing an opportunity where others see chaos, contradiction and confusion.'

When we look at the variety of definitions of entrepreneurship, some of which focus on the extraordinary activities of great individuals and leaders, new venture creation and business entry, entrepreneurial behaviour and innovation, while others even equate it to small business management and self-employment, we are left with a Babel-like confusion. Various domains and approaches have been distinguished, which may in some cases even contradict each other (Shane, 2003). For instance, there are clear differences

between the entrepreneur and the small business owner: the former seeks to extend his business by actively pursuing innovation and growth, the latter perceives the business as an extension of his/her personality with no major effort in marketing and innovation (Carland, Hoy, Boulton & Carland, 1984). Also, independent entrepreneurship (i.e. self-employment) and intrapreneurship (or corporate entrepreneurship) are not the same. There are, for instance, clear differences in the decision-making processes and the biases and heuristics used by entrepreneurs and managers in large organizations: compared to corporate managers, entrepreneurs will overestimate the probability of being right and overgeneralise from a few characteristics or observations (Busenitz & Barney, 1997). In addition, there are various ways to achieve business ownership: one can start up, purchase or inherit a business, or alternatively be promoted by the existing owners of a company (e.g. Cooper & Dunkelberg, 1986). Furthermore, venturing has been identified either as a visionary, intuitive and creative process, or as a learning process in which the focus is on further developing skills and competences: whereas in the former of these definitions the myth of the great idea and the charismatic leader plays a crucial role, in the latter the gradual process of building a company with a dynamic set of capabilities is considered much more important.

Another pitfall in entrepreneurship and small business research is the Schumpeterian bias, in other words, a strong focus on the innovativeness of entrepreneurial ideas and practices, the creative combination of old and new technologies and the entrepreneur as an extraordinary and revolutionary force (Schumpeter, 1976; 2000). As many empirical studies in the population ecology literature indicate

(e.g. Aldrich, 1999; Hannan & Freeman, 1989), the 'Schumpeterian' entrepreneur is the exception rather than the rule, and most new firms imitate rather than innovate. As such, most new organisations are simple reproductions of existing ones rather than innovative creations, and only a very few manage to do something that has not been done before. Most entrepreneurs benefit from market imperfections and optimise existing possibilities; according to Kirzner (1997), they have the ability to be alert and spot opportunities that have not yet been seen by others.

Over the last decade, attention has shifted away from the creative genius of the entrepreneur (the characteristics and functions of the entrepreneur), towards the nature and characteristics of entrepreneurial processes and events – such as opportunity identification, resource mobilization, the creation of new organizations, firm growth and networking (among others: Shane, 2003; Baron & Shane, 2005; Bhidé, 2000; Stevenson, Grousbeck, Roberts & Bhidé, 2000; Timmons, 1989). In this respect, Gartner (1989: 58) in his analysis of the field of entrepreneurship argued that research should focus on what entrepreneurs do instead of what they are. In terms of identifying the role of entrepreneur in the world of business and separating it from roles and functions that are almost similar, a distinction could be made in terms of the degree of creativity and innovativeness involved, varying from low to high, and the knowledge and skill base, varying from thin to thick (Timmons, 1989; Timmons & Spinelli, 2003). Unlike managers and business promoters, entrepreneurs show not only a creative and innovative style through original products and concepts, but unlike inventors and promoters, they also possess a certain level of solid general manage-

ment skills and business know-how (see table 1).

Table 1: Who is the entrepreneur ? (Source: Timmons 1989: 21; Timmons & Spinelli 2003: 65)		Business know-how / management skills	
		Low	High
Degree of creativity & innovativeness	Low	Promoter	Manager
	High	Inventor	Entrepreneur

Shane (2003) places the ways particular business opportunities can be exploited in another matrix, based on the one hand on whether a person is an independent individual (i.e. an employer or self-employed person) or a member of an organisation, and on the other hand on whether it was the individual or the member of an organisation who originally spotted the opportunity. In table 2, we see that the independent start-up is different from the others because he or she is not only the one who discovers the new product, process or concept, but also the one who exploits it independently. In a way this independent form could be considered the pure form of entrepreneurship. Other cases where independent individuals buy or license entrepreneurial assets, employees become risk-seeking employers, or corporations, through a pro-active and committed workforce, both pursue and exploit opportunities, could be considered semi- or quasi-forms of entrepreneurship. Intrapreneurship and corporate venturing refer to the development of innovative activities within a company and the strategic commitments and investments made by an established corporation in internal ventures and/or start-ups respectively (Elfring, 2003). Extrapreneurship involves

bringing together a number of players in a joint venture, allowing for spin-off creation, licensing and incubation, often involving an idea generator, entrepreneur, investor, source organisation, and/or incubator (Hulsink, 2003).

Table 2: The Modes of exploitation (Source: Shane 2003: 224)		Discovery of the opportunity	
		Independent individual	Organisation member
Exploitation of the opportunity	Independent individual	Independent start-up	Spin-off
	Organisation member	Acquisition & licensing	Corporate venturing

In their definition of entrepreneurship Shane & Venkatamaran (2000: 218) emphasize that it is a 'nexus' that involves entrepreneurial individuals seizing lucrative opportunities: 'the field involves the study of *sources* of opportunities; the *processes* of discovery, evaluation, and exploitation of opportunities; and the set of *individuals* who discover, evaluate, and exploit them.' By actively linking the generation of ideas, concepts and products and the spotting and seizing of opportunities, these 'entrepreneurs' make a positive contribution to the innovativeness, economic activities and dynamics of a country. There is another ingredient we need to address in our discussion of the building blocks of entrepreneurship, and that is the new enterprise that is created by the new entrepreneur to exploit the idea or opportunity commercially and to market the innovation. In entrepreneurship research we should try to investigate the role new ventures play in furthering economic progress: entrepreneurs establish new organizations, non-entrepre-

neurs do not (Gartner, 1989; Low & Macmillan, 1988; Low, 2001). It is important to emphasize that in the process of identifying and pursuing opportunities, entrepreneurial individuals - either acting on their own or inside an organization – have limited resources at their disposal and face major uncertainties and risks (in terms of demand, competition, supply, prices and the development of skills) (Stevenson, Grousbeck, Roberts & Bhidé, 2000; Stevenson & Jarillo, 1990). In the initial stages entrepreneurs often have to do more with less and use what abilities and resources they have at their disposal, which are often the ones that are hidden, overlooked or neglected by others. In other words, most firms set out with a minimum of capital and a maximum of ingenuity and improvisation.

Aware that attaining their goals and ambitions requires considerably greater resources than the ones to which they currently have access, entrepreneurs have to be creative in how they use and acquire their resources. In this 'bootstrapping' process (Bhidé, 1992; Winborg & Landstrom, 2000) starting entrepreneurs can fall back on several tactics, such as working from home, buying used equipment or renting equipment (instead of buying new), generating word-of-mouth marketing, not being paid for shorter/longer periods, deliberately delaying payment to suppliers, exploiting cheap and flexible labour, and turning customers into sales personnel. As Starr & MacMillan (1990) put it, they have to be parsimonious with their assets: buying only what is needed and using the rest without actually owning it, obtaining professional advice through friendship or the promise of future business, raising funds from family, bringing in cash flows before allowing major expenditures. In this phase entrepreneurs are 'hustlers'

(Bhidé, 1986): they act before they analyze, or act and analyze simultaneously. Often the line between research and selling becomes blurred, and entrepreneurs will try to sell their product or service while they are officially looking for advice, information and initial commitment. New entrepreneurs start out with a limited amount of knowledge and pursue modest strategies, with their initial successes depending on their ability to exploit unexpected opportunities. Their success depends on their ability to transform and upscale themselves as they grow in order to benefit from their increased size, allowing them to take on more capital-intensive projects with more predictable outcomes (Bhidé, 2000). On the basis of these dynamic skills and modest and parsimonious planning, entrepreneurs learn and become more ambitious. Initially, stakeholders have a low level of commitment, but as time goes by, they may increase their commitment as the new entrepreneur proves to be a trusted partner.

