

Nurture or nature: interplay between the individual and the institution within the commercialisation practices of Australian Universities

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ABSTRACT

Universities play a key role in the national innovation system as generators and disseminators of intellectual property (IP) (Porter 2001; Lundvall 2007). Australia's 38 universities have become active players in the globally competitive field of commercialisation (Harman 2004). While the research performance of Australia's higher education institutions over the past decade has been good their performance in commercialisation has been mixed (Ville 2006). Through technology transfer and spin-outs the modern university has now embraced commercialisation as one of its core functions (Raizel 2004). This paper examines the nature of academic entrepreneurship and the interplay between the individual researcher and the institution in which they work. Although there has been a growing body of research into technology entrepreneurship (Gans 2003), there is a gap in the literature relating to academic entrepreneurship.

Introduction

In the knowledge economy that is now emerging, universities, as major centres of learning and research, are becoming increasingly important as the sources of ideas that turn into new products, processes and systems. This is particularly so in the enabling technologies such as information and communications technologies, biotechnology and nanotechnology. There is a distinction between traditional technology transfer and knowledge transfer. Technology transfer is a term used to describe a formal transfer of rights to use and commercialize new discoveries and innovations resulting from scientific research to another party. Universities typically transfer technology through protecting (using patents and copyrights), then licensing innovations. The major steps in this process include the disclosure of innovations, patenting the innovation concurrent with the publication of scientific research and licensing the rights to innovations to industry for commercial development.

To facilitate the commercialisation of academic knowledge many universities have established technology transfer offices or commercial units, which are administered by the university's central administration, while some have set up companies. This is a pattern similar to that found around the world (Lockett 2003). However, a successful process of taking discoveries into the market has not yet emerged smoothly in most Australian

Universities. The limitation is considered to be mostly due to the universities lack of an effective commercial process (Siegel 2004).

An important element in the successful commercialisation of university generated IP is the academic researcher and their ability to engage in an entrepreneurial process (Pilegaard 2010). The role played by university academics within modern, highly commercial universities has emerged as a significant point of debate over recent decades (Slaughter 1997; 2004). A unified understanding of this area for the individuals and the institutions is imperative for the development of the country and a profound shift from a "managerial" to an "entrepreneurial" economy is needed (Drucker 1986). Having a sound innovation strategy is critical for the universities. Innovation strategy is generally understood to describe an organisation's innovation posture with regard to its competitive environment in terms of its new product and market development plans. The understanding and motivation of academics and the nurturing environment created by their institutions are discussed. Particular interest is the way in which university designs the support for commercial activities. Collaboration with university researchers provides many benefits to mainstream manufacturers. University research can include basic and applied research, prototype development and testing, market research, and clinical trials. The collaboration provides the manufacturer with access to research infrastructure; technical, business and clinical expertise; skilled labour, financial resources through grants, and human subject populations. Unfortunately, a number of factors interfere with such collaborations. If the goal of research is product commercialization, and product commercialization only takes place through manufacturers, then manufactures are the customers of researchers. The relationship through university commercial unit becomes critical.

An effective understanding of business innovation and commercial activities in Australian universities and its management, will result in policy frameworks that assist academic researchers to achieve greater commercial success and it will enable public policy to take a broader, more holistic view of the range of policy structures that influence business innovation, rather than the current narrow focus on science and technology policy. A major component of Australia's national innovation system is its investment in university-based scientific research. A shift away from a narrow scientific approach to innovation and commercialization to a greater recognition of the importance of management and marketing within the research and development area will improve business innovation (Boter 1996). Innovation is the key to ensuring the long-term economic prosperity of the Australian economy.

Knowledge transfer is an element of the so-called informal technology transfer and it includes student placement, consultancy, research and training for industry, technology licensing, and spin-off company formation. Universities are tasked with knowledge creation and the dissemination of this knowledge. Research faculty members are the key agents of knowledge transfer. Social networks through academic and industry scientists, university

administrators, Technological Transfer Offices (Brunetto 2007) directors, and managers/entrepreneurs allow knowledge transfer to work in both directions. It is vital that university and other stakeholders are very clear on the university's objectives on knowledge transfer, the motivations behind it as well as its benefits.

