

## Appendix - Action-Framework applied to selected cases

<b>LULEA UNIVERSITY OF TECHNOLOGY, SWEDEN</b> (Ylinenpää, 2013)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>• Creation of VINNOVA, a national agency to develop innovation systems based on Triple-Helix concept</li> <li>• Opportunities presented from Initiatives from EU's framework programmes to promote local innovation through international consortiums</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>• Founded in 1971 it established close collaborations with external partners from inception, with the believe it enriches education, and serves as a development strategy</li> <li>• Located in peripheral north of Sweden, a region economically dependent on extracting and processing raw material industries, the universities Research and Development Centres focuses are aligned with this profile</li> <li>• Integration of "Third Mission" in the university's mission statement</li> </ul>				
IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Action-learning using community problems for students' projects and case studies</li> <li>• Competitions like Venture Cup and House of Ideas</li> <li>• Build upon Research Centres established collaborations with industry: (1) Industrial Doctoral Students and (2) Adjunct professorships, who are practitioners that dedicate 20% of their work-time to the university for teaching or research</li> <li>• Development of multidisciplinary research and education projects</li> <li>• Teaching educators in entrepreneurship</li> <li>• Need to manage paradox forces, as "the need for both scientific excellence and practical relevance in research and education" and "supplying both a regional/national and an international knowledge market"</li> </ul>	<ul style="list-style-type: none"> <li>• Development of initiatives and infrastructure via triple-helix enabled joint-venture initiatives: Science Park, Business Incubator, Local Venture Capital Company, Innovation Unit (to commercialise research) and Centek (a technology and business transfer foundation)</li> </ul>	<ul style="list-style-type: none"> <li>• Smart specialization in 6 areas to strive for excellence in research and entrepreneurial output, including construction, mining and materials engineering and information technologies</li> </ul>	<ul style="list-style-type: none"> <li>• The university requires dynamic capabilities to be innovative, pro-active and take risks to build competitive advantage, by recognising and exploiting opportunities</li> </ul>

**CHALMERS INSTITUTE OF TECHNOLOGY, SWEDEN**

(Jacob, Lundqvist and Hellsmark, 2003; Berggren, 2011)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Election of conservative government in the early 1990's was a catalyst for a national transition from a science to an innovation system, having HEIs a key role. Subsequent governments continued the process
- Governmental reorganisation establishing 5 research councils, being only one dedicated to basic research on all areas and the remaining 4 with strategic focus
- Educational reform in 1997 established the need for universities to incorporate a "Third Mission" towards support economic development. This has been mainly interpreted as a need for academic research commercialisation
- Creation of the Swedish agency for innovation systems (VINNOVA) concentrating resources and mechanisms to facilitate, among others, university knowledge transfer
- IP developed from university research belongs exclusively to the inventor and the commercialization responsibility belongs to him rather than the university

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Founded in 1829 with a donation from William Chalmers, an industrialist. It remained a private until 1936 when it became a public university. In 1994 it changed status again, from public to a foundation to have more autonomy
- University founder and first president, Carl Palmstedt, fostered a culture build upon the ambition to integrate science knowledge and practical work. His practical experience as business man and frequent international travels for benchmarking allowed him foresight to create a technical university with the "Third Mission" from inception
- Throughout the decades other presidents further developed entrepreneurialism, as e.g. Sven Olving, who graduated from Chalmers in 1952, being later Vice President (1966–1974) and President (1974–1989), who consolidated research commercialization and ignited new initiatives and infrastructure, as the Chalmers Industrial Technology in 1984, which offers consultancy to industries
- Historical collaboration with industry in diverse formats through relationships networks of professors and alumni
- Strong alumni network actively managed by the university through the Alumni Association founded in 1907 with over 35.000 members and the motto "Once a Chalmerist always a Chalmerist"