Smith & Miner (1983) were among the first to distinguish different types of entrepreneurs, firms and managerial motivations. Initially they identified the 'craftsman' and the 'opportunistic entrepreneur', as well as the organizational vehicles with which they are associated, the rigid and the adaptive firm structure respectively. While the craftsman usually has a limited education and training and a low social awareness and involvement, finding it difficult to interact with the social environment and operating within a limited time horizon, the opportunistic entrepreneur is known for his breadth in education and training, a high social awareness and involvement, a confidence in his ability to deal with the social environment and an awareness of and orientation towards the future. When I started preparing for this inaugural address, I realized that I was going to

need a gown (or 'toga' in Dutch), so I decided to look around for gown-makers. I talked to two companies that clearly reflected the two opposing configurations described by Smith and Miner. One of them was a craftsman that came highly recommended by Wageningen University (as well as by other universities in the country) – who nearly managed to intimidate me with talk of a waiting list of up to four months and who made it clear to me that I should consider myself lucky to be his customer. The other one was a tailor in the street where I live – who not only makes gowns for the academic and legal professions, but serves the airline industry as well, and who was happy to inform me that she could deliver my gown within a week.

Miner and Smith, together with Bracker (1992), later identified a third category, the inventor-entrepreneur, who focuses on obtaining patents and making new products. Whereas the craftsman is in the business of making a better product and the opportunistic entrepreneur is trying to build a better company, the inventor-entrepreneur lives to invent: his or her sole purpose in doing business is discovering new things and generating new products. If we are to analyze the past, present and possible future of the larger entrepreneurial setting of Wageningen and the Dutch agriculture industry as a whole, this classification is particularly relevant. In the past, the industry was dominated by craftsmen, in addition to large established corporations and cooperatives further down the value chain, and the opportunistic entrepreneur was underrepresented (to some extent this role was played by the larger companies and cooperatives); today, Wageningen University, through its business generator and incubator, focuses more on promoting the inventor-entrepreneur, by facilitating the creation of tech-

nology start-ups and spin-offs. In the more established segments of the Dutch agri-food industry, like the knowledge-intensive life sciences, there is still room for the flexible, agile and innovative attitude of opportunistic and assertive (inventor-) entrepreneurs.

... Networking & clustering ...

Rather than selecting the best of a number of standard recipes, entrepreneurs gather their ingredients as they go along: they look around their workshop, kitchen or laboratory to see what is available and build their vision on the basis of affordable losses or acceptable risks (Sarasvathy, 2001). Depending on their business experience and level of expertise as well as their goals and ambitions, the venturing activities of nascent entrepreneurs may vary substantially, and predetermine the start-up configuration and subsequent networking activities. While a fresh PhD researcher in his late twenties with only a few key names in his Rolodex may try to commercialize his invention through the research laboratory's incubator or seriously consider setting up an entrepreneurial spin-off, a former senior engineering consultant in his early forties may not need to rely on the active support of his parent organization because he has already built up his own support network. There are obvious as well as subtle differences between these two types of entrepreneurs, with regard to their self-confidence and efficacy as well as in the way others treat them in terms of status and the way their activities are evaluated. Because they lack stable relationships, access to sufficient resources and reputation, young and inexperienced entrepreneurs are prone to a liability of newness or adolescence (Hannan &

Freeman, 1989). If they are to survive they need to gain access to the resources and information they require and establish the partnerships that will bring them political clout and overall credibility (Elfring & Hulsink, 2003; Hulsink, Manuel & Stam, 2004).

Networks are important in the innovation processes of start-up firms and small and medium-sized firms, since 'innovation does not exist in a vacuum' (Van De Ven, 1986: 601). On the one hand, the contacts a firm has can provide opportunities for further innovation and growth, and eventually lead to a better performance, while on the other hand they may lead to inertia and stagnation, for instance when the wrong advice is followed or the wrong partner chosen, or when the firm is locked into a leading firm or a sector in decline (de Jong & Hulsink, 2005). In the former case the existing social network or new business contact provides opportunities for growth and success, whereas in the latter case the existing network or new business contact turns out to have a constraining or even detrimental impact on the firm's performance. The search for and use of social capital is driven by goal-specificity: it only includes those ties that help a firm attain particular goals. The network of a small firm may range from of a loose collection of ties to a close-knit business group in which the focal organization is strongly embedded.

Networks can be described in terms of i) diversity, ii) strength of relationships, iii) structural holes (de Jong & Hulsink, 2005). *Network diversity* refers to the number of actors in the network, what they do and for what they can be contacted. Highly diverse networks consist of partners with distinct, non-redundant abilities. Various partners may be able to contribute financial capital (e.g, banks, ac-

countants, relatives), physical capital (suppliers) or human capital (educational institutes). In the context of innovation, new customer preferences may be a source of inspiration, but customers can also contribute to the realization of new products by providing feedback on a first concept or by acting as lead users (Von Hippel, 1988). The *strength of relationships* refers to the contradiction of strong versus weak ties (Granovetter, 1973; 1995). Strong tries are relationships one can rely upon both in good times and in bad times. They tend to bind similar parties in longer-term and intense relationships. Of course, strong ties are not the panacea of good networking. A network consisting only of strong ties may limit a firm's ability to discover information regarding opportunities. Weak ties can be beneficial as well in that they offer new kinds of information, resources, etc. *Structural holes* refer to the position of a firm in its network structure. A structural hole is a relationship of non-redundancy between two contacts. It may imply that the firm is connected to disconnected others, to paraphrase Burt (1992), or that the network partners do not know each other. Structural holes provide information advantages to people who manage to build across cohesive groups, exploiting a position at the edge of two groups. They are extremely important when it comes to seizing and exploiting opportunities for innovation and new businesses.

Successful innovation requires a collective effort in bringing together people, ideas and objects that were previously separate, and an effective networking among heterogeneous ties spanning various markets and technologies. Innovators and entrepreneurs put inventions together from what they already know and recombine existing ideas and practices from other industries and innovators (Hargadon, 2003).

Edison, for instance, owed his success not so much to his ability to build something out of nothing, but rather to the way he managed to exploit his network, borrow the ideas of others, and incorporate and recombine them in his breakthrough innovations. Edison is an example of a technology broker, someone who links otherwise disconnected communities in an attempt to maximize their range of connections. By doing so, a technology broker is in a better position to be the first to see how people, ideas and objects of one world may provide valuable solutions in another. An example of a company acting very much like Edison is the invention factory IDEO, a company that tries to capitalize on the connections it has with many different industries that may not know each other for its commercial innovations (Hargadon & Sutton, 1997). As a true (technology) broker, IDEO also clearly benefits from its central position and gaps in the flow of information between subgroups in a larger network, filling these gaps by combining technologies from within and outside its client's industry into new solutions. Because they are connected to a wider variety of industries, knowledge brokers typically have access to a broader range of ideas than firms working in one or a few industries. Technology brokers like IDEO and Edison bring together flows of information at the right moment and design solutions in one area that are potentially valuable to others (Hargadon, 1998).