Innovation management measurement is described in many studies (Tsai 2009), however Adams and et al (Adams 2006) have conceptualized this as a process, which is in need of a holistic framework covering the range of activities required to turn ideas into useful and marketable products. They have attempted to address this at the level of the firm. Considering a wide body of literature they have developed a synthesized framework of the innovation management process consisting of seven categories: inputs management, knowledge management, innovation strategy, organizational culture and structure, portfolio management, project management and commercialization (Adams 2006). "The area of commercialization appears to be the least developed of the issues involved in innovation management. This is a huge gap because, without this last step, the previous steps of assembling inputs and project management will not result in a commercially viable outcome for the firm. We believe that his area of innovation is in urgent need of further development, from both theory and measurement viewpoints (Adams 2006).

Reflecting on this development, governments throughout the Organization for Economic Cooperation and Development (OECD) countries are investing heavily in strengthening the research capacity of their universities (OECD 2006). They are not doing this for its own sake, but in the expectation that this investment will show a return to the economy and the society through improved innovation performance and hence, stronger economic growth. While the universities are increasingly important as sources of ideas, those ideas will only show an economic return if they can be effectively applied by business. This means that an important element of an effectively operating national innovation system will be the quality of the linkages between the universities, business and finance providers.

Universities contribute to economic, social and environmental objectives in a variety of ways. The main benefit channel is associated with the education of people. However, universities also generate benefits associated with the creation of ideas. Some of these ideas will flow freely into the community through publications and other processes, while others transfer to businesses that purchase ideas from universities through contract research or will be used directly by the universities through their control of intellectual property (IP). The understanding of effective business models and adoption of strategies that enhance university commercialization, and which create a shared vision, are vital in the current economic environment.

The science–technology–innovation system is one that continuously and rapidly evolves. Economic development has grown out of the opening up and following the expansion of world trade and by the dramatic reduction in barriers to capital movements (Freeman 2009).

However, the growth externalities of knowledge have had a lot to do with the rapid post-war growth of the OECD countries. The broadening of the science–technology–innovation concept to include “innovation”, with its much stronger local links towards growth and development dynamics is particularly relevant, offering significant new policy insights. A review of technology, institutions, and innovation systems suggests physical and social technologies co-evolve, and that this co-evolutionary process is the driving force behind economic growth (Nelson 2002).

Internal champions facilitate negotiations between the researcher and business. Willingness on the researcher’s part to broaden the notion of university research will uncover many novel opportunities for collaboration. Once collaboration is established, the university research team should learn its role project and adopt a business culture. The university research team should avoid competing with or antagonizing any member of the business team at all costs. Conducting research; seeking patent protection, identifying potential licensees, and securing a license agreement that leads to a commercial product is the most common but much less effective path to market (Bauer 2006). To achieve a successful collaboration, university researchers must bridge the gap between academic and corporate culture; and work closely with their university technology transfer office. The findings of the existing literature and the practical implications of the process of innovation and entrepreneurship in the context of the Australian universities are studied in depth here. Innovation and entrepreneurship is part of any live and active university, and therefore, a growing nation. A comprehensive model for this *Commercial Path* is discussed.

Method

A series of in-depth case studies were undertaken of seven academics within different Australian universities. All were engaged in the commercialisation of an emerging technology within the nanotechnology sector. The principles of case study design and method were followed (Yin 2003). Data collection involved both macro and micro level analysis of interviews and direct observation with research directors, academics and managers of commercialisation offices from these universities. A conceptual framework relating to the commercialisation pathway defined by Techno-Economic Network Theory (Lare’do and Mustar 1996) was used to guide the analysis.

S →(ST) → T →(TM) → M,

where:

S = Scientific activity (e.g. research fundamental & applied)

T = Technological outcome (e.g. patents, prototypes, software, models)

M = Market diffusion of products.

(ST)&(TM) = Transfer points

The TEN framework has been described as:

“A coordinated set of heterogeneous actors – laboratories, technical research centres, financial organizations, users and public authorities – which participate collectively in the development and diffusion of innovations, and which organize, via numerous interactions, the relationships between research and the market place” (Lare’do 1996).

The three primary poles (S + T + M) comprise the core of the TEN frameworks. The weakest links are typically the two transfer points (ST) and (TM). The first relates to the mechanisms, structures and systems that can identify commercially valuable intellectual property within scientific research (S) and move it towards the (T) pole to create commercialization opportunities. The second transfer point relates to the commercialization pathways through which the technology moves towards the market (M). This can involve the interplay between a range of actors (e.g. universities, private companies and venture capital investors).