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• Founded with the endowment of William Chalmer, an industrialist, the university had from inception a culture of entrepreneurialism that was developed with foresight by its first president</li> <li>• Sven Olving, Chalmers' Vice President (1966–1974) and President (1974–1989) ignited key initiatives that were later consolidated</li> <li>• The transformation from public university to a private foundation in 1994 gave the university the necessary autonomy to accelerate the development of entrepreneurial initiatives</li> <li>• Government push to transform a "science system" into an "innovation system" in the late 1990's offered manifold opportunities to Chalmers to ignite new initiatives and consolidate existing programs and infrastructure</li> <li>• Administrators benchmarked MIT and Stanford, although contextual factors required them to adapt</li> </ul>	<ul style="list-style-type: none"> <li>• In the 1970's a series of initiatives to facilitate the emergence of technology-based start-ups were introduced and led by the newly created Chalmers Innovation Centre, which centralized the entrepreneurial activities until the 1990's</li> <li>• Chalmers Innovation Centre started offering incubation services in the 1970's</li> <li>• In 1983, Torkel Wallmark become the first professor in Sweden in innovation technology. Having worked in the USA, his "ice-breaking work" included the opening of a department for business creation that strongly contributed to developing innovation activities and build an entrepreneurial culture</li> <li>• Launch in 1984 the Chalmers Industrial Technology (CIT) to offer academic consultancy services to industry, it is a self-financing operation</li> <li>• Created in 1994 the Chalmers-owned venture capital fund Innovationskapital</li> <li>• Launched in 1997 the Chalmers School of Entrepreneurship, the first in Sweden</li> <li>• Action-based and multidisciplinary learning</li> </ul>	<ul style="list-style-type: none"> <li>• Although Chalmers is seen as an entrepreneurial university, internally there is still the perception that academic staff lack awareness of the system available in order to engage with entrepreneurial activities</li> <li>• The fragmented entrepreneurial system means few strong individuals are responsible for separate units, resulting in a lack of synergy among the different these. It negatively impacted on academic staff awareness of entrepreneurial activities and opportunities available, due to a lack of transparency</li> <li>• Creation of a new vice principal position to coordinate university–industry relations</li> <li>• Administration efforts to develop a more "comprehensive and coherent institutional framework" for all entrepreneurial activities</li> </ul>	<ul style="list-style-type: none"> <li>• Positioned as an entrepreneurial university with strong outputs (industry relation and spin-offs), Chalmers has an integrated entrepreneurial culture</li> </ul>	<ul style="list-style-type: none"> <li>• "The Chalmers infrastructure for innovation and entrepreneurship has been an ad hoc experiment with little or no directions and guidelines from the main administration. This has meant that the different components of the structure are 'owned' by a few strong individuals and each component has its own legal structure and board of directors"</li> </ul>

<b>WARWICK UNIVERSITY, UK</b> (Taylor, 2012)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>(X)</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>The university is highly independent with only a ¼ of its budget being public funded</li> <li>The “Warwick Way” philosophy illustrates how entrepreneurialism is embedded at the university’s culture</li> <li>University has attracted and maintained Leaders with similar mindset, enabling the continuous development of entrepreneurialism</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>Although entrepreneurialism is institutionalized at the university, there is still a continuous need for sensitization: “It could be more effective in communicating what it’s doing... making it more successful in these reaching-out activities. If people in the wider world were aware of what it was doing, or people in the university were more aware of bits we’re doing, because then they can sort of, maybe tack on opportunities that they’re aware of.”</li> </ul>	<ul style="list-style-type: none"> <li>The University actively and successfully pursues a policy of obtaining funding from diverse sources. Only ¼ of budget depends on core public funding. Although some scientists believe it could more pro-actively engage in research contracts with industries</li> <li>The University focus on research having achieved a perceived good balance between teaching and research</li> <li>Ability to attract and maintain academics and administrators with similar mindset towards entrepreneurialism</li> </ul>	<ul style="list-style-type: none"> <li>The “Warwick Way” philosophy illustrates institutionalization of entrepreneurialism at the university, which was an original selected case for Burton Clarks study</li> <li>“The key to Warwick’s success as an academic institution over the past 50 years has lain in its ability over the years to remain true to the Clarkian paradigm, to avoid the commercialism in higher education... and to retain academic standards as the primary rather than secondary objective.”</li> <li>The University is flexible, dynamic and decisive in its decision-making, having a “flat-structure” for university leadership, while remaining collegial and representational. Nevertheless conflicts between collegiality and management still exist</li> </ul>	<ul style="list-style-type: none"> <li>“It’s a low-inertia university. I think the best thing about Warwick: you can change things”</li> <li>“Warwick should not forget how it achieved its success in its dynamic youth, lose its flexibility and become a ‘middle aged rock star’.”</li> <li>“...whether Warwick is to continue to enjoy success stemming from its entrepreneurial culture, it will be important to keep open these pathways of transformation going forward and to ensure the engagement of the academic community and their support for a culture of entrepreneurialism combined with the pursuit of high academic standards”</li> </ul>