In the 1980s large integrated firms with their extensive production systems driven by cost and price leadership concerns found it increasingly difficult to meet the demands for product and process innovation and the flexible manufacturing of high-quality products (Nemetz & Fry, 1988). Strategic networks of heterogeneous firms involving ongo-

ing and complex partnerships combine the flexibility of market relationships with the long-term commitment of hierarchical management (Powell, 1990). Lorenzoni & Baden Fuller (1995) have paid attention to the role of the strategic centre of corporations in managing such a network of partners. In strategic networks, the central firms are remarkable in their desire to transfer skills and knowledge, and add value to their partners. Typically, they set out to build up their partners' ability and competencies and create a sense of common purpose across multiple levels in the value chain and across various sectors. Strategic networks can be seen as a deliberate choice by management, made to increase the strategic flexibility and responsiveness of the core companies and to facilitate, in close collaboration with specialized partners, the development and launching of new products or process innovations. There are a number of reasons for the emergence of networks in the high-technology sectors, such as a shortening of the product life cycle, the rationalization of R&D and production costs, the need for system integration in converging markets, the concentration on core competencies and the contracting out of peripheral activities (Bolland & Hofer, 1998; Quinn, Baruch & Zien, 1997).

High-tech firms follow a kind of spider's web strategy, in that they try to develop and maintain direct and (almost) exclusive relationships with satellite companies from the strategic centre where the core company is located (Hagel, 1996). Strategic investments may have been made by the core company, often through equity stakes in preferred suppliers and spin-off companies, a joint information system and shared knowledge and co-manufacturing between the core company and its satellites. Management literature talks about 'unbundling the corporation' (Hagel & Singer,

2000): the twin activities of design and manufacturing increasingly seem to conflict in today's virtual corporations. Whereas design focuses on responding swiftly to new ideas, nurturing the talents of managers and employees and seizing new business opportunities, manufacturing is mainly about economies of scale and scope. Therefore, it is often better to separate those activities into specialized businesses that have clear advantages over integrated companies. The distinction between key and peripheral functions is made between the core competencies which are vital to a firm's creativity, innovativeness, and long-term viability, such as R&D, intellectual property and design, and supportive (non-core) functions, which may include manufacturing, often put at arm's length or outsourced, through networks of supportive relationships with contract partners.

In addition to looking at the dynamic capabilities and growth strategies of core firms, and the strategic networks in which they are embedded, the role and involvement of key firms could become even bigger: they could feed industrial districts (Lazerson & Lorenzoni, 1999a). The process of globalization and international sourcing has made the larger multinational firms more aware of the competitive advantages of particular regions or districts. Ambitious flagship firms, together with their subcontractors, may create endogenous clusters, if they successfully explore commercial avenues with their partners, and hence diffuse technology and knowledge at the local level. Besides a high R&D intensity, high technology industries are characterized by a greater than average dependence on skilled, professional and technical labour, especially for the non-routine and innovative activities. In this respect, proximity matters: in order to exchange codified and tacit knowledge,

engineers of large firms and specialized suppliers prefer face-to-face communication (on top of electronically-mediated communication). In addition to transferring skills and know-how from large to small firms, local training and innovation institutions may also help upgrade the level of capabilities and the knowledge base in a region. Since firms that are located in strong clusters are more likely to innovate and create spillovers within and between industries and furthermore regional collaboration furthers an endogenous division of labour and offers substantial economies of times, the benefits are clear: 'the locational effects save time since the partners share updated knowledge and work on signals rather than complex contracts (Lorenzoni & Lipparini, 1999: 335).'

However, if these industrial districts become too inward-looking and insulated, they may lose their momentum and suffer from inertia. In order to benefit from new technical and market-related information (e.g. new technologies and products, changing customer tastes), local focal firms also need to be well-connected to distant networks. Connections to other industrial districts or direct access to and representation at key input or output markets will provide them with new competitive challenges and generate new strategic partners with open minds and additional capabilities. In that respect, flagship firms act as conductors of their indigenous industrial district and distinct collectors and pollinators of information and skills from elsewhere (Lazerson & Lorenzoni, 1999b).

... to Technology Transfer in the agri-food business ...

If we look at the composition of the Dutch agri-food sector between 1950 and 1990, we can say that, with the exception of a few large agro-chemical and food companies and cooperatives, the large majority consisted of small business owners, most of them family-owned and –run, and self-employed farmers. In a world economy where, until the 1980s, companies still largely focused on domestic markets, the Dutch agri-food producers were among the pioneers selling their products abroad. To this day the Netherlands is the largest agricultural exporter in the European Union, with leading positions (i.e. to be among the top five) in flowers and plants, potato production, pig farming and milk production (de Bont & van Berkum 2004; Boone, de Bont & Poppe, 1996). In addition, this active export orientation, the successes of the Dutch flowers and food clusters were the result of an effective innovation system based on the Research, Education and Extension (REE) triptych (in Dutch: *het Onderzoek, Voorlichting en Onderwijs (OVO) drieluik)* (van de Ban 1987; van de Ban & Bauwens 1988; Peper, 1996). This REE/OVO triptych is a linear knowledge and innovation chain where basic and applied research is extended to education and to the population of farmers and growers:

- research is carried out by the agricultural university and other universities, government research institutes, experiment stations, and the privately owned R&D laboratories of corporations and cooperatives;
- education is organized by specialized academic and professional education centres and vocational schools;
- extension is structured by an elaborate system of experiment stations and service agencies that involves private and public organizations and professionals providing technical assistance to the nation's farmers and growers.[2]

Although the basic purpose of (cooperative) extension is to

bring relevant innovations to the attention of farmers and growers, there is also another objective that is somewhat underutilized, namely to bring the problems and challenges facing farmers and growers to the attention of university researchers and teachers (Postlewait, Parker & Zilberman, 1993).

Despite its successful exports, traditionally the agricultural sector has been very much inward-looking, supply-oriented and with a low to modest level of innovativeness. From the 1980s onwards it became clear that the large-scale production of bulk products and integrated supply chains no longer guaranteed a strong competitive position. A production system based on simply supplying commodities to the food industry (e.g. dairy, meat) or selling through auctions (flowers and vegetables) with a single focus on efficiency and productivity increases lacked the right set of incentives for the farmers and their organisations to innovate and change (Diederen, van Meijl & Wolters, 2000). Consumers near and far had developed a taste for high-quality and new original products, and thus provided responsive and flexible agri-food producers with demand for differentiated products in the up-market segment. In addition, in the 1990s strong regulations addressing growing food safety concerns and the ongoing exploitation of natural resources (e.g. sea, soil, vegetation and livestock) made adjustments in the existing Dutch agri-food value chain unavoidable, which in some cases even meant looking for alternative forms of production. The Dutch flower cluster managed to survive relatively easily, using the stagnation in demand to stir up its R&D effort and churn out differentiated and better products. Most of the agricultural sector, however, was severely in crisis, realizing that a change had to be made from a pro-

duction system based on economies of scale, process innovation and output maximization, towards a system based on diversified quality production, with an emphasis on economies of scope, quality and flexibility.

Furthermore, the agricultural system of innovation through extension and joint interest representation started to disintegrate and came under political pressure. In his official assignment to the Minister to put forward recommendations to modernize Dutch agriculture, Peper (1996) qualified the sector as internally-open but externally closed and hence proposed privatizing the information and services agency DLV and merging the Wageningen Agricultural University and the Netherlands Foundation for Agricultural Research DLO (until then part of the Ministry). My Wageningen colleagues Elfring (1999), Omta (2002), Dons (2003) and Mulder (2004) in their inaugural addresses all referred to the gap in the Dutch agricultural innovation system, pointing out that the established system is now being challenged by the promotion of entrepreneurship in the agri-food sciences and a more open and outward-looking knowledge infrastructure. Increasingly, words like innovation and entrepreneurship emerged in all kinds of policy documents, and became buzzwords in the corridors of the Ministry of Agriculture, Wageningen University, and the R&D labs and headquarters of agri-food companies.