Figure 1 The TEN Model

Each case selected for this research will be described based on the innovation management in context of environment, organization and performance (Tidd 2001). Examining the process of innovation and commercialization of the university, the first table addresses the university research environment, the second describes the organization and structure of the university in dealing with development of technology and the last table shows the performance of the individuals interviewed who have been effective in this process.

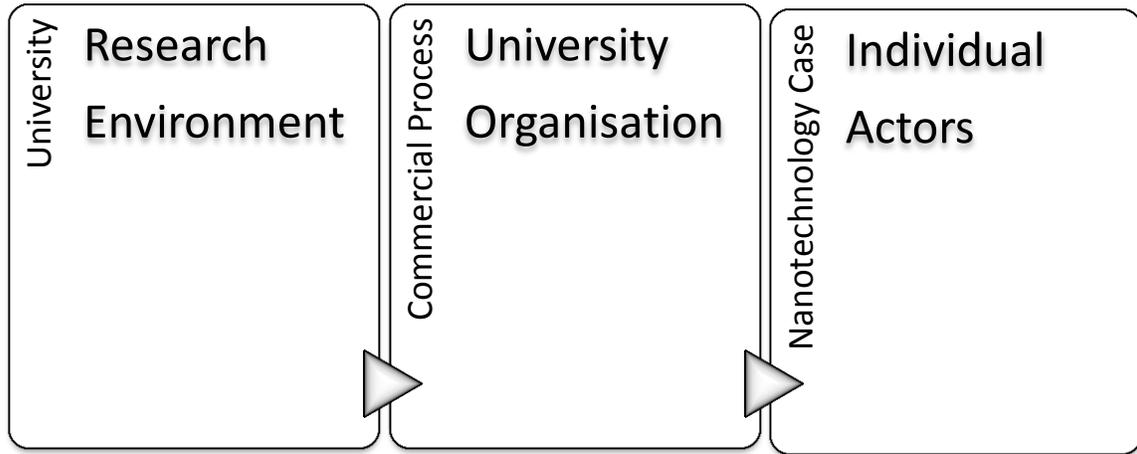


Figure 2 University Innovation Management

For example in management theory for small business, the environment of a coherent organization is global, technical, social and humanistic. The structure and information are open and decentralised. The leadership of such organizations is shared, participatory and based on team building. The perception is for growth. Personal behaviour is cooperative, creative, challenge filled with new experiences. The approach to the first case study was made with the above in mind and the following sections are dedicated to the descriptions of the cases examined. The selected cases for study are introduced in the following boxes.

Also employed was the conceptual framework of innovation measurement within organisations proposed by (Adams 2006). Although these frameworks focus on the measurement of innovation management at the level of the firm, they can also be exploited for the university innovation and commercialization process.