<b>UNIVERSITY OF SURREY, UK</b> (Kirby, 2006; Yokoyama, 2006; McGowan, Sijde and Kirby, 2008)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Crises on public funding urging HEIs to reduce their dependency</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Located 30 miles south of London, the university has a long tradition for promoting innovation and new ventures</li> <li>Historical close relationship to industry since the 1960's as the university was upgraded from a College of Advanced Technology</li> <li>Early consolidation of entrepreneurial initiatives: Science Park created in 1986</li> <li>Governance reforms in 1997 and 2002 to accelerate decision-making processes and improve competitiveness , transparency and accountability of staff</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Review process in 1996, resulting in governance reforms in 1997 (and again in 2002) and establishment of new vision in 1998</li> <li>Funding crises in HEIs led the university to reduce public funding dependency</li> </ul>	<ul style="list-style-type: none"> <li>Build upon historical close relationship to industries</li> <li>Build upon existing initiatives and infrastructure (e.g. Science Park launched in 1986)</li> <li>Establishment of a complete incubation process</li> <li>Focus on research with strong output</li> <li>Focus on employability and practically oriented courses</li> <li>Development of modules and full degrees in Entrepreneurship</li> <li>Online module on Business Start-up to raise students awareness</li> <li>Short courses (boot camps) for researches to analyse the commercialization potential of their research outputs and develop transfer strategies</li> </ul>	<ul style="list-style-type: none"> <li>Integration between academic and entrepreneurial activities</li> <li>Triple Helix partnerships, alliances, consortiums and networks for new initiatives</li> <li>Launched in 1986, at a £70 million cost, The Surrey Research Park, which houses the Surrey Technology Centre, its incubator and technology transfer</li> <li>Strategy to scout technology transfer opportunities and policy of shared revenue model of IP with 35-70% to the inventor</li> <li>Development of a Centre for Entrepreneurship Development to co-ordinate and integrate academic and practitioner entrepreneurship approaches across the university</li> </ul>	<ul style="list-style-type: none"> <li>"The University's entrepreneurial activities in non-academic areas – which are operated by the Corporate Service whose director is a member of the ‘Executive Board’, an ultimate governing body in the University – include operation of the University's subsidies"</li> <li>University policy to integrate academic and entrepreneurial activities, in practice, still cause conflicts between collegiality and management</li> </ul>	<ul style="list-style-type: none"> <li>Continuous funding bids and formation of consortium partnerships on UK and European levels to further develop entrepreneurial activities, as e.g. creation of the Southern England Technology Triangle (SETsquared)</li> <li>Considered an Adaptive Entrepreneurial University for its ‘Institutional self-determination’, diversified funding strategy and ‘Market-oriented governance and management structure’</li> </ul>

**NEWCASTLE UNIVERSITY, UK**

(Benneworth, 2007)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- North-East England is a region industrialized in the late 18<sup>th</sup> century based on traditional and currently declining industries, due to lack of investment in innovation during the 20<sup>th</sup> century: coal, iron, steel and shipping.
- Few available regional financial resources for university transfer

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Founded in the 1870's it is considered a "place of useful knowledge" for local industry, having established and sustained a relationship with external partners since foundation
- Interdisciplinary approach for excellence: e.g. combined an existing medical and dentistry school with an engineering college

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• Historical industry relationship since foundation in the 1870's</li> <li>• In the 1980's started a phase of regional engagement based on knowledge transfer and commercialization</li> </ul>	<ul style="list-style-type: none"> <li>• Launched commercialization activities: e.g. City Technology Centre and University Consultancy</li> <li>• In the late 1980s, the Technology Centre failed and merged into a regional technology centre, linked to all five regional universities</li> <li>• Focus shifted to promote spin-off companies with the creation of Quantum, an investment fund and NUVentures to encourage academic entrepreneurship. In the mid 1990's the fund was empty and focus shifted back to IP sale with a technology transfer office</li> <li>• In 1995 a Regional Development Office was created to focus on the "third mission", benefiting from European funds. In 1998 a small steering group of business development professionals was hired with grant funds to manage risk and cultural change</li> <li>• Initial attempts failed to consolidate due to lack of response from regional actors, slow growth of early spin-offs and lack of leadership from Vice Chancellor. Nevertheless, a community beyond university boundaries formed based on formal and personal relationship networks. The newly formed steering group started to leverage it to seek new opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• In 2001 a former entrepreneurs was appointed Vice-Chancellor</li> <li>• In 2003 a Business Development Directorate (BDD) integrated all entrepreneurial activities and staff in a university system.</li> <li>• Launch new triple-helix enabled projects "to harness the already demonstrated entrepreneurial capacities of university staff". These projects "became significant to the university, and university culture (and financial systems)"</li> <li>• Recruitment of professors considering their research's commercial potential to form new or integrate existing (industrial) research centres</li> </ul>	<ul style="list-style-type: none"> <li>• University became (pro-) active to inform policy towards regional strategy development</li> <li>• "...open-facing university governance structures" include key external actors</li> <li>• Recognizes importance of global linkages to deliver local outcomes</li> <li>• Institutionalization of a "social community" of internal and external actors around the university's entrepreneurial activities</li> </ul>	<ul style="list-style-type: none"> <li>• Use of specific national and European tenders to develop significant projects</li> <li>• Project failures provided learnings that ignited new initiatives: "...each particular attempt proved unsuccessful, and that failure in turn stimulated a further attempt to engage regionally"</li> </ul>