From the 1990s onwards the sector has become increasingly dynamic, both in a positive and in a negative way. In addition to numerous firm exits and business transfers, we have seen new entrants and re-born agricultural firms with alternative approaches and competencies, pursuing new product, process and service concept innovations (Rutten

& van Oosten, 1999). Now the Ministry of Agriculture finds the key to structural change among innovative entrepreneurs, who bring in some creativity and variety to the agri-food sector by pursuing all kinds of opportunities traditional farmers and firms have never considered (LNV, 2001). For that purpose some of those 'new farmers' and 'agro-entrepreneurs' have even formed study clubs and alternative networks sharing information and best practices, and effectively questioning the REE/OVO system (de Groot, 2003). It is a change that has opened the door to experiments with alternative farming methods and new business concepts (e.g. landscaping, rural tourism) and products (e.g. functional foods and organic farming), and innovations in business processes and distribution (i.e. introducing tracking and tracing systems and value added logistics, certification, etc.). An example of a farmer who has managed to become a successful innovative entrepreneur is the dairy producer Heida, who sells his home-made and artisan yoghurt products in corporate restaurants throughout the country (seeking autonomy from his dairy cooperative and avoiding the power of the supermarkets) and who distributes his products himself as well (Agrarisch Dagblad, 2005; van Uffelen, van den Ham & Splinter, 2005).

Now that we have addressed the relevance of innovation and entrepreneurship for the agri-food sector, we need to look at the origins of those new ideas and new or reborn firms. Traditionally there were three mechanisms to disseminate technical and commercial information in agricultural communities:

- the first one is the transfer of knowledge and skills from father to son (which is still in use today);
- the second one was a short-lived experiment in the 19th

century to equip clergymen and priests with sufficient agricultural knowledge to help farmers in poor and rural areas (van der Haar, 1993a: 11-30);
- the system of knowledge generation and subsequent extension of the knowledge to educators and practitioners (via intermediaries) is another method of technology transfer, which was and still is popular.

Technology transfer has to do with the development of an idea from a (public or private) laboratory into a commercial product; in this case involving the transfer of people, knowledge, know-how and practices from university to industry and society. In order to manage the transfer of knowledge effectively dedicated offices within a university or company may well be expanded or established or new organizational forms outside the parent (or source) organization may be developed that are designed to move the product from the laboratory to the market place. The key mechanisms in technology transfer are cooperative extension and outreach on the one hand, and patenting, licensing and spin-off creation on the other (Postlewait, Parker & Zilberman, 1993). While the former focuses on the development and dissemination of publicly available (non-shielded) agricultural technologies, the latter is aimed at making money from the inventions of public or corporate researchers through the sale of patents, licensing and royalty payments, and equity in spin-off companies. In the former case, there is a strong belief in the free dissemination of knowledge, for instance through publishing, consulting, one-to-one interaction between university and industry scientists, and personnel exchanges and the idea of appropriating and commercializing intellectual property is opposed. In the latter case, alternatively, private gains from academic

research are sought and secrecy requirements to protect proprietary information are met: the university starts licensing its intellectual property rights (IPR) in exchange for cash, (future) sponsored research or equity (i.e. taking shares in new ventures). Knowledge transfer through an Office of Technology Transfer and Licensing is a complex matter that depends on encouraging researchers to participate actively in the commercial exploitation of an organization's intellectual capital, creating proper and transparent incentives, and pooling critical specialized resources to set up effective patenting and licensing agreements and generate successful spin-offs (Debackere & Vleugelers, 2005).

A parent company's technology can, for instance, be commercialized by an external entrepreneur (actively supported by the parent company). Alternatively, inventors and idea-developers can enter into a partnership with an incubator to develop their concepts further and start up their own company. Within the spin-off process four different roles can be identified: the inventor, the (often internal) entrepreneur, the source or parent organization and the external investor (in the words of Roberts & Malone (1996): *technology originator, entrepreneur, source organization & venture investor*). Ideally these four are all actively represented, but is also possible that, for example, the internal entrepreneur or the external investor are absent from the commercialization process. To facilitate a spin-off in such a situation the parent organization will have to persuade external entrepreneurs to take a license for the developed technology and to work together with the internal inventor(s). If there is a lack of financial means in the initial stages, the parent company will have to look for venture capitalists or itself participate financially in the new product. In the start-up of new busi-

nesses supported by incubators, similar roles can be identified, the role of entrepreneur/inventor, the incubator as active mentor of the start-up company (for instance by offering housing and coaching), the investment role of the incubator, and the incubator as liaison with professional service providers (specialized law firms, accountants, etc.). In the Netherlands, Biopartner and Twinning were established as incubating networks for the life sciences and ICT respectively, to launch a whole range of activities to promote new venture creation and fast firm growth (Biopartner, 2002-2005; Elfring & Hulsink, 2000).

Entrepreneurs are better than others (i.e. investors, technology transfer officials) at identifying and appreciating opportunities, i.e. future states that are desirable and achievable, and at obtaining additional relevant information, because they have prior knowledge and relevant life experience (e.g. through previous jobs, expertise about particular markets, customers, distribution). In other words, whether or not they recognize or perceive an opportunity depends on their own specialized and personal knowledge base. It also means that they will be predisposed to recognizing opportunities in areas with which they are familiar but not in other sectors, even though opportunities there may be more promising. This implies that it is unlikely that two entrepreneurs will identify similar opportunities and that, once an opportunity has been recognized, entrepreneurs and investors may have different interpretations of what the opportunity is. When we apply this to the domain of technology transfer, it becomes clear that it is difficult to centralize opportunity exploitation; hence the critical early stages of commercialising knowledge (screening, selecting, prototyping) should take place bottom up and operate close

to the scientists, engineers and research groups involved (Debackere & Vleugelers, 2005). Shane (2000), for instance, identified eight different ventures that exploited a single MIT invention, namely three-dimensional printing (3DP™). This patented manufacturing technology was commercialized by entrepreneurs and firms with various industrial backgrounds (e.g. an architectural service agency, chemical manufacturer, and a photo retail chain). In addition, an entrepreneur's perspective will be influenced by the social networks to which he or she has access, and he or she may possess specific abilities that will affect the way he or she looks for information (e.g. quick and selective) as well as the way he or she sees things (perceptive ability, not-seeing risks).

... Wageningen UR, Food Valley and the NEW Research Triangle ...

If we look at the history of the Wageningen University and the Netherlands Foundation for Agricultural Research (DLO), we get the impression that Wageningen UR, integrating the University and the Ministry's research laboratories, has arrived almost a century late. Of course this is with hindsight: both institutions started in Wageningen, the agricultural school that preceded the university was established in 1876, and the first experiment station in the country, propelling practical research and experimentation which later evolved into the DLO Foundation, a year later. Looking back at the history of the University and the DLO foundation, we realize that things could easily have turned out differently (van der Haar 1993a, b; Faber, 1993). In its formative years, Wageningen was lucky to be chosen by the na-

tional government as the location for the only national mid/higher-level school in agriculture (thanks to its central location and a pro-active municipality providing free premises), beating, among others, Warffum (Groningen). When it was decided that the country needed a national agricultural university, Wageningen's claim was again contested by the other universities, contemptuous of the academic aspirations of what they felt was a mere polytechnic. However, to avoid having to spend time and money it was decided to keep things the way they were and upgrade Wageningen to be established as a university in 1918. Merging Wageningen University with the Veterinary School of Utrecht University or with Radboud University Nijmegen was discussed regularly over the years as well, even recently, but never materialized. Instead, in 1997, Wageningen University and DLO decided to join forces and establish WU&R.