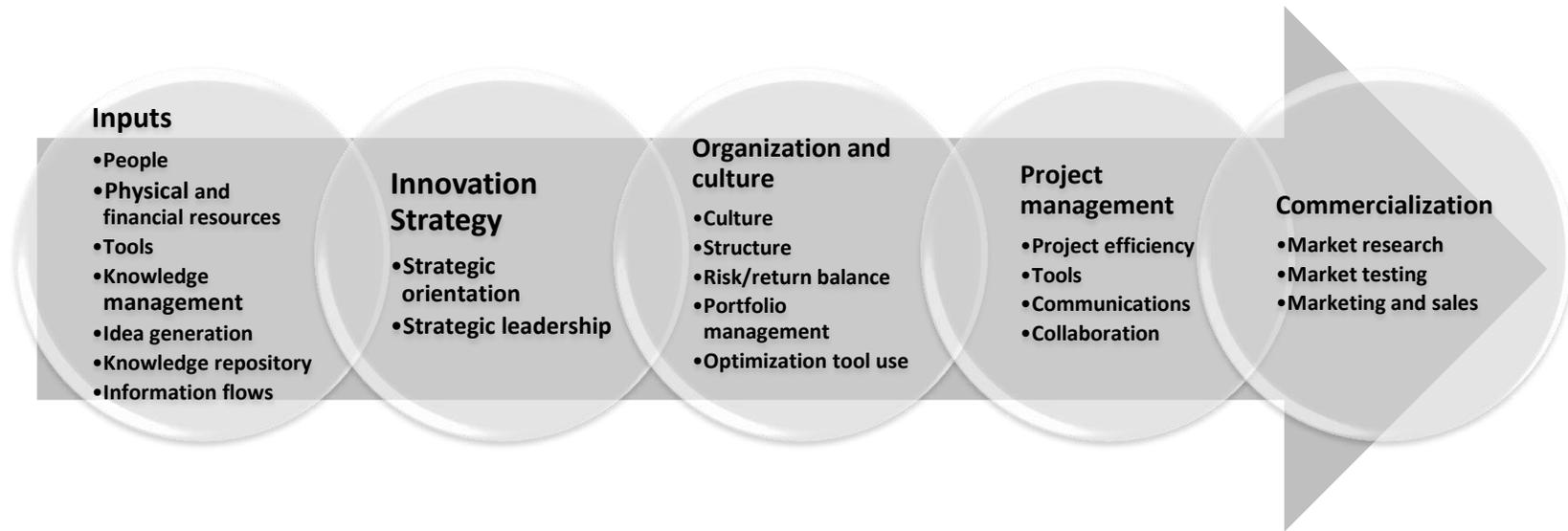


Figure 3 Innovation Measurement Areas

Results and Implications

The emerging models for the commercialisation process at the university through cross case analysis in this research are three distinct structures for commercial process for application of the university research outcomes. The first model is a simple one, which includes a commercial lawyer, and several managers who work at the central administration of the university monitoring and supporting the commercial process through a commercial unit at the university. In this model, the commercial unit is located at the central administration of the university and is directed by an appointed director/manager who works for the university and for the central administration. This model is simple and straightforward and many universities have now adopted this model for their technology transfer.

The second model is a little more complicated in which the university sets up a company to direct the commercialization process for the university. In this model, the commercial managers have more autonomy and resources. Therefore, the support and expertise increases with this model because more ownership is given to the project management and the company has more funding to support commercialization. There are more success stories reported with this model.

The third model discovered during the data collection and analysis, is a professional private company that is set up by the university as an independent company conducting the work in close collaboration with the university. This model has proved very promising because of the independent and professional commercial company that is conducting the commercial process for the university. This company has managers that work for the company but are located in the research centres or faculties. This physical daily contact proves very beneficial to the researchers as well as the commercial company. The accumulated human and financial resources in this set up are also very significant and prove essential for the support of commercial process.

The most important finding in this research is that any structure created for technological transfer at the university is a support for and not an impediment to the process of commercialization. The university research community plays an important role in industry research and development activities leading to new products. Further, business is the gateway through which all new products enter the marketplace.

Effective university researchers are those who engage business partners prior to the inception of their own research activities, and early in the corporate product development cycle. It is therefore vital that university and other stakeholders are clear as to the university's objectives in relation to knowledge transfer, motivations and benefits. A clear model (structure and approach) for commercialization at the university is essential.

Senior management are responsible for developing and communicating a vision for innovation and commercialization. They need to be supportive and to adopt an attitude that is tolerant to change and can champion the notion of innovation within the university. For example 'to what extent should the university make it possible for the people working

on an innovation to bend the rules of the institution to develop the innovation, or be allowed to bypass certain personnel procedures to get people committed to an innovation?

Entrepreneurship is more likely to occur if the institution is less hierarchical, since bureaucracy reduces creative activity. Communication enhances invention because much of people's inventive activity requires input from others. In hierarchical organisations, there is less communication between superiors and subordinates than in non-hierarchical ones.

Innovation and entrepreneurship requires decentralized authority because such a structure brings more information to the attention of the senior managers and gives employees greater incentive; and hierarchical institutions tend to have more centralized authority. Hierarchical organisations tend to have control systems based less on trust, and more on rules and procedures, and these controls inhibit creativity and inventiveness. Inventiveness is hard work and requires a strong work ethic, and hierarchical organisations are more fatalistic and less inclined to undertake the hard work necessary for innovation. The institutions that value freedom of the individual to create are more effective in their productivity. Entrepreneurship requires an outward-looking view (ref). Creativity and innovation are identified by Moorcroft (Moorcroft 2007) as a legitimate macro competence. Florida's study in 2005 touches important points that should get more attention in science and policy. He states that the best innovation strategy is a liberal immigration and cultural policy. The physical proximity of talented, highly educated people has a powerful effect on innovation and economic growth, in fact, the Nobel Prize winning economist Robert Lucas declared the multiplier effects that stem from talent clustering to be the primary determinant of growth- success breaths success. What matters today isn't where most people settle, but where the greatest number of the most skilled people do (Florida 2006). The role of personal networking in the international decision-making process is critical (Hutchinson 2007).