<b>NOTTINGHAM TRENT UNIVERSITY, UK</b> (Yokoyama, 2006)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>1988 Education Reform Act, increased HEIs autonomy</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Young university, upgraded from a Polytechnic in 1992, established the a “third mission” from inception, separating the management and academic affairs in two separate governing bodies</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Upgrade from Polytechnic to University in 1992, included a commitment to regional economic development</li> <li>Establishment of a “Self-identity as an entrepreneurial university”</li> <li>Intend to increase autonomy by reducing dependency of public funding, pushed by Government policy reform in 1988 and 1992.</li> </ul>	<ul style="list-style-type: none"> <li>Outreach activities and collaboration with regional economy</li> <li>Partnership with East Midlands Development Agency and Nottingham City Council.</li> <li>In 2001 received £ 8 million in three joint bids from the government’s new “science jackpot” fund</li> <li>Entrepreneurial activities based on teaching rather than research;</li> <li>Entrepreneurial activities at the institutional level and school/faculty level</li> <li>Interdisciplinary teaching</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>“Attention to the changing market niche”</li> <li>“Strong awareness of rapid changes in consumers’ demand”</li> </ul>

<b>UNIVERSITY OF ULSTER, UK</b> (Mcgowan, Sijde and Kirby, 2008)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>“In the late 1990’s the UK government adopted a specific strategy to generate a greater entrepreneurial culture in SET faculties in universities. The Science Enterprise Challenge (SEC) network emerged from this effort”</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>(X)</li> </ul>				
IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>In the late 1990’s government, initiatives towards developing entrepreneurial culture in HEIs funded the ignition of a series of initiatives</li> </ul>	<ul style="list-style-type: none"> <li>One of these was the creation in 2000 of the Northern Island Centre for Entrepreneurship (NICENT), a partnership between the University of Ulster and Queens University Belfast</li> <li>Initial discussions with faculties allowed NICENT to identify needs, concerns and how best to push the agenda at each university faculty</li> <li>To address concerns towards entrepreneurialism “NICENT emphasized a broad interpretation of entrepreneurship that included not only new business creation but also other dimensions, such as social entrepreneurship, academic entrepreneurship and intrapreneurship”</li> <li>Launch online course in “Entrepreneurship Awareness”</li> <li>Strategy to integrate entrepreneurship learning outcomes and assessment in existing courses</li> <li>Staff development training on how to teach entrepreneurship internal and at foreign HEIs</li> <li>Entrepreneurship Competition for students to develop their classroom business ideas</li> </ul>	<ul style="list-style-type: none"> <li>New policy on staff promotion aligned with entrepreneurship agenda</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>5-year development cycle including external examination, reviews and revalidation processes for entrepreneurship education development</li> </ul>