Wageningen UR (2005a) is unique among the Dutch universities in a number of ways:

- the university specializes almost exclusively in the plant and animal sciences, agri-business and food technology, and environmental sciences, and as such, unlike any other university in the Netherlands, does not have any specific faculties;
- the student/staff ratio is almost 1 to 1, with about 6,500 students (including approximately 1200 PhDs) and 7,000 professional staff (about 4,000 of whom work as researchers);
- because of its close ties to the various experiment and applied research stations over the years and its merger with the DLO Foundation, formerly part of the respective Ministry of Agriculture, the new entity called Wageningen UR can be considered the only true

American-style research university in the Netherlands[3];
- furthermore, the university's activities are not strictly confined to its home city Wageningen but also include major research centres in Lelystand, IJmuiden, and The Hague, and approximately 35 smaller data & accountancy and experiment stations throughout the country. This was shown very clearly in the University's weekly magazine WB (No. 21, 30 June, 2005: pp.10-11) in which a map of the Netherlands was included that was covered almost completely by the numerous establishments of Wageningen UR, and which suggested changing the university's name to Nederland UR (see below).

In addition to providing education and carrying out research, recently a third objective was formulated, one which is currently being implemented, namely the active use and commercialization of the University's knowledge base (in Dutch: *valorisatie*) (Wageningen UR, 2003). The assumption is that the commercial value of the University's intellectual property (IP) can be marketed more actively. Neither the university nor the DLO Foundation have a long tradition of patenting, and if there is one it is very idiosyncratic, depending on the people involved, their drives and predominant financing mechanisms (Jongen, Kleter, Lelieveld & van der Meer, 2004). While the university conducted discovery-based research, DLO carried out applied research on behalf of the Ministry of Agriculture, and practical research was carried out by the experiment stations, jointly financed by the government and the farmers or growers involved. Although the University hired its first technology transfer official in 1981, patenting remained a marginal activity until 2002; the situation was not much different at the DLO Foundation, where in 1999 a mere 9,7% of the revenues originated form consulting

and patents/licenses (Van der Haar, 1993b; Faber 1993: 236; Annual Reports WAU, DLO & WUR, 1995-2004).

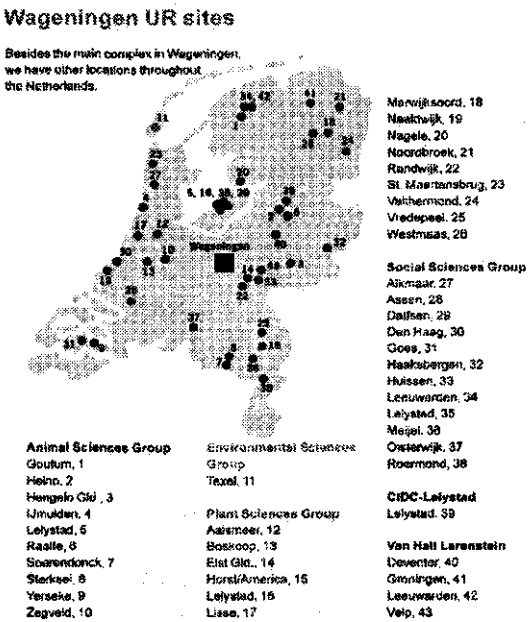


Figure 1 (source: Wageningen UR 2005a: 34-34) Early 2000,

when the university and DLO were busy implementing the merger, a clear need was felt to commercialize the abundantly available knowledge and to translate it into a number of smaller projects (Wageningen UR, 2003), such as:

- pursuing an active IP policy aimed at generating revenues and creating a scouting and support infrastructure for that purpose;
- launching new spin-off businesses and actively promoting, supporting and acquiring new knowledge-intensive

businesses;
- creating a commercial awareness among researchers and lecturers and encouraging them to look for opportunities for consultancy, contract research, and new products;
- stimulating entrepreneurship among students and staff members.

The first two goals are being addressed by the newly created Wageningen Business Generator (WBG) (Jongen, Kleter, Lelieveld, van der Meer, 2004). Given the knowledge that is available and the value it may represent, and the dominant contract research tradition, WBG faces this challenge with a dedicated technology transfer policy to increase licensing to external entrepreneurs and businesses, and to generate new business, spinning out from Wageningen UR. The other two activities have been allocated to academics such as myself and business developers working in their various research units and departments.

When we look at the entrepreneurial attitudes of the regular students and alumni, there is still some work to be done. For instance, some 50% of the 25,000 alumni work in the private sector, while the other half works for not-for-profit organizations, educational institutions and governments (Wageningen UR, 2005a). More precise data on how many of the Wageningen University alumni that work in the private sector are actually self-employed or own a business are not yet available, although it has been estimated that it applies to a maximum of 5 % of the total population, approximately 1,000 to 1,500 alumni (KLV, 2005). In a recent survey among 445 alumni-entrepreneurs conducted to measure their level of interest in becoming involved in start-up, spin-off and business generation activities, it

turned out that most of them (almost 80%) were active in the areas of consultancy, catering and trading, with only 15% working in production. The sad conclusion is that the population of Wageningen-educated entrepreneurs is a very small one, and if we look more closely, we see that most of them operate in low-innovative and services-oriented sectors. To end on a positive note, the large majority of the alumni-business owners were willing to help other Wageningen-affiliated nascent and actual entrepreneurs with advice, coaching, financial support.

Wageningen is a leading centre for agri-business and food research in Europe, centred around the internationally renowned university. In terms of the availability of public and private research laboratories, there is the Wageningen Centre for Food Sciences (WCFS), which is a powerful alliance of European food corporations such as Unilever, DSM Nutrition and Friesland Dairy, to name a few, and the public food research laboratories, including Wageningen University and, within close range, NIZO Food Research (Ede) and TNO Food (Zeist). Adjacent to the university and the private research labs of Numico and Campina DMV, there is a concentration of dynamic and innovative companies that work together with leading players in the life sciences and agri-food industry, including Keygene, Noldus, Bfactory and Checkpoints. Also, there is the Biopartner Centre Wageningen, which acts as an incubator for new projects and products (e.g. Campina Innovation) and fledgling businesses (such as Easygene, Catchmabs and Genetwister). The municipality of Wageningen and the regional development agency GOM (a predecessor of Oost NV) have played a supportive and pro-active role in real estate development by working to-

gether with the University in developing the Agro-science park Wageningen in the early 1990s and the Biopartner Center Wageningen at the start of the new millennium.

Some years ago this diverse cluster, with its combination of education, industry and local/regional governments working together, was given the name Food Valley. Although it has not reached the level of Silicon Valley yet, qualifying it as a miniature Silicon Valley certainly makes sense, the way Wageningen University was seen by its rivals as a 'miniature university' (van der Haar 1993a: 148). Let us not forget that it took Silicon Valley over 50 years to replace the Santa Clara fruit orchards with offices and business parks of successful homegrown companies like Intel, Hewlett & Packard, Apple, Cisco and SUN, who from the 1970s onwards capitalized on the local development and production of semiconductors and computers (Hulsink, Bouwman & Manuel, 2000).

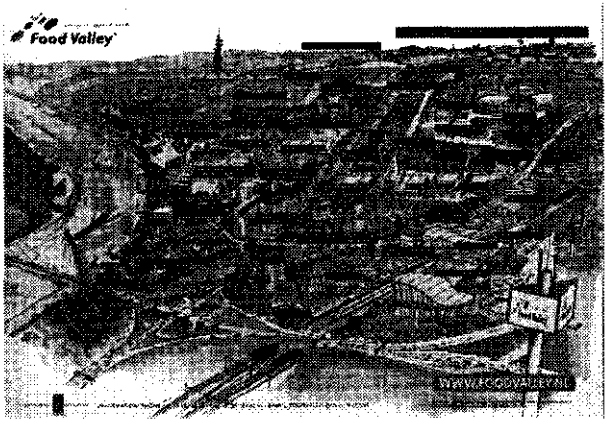
There is a Research Triangle in the making in the East of the Netherlands: it involves three universities, namely Radboud University Nijmegen (bio-medical and health knowledge), Twente University Enschede (with an emphasis on technology and engineering), Wageningen University & Research (with a strong focus on agri-food & life sciences), and the regional development agency Oost (Regiegroep Oost, 2004a, b). The triangle covers roughly the economic area between the universities of Nijmegen, Enschede en Wageningen, which was why the initial name that was given to this project was the NEW Triangle, later the epithet 'NEW' was dropped. In addition to promoting synergies between three specific domains and three knowledge and research poles, the project is aimed at bringing to-

gether three different kinds of partners, namely universities, local/regional governments and businesses. The ambition of the Triangle project team is to be among the world's top five in their respective fields within 10 years. Although it is a very ambitious and complex project, it could provide a way to mobilize forces to promote entrepreneurship, innovation and economic development in the East Netherlands.