Through this research a new dynamic cyclic model based on Techno-Economic Network for commercialization at the university has emerged. At the level of research, the input for ideas and funding for research are essential. From research to the technology, cost of the IP and networking with the right people to get the technology registered and tried, are most important issues that academics face. Once the IP is sorted out and the technology is registered, the university must face market and it is here that the need for finding venture capital and establishing market prices becomes the issue. It is again only through networking opportunities and shared costs that working with an independent commercial company is viable.

Figure 4 shows the dynamic new model for commercialization at university. It consist of the research circle which deals with developing new ideas, technological circle that is involved in developing intellectual properties, proof of concepts and policies for protection of the intellectual properties and technology transfer and the market circle which deals with developing the new products and processes. The circles connect at all levels through networking. For example in setting the licence fees strong network effects

make a lump-sum fee more profitable than a royalty fee (or a combination of both) because a royalty fee reduces the licensee's production (Sun 2009).

The boundaries of these interactions are set by the innovation strategies, good management, organizational culture and behaviour, and, no doubt connected directly with the National Innovation System. Wood (Wood 1992) describes the issues and problems of commercializing university research in Australia and suggests some actions. The facilitation of commercial activities within the university is of course not just a concern for university administrators, it is essential that debate about such facilitation and the issues raised be as broad as possible and informed from a number of perspectives including students, academics, government, and industry. At the level of the individual academic and department, it is important that awareness is fostered concerning both the immediate and long-term implications of commercial liaisons for traditional academic activities. In particular, ethical and legal obligations, especially regarding students should be explored and at the departmental level, guidelines are both established and reviewed as the commercial association develops. There may of course be some resistance to making commercial relations more open and accountable. This may come from those who have enjoyed for many years the relative anonymity and freedom of consultancy work. However, these conditions have more an historical rather than legitimate academic basis and it is reasonable to expect that individual academics engaged in commercial activities meet certain minimal requirements to ensure that consultancy work does not entail potential conflicts-of-interest. Indeed, such staff may be instrumental in demonstrating that commercial links offer, for example, an alternative but not necessarily controversial or unacceptable way for students to acquire their professional credentials. Fundamental questions regarding the nature, purpose, ownership and responsiveness of universities are posed by university/industry links. In this context peak bodies such as the Australian Vice-Chancellors' Committee, the Federation of Australian University Staff Associations, the Australian Science and Technology Council, government research funding agencies, the Council for Business Higher Education Round Table, the academies and professional bodies could collectively play a much more prominent role in encouraging public forum on these issues. Industry has historically been able to exploit the basic research output of universities. In this context, it is unlikely that it would continue in joint ventures with universities that would undermine basic research activities from which it receives some benefit.

The research outcome shows a twofold process for commercialization at the universities in Australia. First, is the focus on the strategies adopted at the macro level by government and other relevant institutions and the second is how the collaborators namely academics, commercial managers and practitioners may work together at the micro level in an environment, which is conducive to economic growth.

At the macro level, the role of Australia in the world economy, its National Innovation System and the role of universities in Australia's National Innovation System need further research. If Australia would like to play, a major role in a world economy the approach of the government in setting policies for this will be most critical. Government can help by

creating opportunities for the industry, university and community organisations and groups to come together in an open environment for knowledge exchange. As discussed, universities can contribute to innovation by knowledge management. Setting right policies for universities especially for the commercialization process, its structure at the university, the university engagement with industry and the community are important for growing economy. Australia is rich in resources and the educational system has always played a major role here. At the core of this educational system is the university. The future of a country depends on its young people and their promising minds. The focus on the educational system in the National Innovation System creating an open environment supporting universities and creating a culture of innovation will put Australia in a promising position in the world economy.