<b>UNIVERSITY OF DERBY, UK</b> (Rae, Gee and Moon, 2009)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>“Government policy and independent reports, such as Dearing (1997), the White Paper on higher education (Department for Education and Skills, 2003) and the Lambert Review (2003), exhorted universities to become entrepreneurial, stimulated by significant funding through such initiatives as Higher Education Reach-Out to Business and Community (HEROBAC), the Science Enterprise Challenge (SEC) and Higher Education Innovation Funding (HEIF). These measures were intended to stimulate academic entrepreneurship and the earning of ‘third-stream’ funding through cultural and systemic change in the sector”</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>In 1992 the College of Higher Education received University status</li> <li>Between 2001-2006 the university was re-structured in 4 large faculties and key staff changed, as the Deputy Vice Chancellor</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>The acquisition of University status in 1992 ignited a transformation period characterized by rapid expansion of infrastructure and offers in alignment with market needs</li> <li>Top-management commitment after replacement of Vice Chancellor in early 2000’s accelerated the ignition and consolidation of an entrepreneurial culture</li> <li>Between 2001-2006 financial difficulties led to a re-structuring from 9 small schools to 4 large faculties to achieve economies of scale. Key staff left, including the vice-chancellor. Institutional credibility was questioned.</li> <li>In 2001, Deputy Vice Chancellor benefited from learnings and public funding from consortium partnerships with other HEIs in the region to ignite entrepreneurial activities (East Midlands Universities Association (EMUA), the Science Enterprise Network (EMSEN) and the Incubation Network (EMIN).).</li> </ul>	<ul style="list-style-type: none"> <li>In 1999 series of successful national funding rounds fostered close collaboration with industries. In 2000, opened the Regional Enterprise Development (RED) office to develop and manage these contracts and relationship</li> <li>Despite this initiatives the transformation is perceived as slow and problematic, due to organisational complexity</li> <li>In 2001 a small “entrepreneurial learning team” started to develop entrepreneurship courses at all levels and degrees, staff training in innovative teaching methods and start-up support activities. ‘Energizing Enterprise Education’ (3Es) event, in 2006, consolidated the entrepreneurial culture, by achieving cultural change through staff development</li> <li>"Engaging students outside the curriculum is hard work: business idea and plan competitions, special and evening ‘enterprise club’ events initially attracted only a small ‘hard core’ and students tended to behave quite instrumentally in focusing on assessed work and what would bring short-term benefits, so it is essential to ensure that activities are perceived as relevant and attractive by students."</li> </ul>	<ul style="list-style-type: none"> <li>Creation of the Centre for Entrepreneurial Management (CEM) as a central-point for entrepreneurship related activities</li> <li>Connecting entrepreneurial learning with incubation support services and network opportunities</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>“The formative and reflective learning experiences of the team as practitioners were a process of entrepreneurial action learning through sense-making, featuring ‘critical incidents’ and ‘practical theories’ developed from praxis”</li> <li>“During 2001–06, the growth of enterprise at Derby went through broad phases of initiation, organization, development, expansion, refocusing and wider engagement.”</li> </ul>



<b>UNIVERSITY OF TWENTE, NETHERLANDS</b> (Lazzeretti and Tavoletti, 2005; McGowan, Sijde and Kirby, 2008)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>1997 Education Act changed HEIs governance model from a state-controlled to a state-supervision system with the establishment of an advisory university council and a supervision body</li> <li>The region of Overijssel, with an economy formerly based on textile and machinery industries, which moved to cheaper labour countries became an European Union, priority 2 region, receiving European funds to develop a knowledge-based economy</li> <li>The region had its economic, social, politic and technologic development positively impacted by the introduction of the university in the last decades</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>One of the younger HEIs in the country and the only to be located in a single campus, officially created in 1961, the first 250 students were enrolled in 1964</li> <li>Development of a strong entrepreneurial vision with the inclusion of the “Third Mission”, benchmarking American Universities development strategies rather than following European standards</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Idea of being an Entrepreneurial University emerged in the 1980’s due to the competitive scenario of HEIs in the country and the economic situation of the region and rumours the government would close down the university</li> <li>Vision to lead the development of the Information Communication Technologies industry in the country</li> <li>Appointment of new Rector, who proposed and pushed the transformation process</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of close links to regional industry, allowing students to be trained via real-problem solving methods, by creating schemes that build up on personal relationships</li> <li>Creation of Transferpunt in 1979, similar to the American technology transfer offices, responsible for making deals to acquire private funding to minimize dependence on public funding and support creation of spin-offs</li> <li>Creation of the TOP Program in 1984 to motivate and support students to develop their knowledge-based start-up company, in a pre-incubation format.</li> <li>Professor Van den Kroonenberg funded spin-offs with his own money creating the first success stories that would serve as role models</li> <li>The business school is hosted at the Dutch Institute for Knowledge Intensive Entrepreneurship (Nikos), which offers series of entrepreneurship training to undergraduates and graduates</li> <li>University Student Entrepreneurs (USE) is a student union that supports students to create start-ups via training and mentoring activities</li> <li>The “responsibility-centre budgeting” proved an effective method to stimulate entrepreneurial mindset among staff, who became responsible for their department’s budget</li> </ul>	<ul style="list-style-type: none"> <li>Creation of an incubator as a limited liability company owned mainly by the university (BTC-Twente Ltd.)</li> <li>Development of an extended periphery, by launching a Business and Science park that supports the networking activities and offers acceleration services for research results with commercialization potential</li> </ul>	<ul style="list-style-type: none"> <li>An integrated entrepreneurial culture was consolidated through credible leadership to institutionalize the “Third Mission” as an ideal</li> <li>Adoption of smart specialization strategy (strategic science) for the future, formally selecting five areas of focus: ICT; microsystems technology; biomedical technology; chemical process engineering and governance</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