... to knowledge farming ...

Now that I have almost reached the end of my address, I want to talk about the title 'from farming knowledge to knowledge farming', and play with the meaning of the concept of farming, its history and options for the future, to define a new kind of farming. I want to bring together farming in its traditional – and agricultural – sense and farming in its new sense, with its emphasis on the exploration and exploitation of knowledge and technology by innovative and dynamic entrepreneurs. Ehrenfeld (2002) compares entrepreneurship to farming and gardening, and he talks of identifying and planting the seeds, nourishing and feeding the plant to make it grow, and ultimately harvesting the fruits of one's labour. What is missing in this metaphor is the broader picture that emerges when all the gardens are combined into a single ecosystem or park, a place where researches, educators and entrepreneurs are all involved in technology and knowledge farming. One example of such a park in the making is Food Valley, centred in and around Wageningen, where there is central knowledge institution, R&D-intensive establishments of large and small firms, and all kind of networks that connect the various actors involved in this endeavour into a vibrant

cluster (see figure 2, see below).



New concepts like technology farming and wind farming highlight the new meaning farming is about to obtain. Although there is still a sense of pioneering, taming the wild, venturing into the known and unknown with (re-)using and cultivating knowledge continuously, and ultimately reaping the rewards, this term is slightly different from the original notion of the traditional farming activities I have just described. The traditional farmer, (re-)educated and acquiring new knowledge through the OVO/REE system, is being replaced by a new knowledge farmer using his laboratory, which can be an R&D establishment but also invention factories used by international chefs like Ferran Adria and IDEO, the product design company, as a playground and incubator for generating and selecting new ideas and concepts. Despite incremental production increases over the years, it has become clear that the traditional farming was myopic and locked-in to established

players, practices and platforms; opportunities for more radical or sustainable product and process innovations and the emergence of new firms and spin-offs were ignored, marginalized or smothered by subsidies, instead of taking them seriously as potential new business cases. The development of new high-quality product markets, safety and locality characteristics, the introduction of far-reaching process innovations and improved distribution systems and value chains, the cultivation of new breeds, and the expansion of traditional agriculture to include land/park maintenance management and leisure, and educational activities, have only now appeared on the policy agenda. Although this is relatively late, it is not yet too late.

Knowledge farming is about developing technologies and ideas, screening them and finding business opportunities to exploit them through licensing or selling intellectual property, and generating spin-off firms.[4] The idea of technology or knowledge farming was pioneered by Gordon Campbell, who with his incubator network Techfarm ventures grows startups of all shapes and sizes. After a long managerial and entrepreneurial career in the semiconductor industry, he set up Techfarm Ventures in 1993, to promote the creation and growth of a multitude of projects, ventures and new firms around a flagship company, both literally and virtually, with the aim of pushing the technology or industry forward. Knowledge farming does not involve a grand design to build a single cathedral over time (Duby, 2002), nor is it based on the myopic notion that what works today will work tomorrow, but instead it treats the time horizon not as a constraint but as a gateway to a multitude of opportunities that all contain interesting options on the future, to be anticipated and prepared for by devel-

oping an evolving portfolio of activities. Knowledge farming is basically about investing in tomorrow's opportunities and future capabilities by encouraging 'a thousand new firms' to flourish. Such a process of experimentation may lead to the discovery of new opportunities and the unfolding of unforeseen initiatives: through their actions these new entrepreneurs and firms may discover new possibilities and play a dynamic role in affecting the value of those opportunities.

The new real options approach zooms in and seeks to manage the links between current actions and the set of uncertain futures and upcoming heterogeneous possibilities of actors in dynamic environments, such as R&D investments and high-tech development.[5] Instead of previous 'study & wait' and 'wait & see' methods to forecast, prepare for and enact the future, the real options perspective argues in favour of 'act and see' approach by investing in options on future possibilities, and subsequently these options can be exercised through follow-on investments (when the results are promising) or abandoned (in case the results are disappointing). The real options approach is especially relevant to universities, other R&D institutions and incubators/business generators, where the widespread commercialization of knowledge and betting on new technologies, new firms and start-up entrepreneurs to be eventually successful through all kinds of mechanisms has become increasingly important. Among a portfolio of initiatives they can make selections based on which outcomes merit to be continued and which ones abandoned, hereby reducing downside risk while maintaining upside risk.

A good example of what could be called 'knowledge farm-

ing' in the larger Wageningen setting is the Action Plan Key Area Flowers and Food that was recently developed in response to a call by the national government's Innovation Platform for interesting ideas and projects (Wageningen UR, 2005b). The objective is to upgrade and upscale the Dutch horticultural system by abandoning the linear innovation model, from R&D establishment to experiment stations to all kind of extension activities, and replacing it with a variety of joint innovative activities and public-private partnerships. While there are projects in the overall plan that address the issues of technology transfer and the development of innovative competencies and skills among small business owners (e.g. spotting opportunities), the importance of innovative entrepreneurs and new businesses to a future vibrant horticultural cluster has not been fully acknowledged. The contribution of tomorrow's new entrants that will venture into the unknown can, of course, not match the short-term package deals of the established players and inclusive lobbies of trade associations (representing horizontal or vertical chains of activities), and public-private partnerships. In order to close the knowledge gap between public R&D institutes and private sector firms, between large companies and small and medium-sized enterprises, the mobility of people, knowledge and other assets in innovation systems needs to be increased by every means available. In all these plans there has to be a focus to allocate resources, give room to new entrants and facilitate the creation of new firms, because there is another 'virtual' knowledge gap that needs to be addressed. We need to find ways to bridge the gap between, on the one hand, existing firms, both large and small, and public institutions with their focus on the here and now, and, on the other hand, the innovators of tomorrow in their quest for possible holy

grails and breakthrough solutions.

The focus on local and predictable findings and the inherent bias towards short-term discovery and venturing processes may drive out longer-term and distant search and experimentation. In that respect we should not forget the statement made by Alexander Graham Bell, one of the great inventors of all time, which can be seen in the foyer of the main entrance to the main site of Bell Laboratories (one of the great labs of all time), along with a bust of Bell himself: *Leave the beaten track occasionally and dive into the woods. You will be certain to find something that you have never seen before.*

... Finally, to go out in the fields: teach, carry out research and do outreach activities ...

After I was appointed here at Wageningen University & Research and began the necessary preparations for the delivery of my inaugural address, I decided to familiarize myself with the history of Wageningen University and the broader Food Valley (or even better: Food Family), in which it is embedded. In my new position, I tap into innovation and entrepreneurship, a field I am familiar with due to my RSM Erasmus University appointment, but I did not think that I would start investigating anything before familiarizing myself with the area of new venture creation and growth, namely, the privatization, liberalization and governance issues in public utilities and services provision. Almost ten years ago I defended my PhD thesis at Erasmus University, in which I compared the restructuring processes in the Dutch, French and British telecommunications in-

dustry, and the political and corporate strategies involved in the implementation of privatization, liberalization and regulation (Hulsink. 1996). Later I investigated how competition was created in formerly monopolistic markets and the shifting public and private involvement in shaping tomorrow's infrastructures (e.g. Hulsink, 1999; Wubben & Hulsink, 2003; Hulsink, 2005). At more or less the same time, I worked together with several colleagues at SPRU University of Sussex in preparing a project proposal to look into the governance of British government laboratories and their changing roles in the field of science and technology (Martin, Hawkins, Berkhout, Hulsink & Molas-Gallart, 1997), a project that was never realized. Having looked in the recent history of Wageningen UR and one of its subsidiaries, the DLO Foundation, I am curious to find out how the decision-making process regarding the more or less secret privatization of DLO took place and how it eventually remained within the public sphere (as part of Wageningen UR). Also, I want to look into how it was that a clear bias towards extension and safeguarding the vertical and integrated chain approach to innovation in the agribusiness emerged and manifested itself, and how alternative knowledge transfer mechanisms (e.g. through patenting, licensing and spin-off creation) were not even considered.