At the micro level, also universities can contribute to the innovation process with a sound commercial system. Individual players especially academics need to work in an open environment where teaching and research would be their major focus. However, networking opportunities, which is healthy and is based on mutual trust may be created for the academics supported by the university through its commercial process. For those who choose to have meaningful relationships with industry and community, sufficient support should be given by the university to collaborate with the commercial managers and hence the market. Strategies need to support the diversity between the various players at the same time provide financial support, focus and direction.

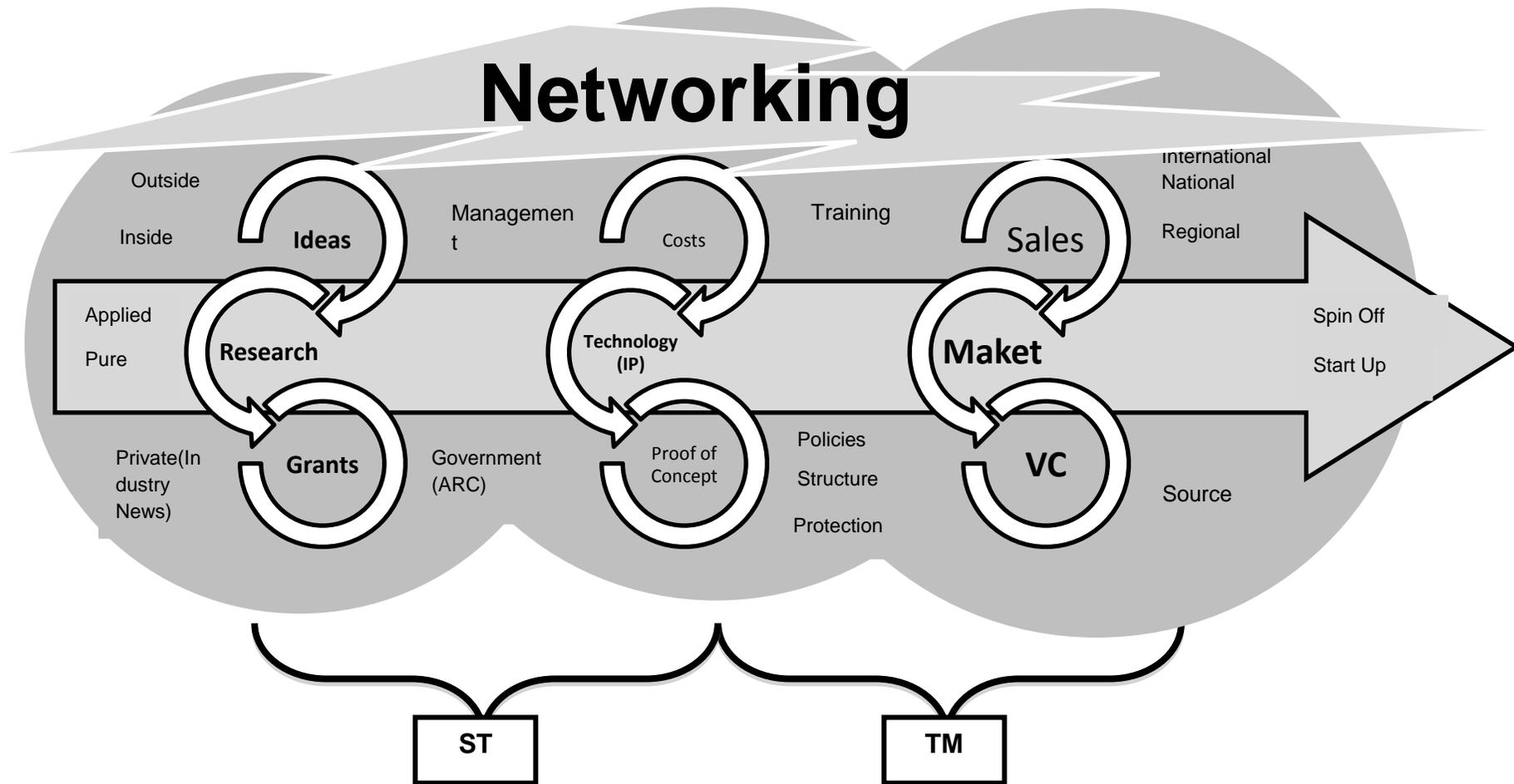


Figure 4 Dynamic new model for commercialization at University.

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