**AARHUS UNIVERSITY, DENMARK**

(Pinheiro and Stensaker, 2014)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Reforms on Higher Education to strength HEIs as organizations, including funding schemes and internal governance
- In 2001 new ministerial policies aimed to increase effectiveness of research, creating in 2003 to sub-research councils, one for independent research and another for strategic research, resulting in diverse funding schemes
- University Act of 2003 fostered Triple-Helix relationships. “Knowledge exchange, technology transfer and staff mobility were explicitly added to the mission of universities, alongside the traditional tasks of education and research.”
- In 2005 the government created a Danish Globalisation Council, which merged public HEIs to strengthen them, reducing from 12 to 8 HEIs. Also, 12 research institutes were integrated to the 8 HEIs

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Since 2003 the university has an the status of an independent organisation
- Aarhus University is the result of a merger process initiated in 2006, integrating 2 public HEIs and 2 public research institutes, creating a super-university with a large public research budget
- Professionalization of university management with appointment of leaders and an advisory board mostly with external members
- In 2010, the university edited its Mission and Vision statements to include the “third mission”
- Adoption of new matrix-type organisational structure in 2012, reducing number of units and departments to accelerate decision-making as less people are involved, strengthening the university’s steering core

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• Creation of a new university in 2006 by merging 2 public HEIs and 2 public research institutes</li> <li>• Inclusion of “Third Mission” in 2010 in the university’s mission and vision statements</li> </ul>	<ul style="list-style-type: none"> <li>• “...it is vital that the mechanisms for funding inside the University should actively encourage staff to look forward to innovative and creative ways of doing things”</li> <li>• Establishment of interdisciplinary research centres to create new and ground-breaking scientific results</li> <li>• Establishment of inter-organisational collaborations with external stakeholders, aiming at new funding streams</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Efforts to adopt and concurrently adapt a new organisational structure</li> </ul>

<b>COPENHAGEN BUSINESS SCHOOL, DENMARK</b> (Kristensen, 1999)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>• New University Act of 1993 increased university autonomy</li> <li>• Government expects HEIs to take active role in building a knowledge society and positioning themselves in the international elite of HEI</li> <li>• Growing international labour market with graduates mobility and new demands towards knowledge economy</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>• Historical strong co-operative relationship with Danish industries</li> <li>• Since 1993 the university has been steering itself, having the goal to be a “Learning University” via institutional experimentation and systematic evaluation</li> <li>• Strong International orientation and stakeholder-driven concept of quality</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>• Macro environment changes regarding the knowledge society</li> <li>• Education Act of 1993 gave more autonomy to HEIs. Hence, the university president started to actively steer it</li> <li>• Institutional External Audit in 1996 and follow-up review in 1998 for organisational strategic planning</li> </ul>	<ul style="list-style-type: none"> <li>• Integration of transferable skills, as from entrepreneurship, in academic curriculum</li> <li>• Established in the late 1990’s several new research centres in technology, business and design studies with application-oriented focus</li> <li>• Partnership with the Danish Academy of Design</li> <li>• Centre of Continuous Education developed new courses for companies</li> <li>• New teaching methods, as action-learning</li> <li>• Creation of Interdisciplinary degrees</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of networks, strategic alliances</li> <li>• CBS Center for Innovation and Entrepreneurship locates at Symbion Science Park</li> <li>• Commitment to establish collaborative science parks in the region</li> <li>• Introduction of accountability measurements internal and towards external stakeholders and creation of an Evaluation Unit</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic learning by benchmarking and evaluating experiments conducted</li> <li>• Problem-solving mechanisms, enabling openness, curiosity and risk-taking</li> <li>• Constructive strategic alliances</li> </ul>

<b>WSB UNIVERSITY, POLAND</b> (Pawlowski, 2001)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Poland's National Ministry of Education unsuccessfully proposed legislation against private HEIs</li> <li>Enablement of foreign institutions to award degrees in Poland via partnerships</li> <li>Town government leaders opposed the inception of the university in 1991, rejecting cooperation initially</li> <li>Perceived excess of supply in HEI business degrees</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Founded in 1991 with endowment from a philanthropist, started to offer interdisciplinary degrees in Business, Law and IT fields,</li> <li>International focus with degrees also awarded through an American University partner</li> <li>Perceived as an organisation working towards the development of the town and the region</li> <li>Managed as a business project, it "considers itself an entrepreneurial university because of the entrepreneurial way its managed and the overall target-group of students"</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Private Business School HEI founded with an entrepreneurial mission with an endowment from a business philanthropist</li> <li>International focus, awarding American validated degrees</li> <li>Local government placed barriers to the founding of the HEI</li> <li>Financial independence. Income mainly from tuition fees</li> </ul>	<ul style="list-style-type: none"> <li>Interdisciplinary curriculums</li> <li>Development of degrees with focus on current market demands, including Business, Law and IT</li> <li>International focus with attention to local needs</li> <li>Partnerships with external stakeholders, specially private sector, offering consultancy services and extension courses</li> <li>"The process in question may be described as a transition from a teaching-oriented college to an education-and-attitude-development-oriented college"</li> <li>Staff management, including training and motivation-based remuneration</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>Development of degrees in response to market needs</li> </ul>