One of my goals for the next three years is to try and bring the dispersed group of entrepreneurship teachers, researchers and practitioners at Wageningen closer together. It took my close colleague Hans Dons and me over a year to find out that there is a potentially strong community, covering the areas of innovation, new venture creation, knowledge transfer and firm growth, with colleagues from various disciplines with different affiliations, backgrounds and orientations, varying

from the normative and prescriptive to the analytical and clinical. Initially, we got the feeling that the two us, working at the Management Studies group of the Social Sciences department, were two lone riders trying to find their way in the Wageningen labyrinth, but then we heard about the teaching, research, and outreach (extension and knowledge transfer) programme of Wageningen Business School, the Students' Entrepreneurship Centre (STOC), the Biopartner Centre Incubator, Wageningen Business Generator, the entrepreneurship/small business nucleus at the Agricultural Economics Research Institute (LEI), and the education/competencies group in our Social Sciences department.

A positive outcome of this search was that it turned out that the number of people at Wageningen UR who are interested in and committed to entrepreneurship (both full-time and part-time) is much bigger than we initially expected, almost 20 professionals in all. Unfortunately, it also became clear that the majority of these people did not know each other, making it not only embarrassing for all of us but also for external stakeholders, who may ultimately become frustrated or lost, unable to find the professional or function they are looking for at Wageningen UR. We realized that we had our work cut out in trying to bring all these people together and providing an overview of all our/their activities in the field of entrepreneurship (i.e. awareness, education, experience and business creation), and finding out whether we and our outside stakeholders can benefit from the coordination and collaboration in all our efforts. The overall objective of this mobilization effort is to help make Wageningen the 'place to be' when it comes to innovation and entrepreneurship in the agro-food business.
Hopefully I will soon get to know the gems among the

group of entrepreneurs based in the larger Wageningen setting. I have already met several highly motivated opportunity seekers, business builders and recognized entrepreneurs, and invited them to my classes to tell the younger generation about their initial expectations and venturing experiences, providing an opportunity for students and aspiring entrepreneurs to meet the founders and builders of, and investors in new and growing businesses. This is especially useful for those who do not really know or have worked with any entrepreneur first hand, and who are now given the opportunity to find out what it is all about. Students that grew up in a family business already know what small business ownership and entrepreneurship entails, and they are already familiar with the pros and cons. They have learned by watching and experiencing venturing activities and, as a consequence, are more susceptible to the idea of becoming self-employed than students whose parents are not self-employed; in this respect, Shane (2003: 86-89) uses the concept of 'vicarious learning' to refer to the fact that people whose parents are self-employed are more likely to become entrepreneurs themselves.

Since setting up a venture by oneself after finishing the specialized *Life-sciences, Innovation & Management* programme or the *Masterclass Biobusiness*, and perhaps after gaining a certain amount of business experience, has become a career alternative, students and aspiring entrepreneurs may benefit from observing and interacting with true entrepreneurs. According to Harvard University and Babson College Professor Timmons (1989: 9), a good example is the most powerful teacher: 'Seeing what has and can be done points the way cleanly and simply, and plants the seed of what is possible. There is a connection between the presence of role

models and the emergence of entrepreneurs that dispels the notion of entrepreneurs being 'born, not made". It would be very rewarding indeed if the entrepreneurs that are located in Food Valley were to become visible through educational, business and regional activities and if the population of emerging and actual entrepreneurs were to grow substantially over the years.

While there always be people to whom the idea of becoming an entrepreneur does not appeal, fortunately there are still plenty of men and women who are attempting to become entrepreneurs or who are already entrepreneurs. One of the things I want to do in the near future is to take a closer look at this pool of (nascent) entrepreneurs in the larger Wageningen setting and study their venturing activities closely, and find out whether there are any substantial differences between 'potential', 'nascent' and 'actual' entrepreneurship in the East Netherlands, as well as the other regions in our country. This plan could lead to a Regional Entrepreneurship Monitor that would allow us to compare the results to any of the regional, Dutch or Global Entrepreneurship Monitor publications (EIM, 2005a; GEM Consortium, 2005). Leaving the findings of such a future project aside, additional policy measures may be necessary to raise not only the number of new as well as high-growth businesses (EIM, 2005b), but also to improve the quality of those techno-starters and bring their ambitions to a higher level.

This research project is motivated not only by curiosity and a genuine interest in what entrepreneurs do and who they are (or want to become) and what they have to rely upon when establishing and launching their venture, but also by

a desire to put these successful entrepreneurs together in a directory of 'local heroes', the way Scottish Enterprise (1995, 1997) has done, and similar to what Beveridge (2001) has done in a booklet on Cambridge entrepreneurs. In the case of Scotland, considerable effort was made by Scottish Enterprise to increase coverage of entrepreneurship in the media: for that purpose case studies were written and provided to journalists, and published in a directory of successful entrepreneurs called 'Local Heroes'. We need a change in attitudes toward self-employment and new venture creation, and a more positive coverage of entrepreneurship in the local and regional media as well as the education system, with a clear emphasis on entrepreneurial role models, may help make Food Valley a better place to nurture and support entrepreneurs. We should make heroes of local entrepreneurs such as Harry Otten and Lucas Noldus. To cut a long story short, we need to increase awareness about self-employment and new venture creation as alternative career paths, in addition to the traditional opportunities offered by universities, government and businesses; even people in their fifties and sixties, who are not planning to retire or who are not interested in an early retirement scheme or lay-off package, may be interested.

... A special thanks ...

A special thanks goes out, first of all, to my principals at Wageningen UR. To begin with, I want to thank our new Vice-chancellor Martin Kropff for officially endorsing my chair in innovative entrepreneurship. Having heard his suggestion to promote entrepreneurship as a new part of a revised OVO/REE-triptych, I am confident that he will ac-

tively support the promotion of entrepreneurship. Secondly, I want to thank former Vice-chancellor Bert Speelman for his involvement, behind the scenes at Wageningen UR and the Wageningen University Endowment, in pushing for this professorial chair and hence making today's event possible. I will never forget meeting the then Vice-chancellor for the first time and ending up talking to him in our common Saxon dialect. I felt immediately at ease in the holiest of holies at Wageningen UR.

Next, I would like to thank the Wageningen University Endowment (WUF) for financing my chair and helping to make yesterday and today's 'high-tech valleys and research triangles' conference possible, here at Wageningen UR. To their credit, they were the first to set money aside to create the first chair at Wageningen UR for a professor in innovative entrepreneurship. As early as 1998, they asked Tom Elfring, who was at the time a colleague of mine at Erasmus University, to take up that position. Today I feel proud that I am able to follow in the footsteps of a man who has always been a trusted colleague, inspiring collaborator and close friend. Another person who I want to thank for making the chair and today's event possible, is Onno Omta, chairman of the Management Studies group, the unit to which I am affiliated. I know that publicly and behind the scenes he has played an active and daring role, in ensuring that the professenial chair would be maintained and new candidates could apply after my predecessor had left to take up a full time position elsewhere. Also I want to thank Paul van Beek, deputy chairman of the Management Studies group for having helped me out at a critical stage in the application and hiring process and Vinus Zachariasse, Dean of the Social Sciences group, for having facilitated a satis-

factory temporary solution for the office space problems colleague Hans Dons and I faced at the time. I am glad that neither Paul van Beek nor Vinus Zachariasse need to be involved any longer, now that I have been officially appointed for some time and the new and fully refurbished Leeuwenborch building offers us a decent space.