<b>UNIVERSITY OF SALENTO, ITALY</b> (Elia, Secundo and Passiante, 2017)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Pushes on European level, as the 2006 Oslo Agenda for the European Education system and the EU Entrepreneurship 2020 Action Plan</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>(X)</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of the Euro Mediterranean Incubator (EMI) in 2000. From 2000-2004 EMI focus on developing a learning environment to foster an entrepreneurial mindset in engineers and scientists through project-based action-learning didactics</li> <li>Initial focus on research-based entrepreneurialism</li> <li>Launch e-Business Master degree</li> <li>Launch of virtual collaborative platform for knowledge sharing, creation and application processes</li> <li>Establishment of a triple-helix network (local and global) to support the entrepreneurial activities, including seed venture capital network and expert mentoring</li> <li>“Hybrid faculty” with academics, entrepreneurs and public representatives is formed to steer the activities</li> <li>Started to identify and exploit opportunities from new technology fields, through interdisciplinary initiatives</li> </ul>	<ul style="list-style-type: none"> <li>Internationalization of research programs and consolidation of “glo-cal” strategy (i.e. global-local)</li> <li>The most difficult aspect is the establishment of impact measurements relating to the entrepreneurial activities</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

<b>FREE UNIVERSITY OF BRUSSELS, BELGIUM</b> (Mathieu, Meyer and van Pottelsberghe de la Potterie, 2008)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Regional Government promotes knowledge capitalisation through funding and regulatory policies</li> <li>Universities expected to have pro-active role in a knowledge society</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Founded in 1834 is the second largest university in Belgium</li> <li>Strong reputation in academic research, especially in medicine and life sciences</li> <li>Strong liberal tradition of being a “Free” university</li> <li>Governance structure from the 1960’s hinders decision processes towards changes</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Regional government triggered the transformation process by promoting knowledge capitalisation through funding and regulatory policies</li> <li>Complex decentralized governance system in place since this 1960’s remained</li> </ul>	<ul style="list-style-type: none"> <li>Established closer relationship to industry through a liaison office in the early 1990’s: the ULB-Interface</li> <li>Creation of patenting fund in 2003</li> <li>Strong research capabilities and resources were leveraged to produce patents and spin-offs via an organisational framework to translate research results in commercialization opportunities</li> <li>Decentralized organisation of entrepreneurial activities, being some departments more entrepreneurial than others. Departments recognized for research excellence that also include the “third mission” help to legitimize and disseminate an entrepreneurial culture, as role models (e.g. medicine and life sciences)</li> <li>Some departments are critical of university entrepreneurialism with academics not regarding their entrepreneurial-oriented colleagues as scientists</li> <li>Difficult to disseminate a new culture due to the large size and decentralization</li> </ul>	<ul style="list-style-type: none"> <li>Developed support infrastructures, as three incubators: EEBIC, Solvay Entrepreneurs and Wallonia Biotech</li> <li>Creation of Seed Fund “Theodorus” with diversified funding sources in 2003 with 5 million euros</li> <li>Nowadays ULB-Interface is a unit of the Research Department focused on IP registration, management and transfer</li> </ul>	<ul style="list-style-type: none"> <li>“ULB [case] suggests that universities can contribute to economic development in its region without turning ‘all entrepreneurial’ in an organisational sense.”</li> <li>The university does not consider itself an entrepreneurial university</li> <li>Research transfer is largely concentrated in medicine and life sciences departments</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

**POLYTECHNIC UNIVERSITY OF CATALONIA, SPAIN***(Guerrero et al., 2014)***EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Catalonia is considered one of the most entrepreneurial regions in Spain. As of 2007, 18% Spanish companies had been created in the region
- Spanish Education Law (BOE 86/2007) allows academic entrepreneurs to use their inventions, but later return to the university, as the IP law (BOE 73/1986) determinates that the university owns the rights. Nevertheless, the inventor also receives a share of revenues, which is defined on universities' statutes

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Entrepreneurship is part of the university statute and hence its mission