Another person I want to thank for making today possible is my RSM Erasmus University Dean, Han van Dissel. When I told him about the possibility of a part-time appointment at Wageningen University, he supported it and actively looked for ways to make it possible. Talking of my other university, I want to thank my eShip colleagues Wynand, Orietta, Erik and Dick for all the good times we had in carrying out our joint research and teaching activities. I trust new challenges await us beyond the horizon.

It has been a real pleasure working with my colleague Hans Dons for the last eighteen months. I feel that as a team we complement each other perfectly, and I value his seniority, business experience and insider's knowledge of the Wageningen research and the Dutch life sciences settings. I look forward to working together with him, trying to bring the entrepreneurship crowd at Wageningen together and taking a closer look at the evolution of the DLO Foundation and its strengths and weaknesses over all the years. Also I want to mention Wietze van der Aa, the Director of Wageningen Business School, for his helping hand in introducing me to my new working environment, and I also want to thank him for getting me on board at the Bio-Business Masterclass almost two years ago, and for his active involvement in (re-)designing and organizing this programme for life-sciences entrepreneurs.

Talking about our new beautiful Social Science department building, I am especially looking forward to working together with my close colleagues in the Management Studies group, with Martin Mulder and Thomas Lans on entrepreneurial competences, Wim Heijman on entrepreneurship and regional development, Hielke van der Meulen on local food production systems, and the LEI nucleus on entrepreneurship and small business. Also, I am looking forward to exploring future exchanges with all those Leeuwenborch colleagues I met briefly or simply in passing: there are plenty of interesting opportunities ahead of us to exploit.

Next, I want to thank the students for being here and, of course, for showing up in our classes, but especially for being curious about what it means to be an entrepreneur and for being enthusiastic about the prospect of starting and growing a new business. It is good to know that a growing number of Wageningen UR students are interested in finding out what entrepreneurship is all about and translating their enthusiasm in the way they organize all kinds of interesting events. When people talk about further integrating the beta-science and the alpha/gamma-social sciences programmes, you should know that most of you, especially those of you specializing in Life sciences Innovation Management (LIM), are the perfect illustration of that promising new combination.

In addition to being involved in education and research in the field of entrepreneurship and management, like at RSM Erasmus University, at Wageningen I am also close to policy development and implementation, and find myself in a position to work with entrepreneurs, intrapreneurs and

their facilitators, all of whom are involved together in setting up new businesses, and I have an opportunity to help them grow. These 'partners in crime', or more appropriate fellow entrepreneurship evangelists, include:

- Wim Jongen and his colleagues at the Wageningen Business Generator;
- Jeff Gielen at the incubator Biopartner Centre Wageningen;
- Roger van Hoesel and Charles Crombach at Food Valley.

I would also like to thank a small number of people and organizations who were actively involved in preparing our conference 'High-tech valleys & research triangles in the East Netherlands and elsewhere': namely Paul den Besten, Monique Montenarie, Gert Stronkhorst, and our sponsors Oost NV, Rabobank, Wageningen University Endowment (WUF) and PricewaterhouseCoopers.

Dan stap ik nu over in mijn moedertaal het Nederlands, daar ik een speciaal woord van dank voor mijn ouders en familie in petto heb. Mijn kennis van de biologie gaat niet ver, maar ik weet wel dat ik zonder jullie hier niet had gestaan: dat geldt zowel voor mijn geboorte als mijn vroege en late groei. Dat hebben jullie allemaal mogelijk gemaakt. Ik ben mijn verhaal begonnen met te vertellen hoe, ook al heb ik het boerenbedrijf verlaten, datzelfde boerenbedrijf mij toch niet meer loslaat, en op een andere manier dan voorzien. Het lijkt met andere woorden in mijn gen of DNA te zitten dat ik via een grote boog nu toch uiteindelijk zelf aan het boeren ben geslagen, weliswaar met kennis en met kennissen in de IJVER (IJssel-Vecht Rijn) delta, iets anders dan jullie deden met de koeien, maar toch.

Misschien is het beter zo, alhoewel ik onze John Deere toch wel af en toe mis....

Ik heb gezegd

... Notes ...

[1] The contribution of Wageningen University scientists (among others, Professor A. Blaauw, E. van Slogteren and M.P. de Bruyn Ouboter) included further research into flower bulb cultivation and virus disease discovery, and development and renewal of the range of tulip variation, for instance by making them bloom as early as possible (as every tourist can witness when they visit the Keukenhof Lisse around Easter (van Maanen 1993: 1-13; Wageningen Tulip Portal http://library.wur.nl/tulip). Three entrepreneurial firms were also involved in the early international success of Dutch tulips, namely E. H. Krelage & Sons, Zocher & Co, and C. G. van Tubergen.

[2] The so-called 'land-grant' universities in the U.S. (granted on the basis of the federal 1862 Morrill Land Grant Act), for instance the University of Wisconsin, and Massachusetts Institute of Technology (MIT) were the first to align themselves with daily life and socio-economic development (Kerr, 1995). The overall aim of their 'land grant' activities was to assist agricultural and industrial development through opening their doors to the children of workers and farmers, as well as the upper and middle classes, and developing agricultural and urban extension through additional training and research related to the technical advance of farming and manufacturing.

[3] Of course in terms of its size and specialized focus, Wageningen UR is definitely not on a par with, for instance, the Massachusetts Institute of Technology, one of the world's leading science and engineering schools. Wageningen UR, however, has a couple of things in common with the American research universities (Roberts, 1991; Kerr, 1995).

First of all, both Wageningen UR and the American research universities have been recognized as important actors in technological change and economic development in their respective domains and as a source of basic knowledge, technical solutions and skilled labour have made their overall contributions to Dutch and American society. Secondly, both Wageningen UR and the U.S. research universities, initially strongly relied upon services proceeds from extension activities (approximately 1880-1970), subsequently followed by federal or national/European research grants and private funds from industry (approximately 1950 till today), and donations from alumni (whereas this is already common practice in the U.S., in Wageningen this has yet to be developed).

[4] The term farming in the sense described above is also used in the area of biotechnology (as molecular farming or *pharming*), where it refers to the use of plants or other living organisms as factories for biological and chemical products, with the objective of producing not foodstuffs but pharmaceuticals (references). Another application of farming outside agriculture and the life sciences is in the field of artificial intelligence and datamining; here it is an inexpensive method for building systems incorporating montecarlo simulations, qualitative reasoning, machine learning and randomized abductive logic (see for instance the work of computer and artifical intelligence specialist Dr. Tim Menzies, http://menzies.us).

[5] In 1981, after a successful career at Intel, Campbell went to find his fortune elsewhere and set up SEEQ, a company that developed memory and communications chips, which was listed at the Nasdaq two years later. In 1985, he again moved on and established Chips and Technologies, which also went public and was listed at the Nasdaq within two years. After these two successful start-ups, he decided he wanted to be more involved with and bring together new technologies, new companies, new teams and new ideas in new entities, and to that end he established Techfarm ventures (www.techfarming.com). In the late 1990s, this approach was copied and put to the extreme by

the Icarus of the speech and language technology industry, L&H (De Witte, Van Aelst & Van Peteghem (2001) and Joris (2005)).

6 For a first introduction to real options reasoning, see Adner & Levinthal (2004a, b) and McGrath, Ferrier & Mendelow (2004).

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