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• University leadership commitment towards the transformation process. The third mission is added to the university statute</li> </ul>	<ul style="list-style-type: none"> <li>• To start the university focused in initiatives to foster entrepreneurial spirit</li> <li>• Implemented entrepreneurship education courses</li> </ul>	<ul style="list-style-type: none"> <li>• Launch of the Ideas Program to identify and exploit entrepreneurial opportunities</li> <li>• Establish partnerships for collaboration mainly with private sector</li> <li>• new model of governance with reduced dependence on public funding and focused on accountability</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• The university operates as an “innovative enterprise with a big research and development department”, which addresses demands and observe market changes</li> </ul>

<b>AUTONOMOUS UNIVERSITY OF BARCELONA , SPAIN</b> (Guerrero, Toledano and Urbano, 2011; Guerrero <i>et al.</i> , 2014)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Catalonia is considered one of the most entrepreneurial regions in Spain. As of 2007, 18% Spanish companies had been created in the region</li> <li>Spanish Education Law (BOE 86/2007) allows academic entrepreneurs to use their inventions, but later return to the university, as the IP law (BOE 73/1986) determinates that the university owns the rights. Nevertheless, the inventor also receives a share of revenues, which is defined on universities' statutes</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Founded in 1968, the university is currently perceived as a key player in the regional entrepreneurial ecosystem, having incorporated a "third mission" into its statute</li> </ul>				
IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>University leadership commitment towards the transformation process. The third mission is added to the university statute</li> </ul>	<ul style="list-style-type: none"> <li>Series of entrepreneurial initiatives are founded throughout the years: E.g. 1983: UAB Enterprise-Science Foundation ; 1986: Technology Transfer Office; 1989: UAB Friends (University-Enterprise); 1996: European Consortium of Innovative Universities; 1997: Employment Unit (Treball campus); 1999: Technological network (CIDEM)</li> <li>Launch of Entrepreneurial Educational programmes to improve student's mindset, skills and competences and generate business ideas by following an integrated method based on informing, training, accompanying, and advising students</li> <li>An entrepreneurial mission has generated internal conflicts among faculty and students. E.g. "In 2007, hundreds of the UAB's students protested against some of these reforms within the education system"</li> <li>Establishment of network links between academic and entrepreneurs. Government teams have imposed barriers to the develop of some initiatives</li> <li>Recruitment of international staff</li> </ul>	<ul style="list-style-type: none"> <li>Strong development based on public collaborations via partnerships, alliances and networks, although sometimes it also involved private sector</li> <li>Initiatives are further developed and new ones are launched: 2000: Foundation Business-Science and 2001: Entrepreneur Project with CIDEM support; 2003: Business Creation Office, Incubators (Masia, Falco and VE3B), Eureka Building and XIP Financial network; 2005: Business Angels Network (XIP) and Biocampus; 2006 Eureka II Building; 2007: Sphere UAB to identify and exploit entrepreneurial opportunities emerging at the university</li> </ul>	<ul style="list-style-type: none"> <li>The university's entrepreneurial mission is a stimulus for the academic community and external stakeholders</li> <li>Throughout the years a diversity of infrastructures has been developed and entrepreneurial role models emerged, being considered one of the key factor in the university transformation into an entrepreneurial university</li> </ul>	<ul style="list-style-type: none"> <li>The university governance structure and entrepreneurial leadership enabled the development and implementation of support mechanisms to foster entrepreneurship</li> </ul>



**NATONAL UNIVERSITY OF IRELAND-GALWAY, IRELAND**(Guerrero *et al.*, 2014)**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Program for Research in HEIs awarded €1.22 billion in funding for investment in research infrastructure and staff hiring
- Positive attitude regarding entrepreneurship in Ireland since the 1990's has legitimized in the society, with support from government programs and firms as Ernst & Young Entrepreneur of the Year Award initiative

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Operates as a foundation since 1998 with core state grant for funding

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Engagement with experienced entrepreneurs as role models in educational formats</li> <li>• Establishment of technology transfer office and policy where inventor receives 70-75% of IP revenues</li> <li>• Criteria for professor's promotion include patents and triple-helix engagements</li> <li>• Hiring strategy to attract "high-caliber experts" to the university for the technology transfer</li> <li>• Triple-helix interactions via alliances and networks</li> <li>• Engagement with public initiatives, as Enterprise Ireland</li> </ul>	<ul style="list-style-type: none"> <li>• One of the longest established programs in entrepreneurship, in which students develop a business plan for an entrepreneurial idea and actively participate in national Strategic Innovation Fund programs such as Accelerating Campus Entrepreneurship and Roadmap for Academic Enterprise Partnerships</li> <li>• Establishment of a range of specialized Research Center, as the biomedical focusing on gene therapy and stem cell</li> <li>• On-campus complex of 25 incubation units ranging in size from 300 to 750 square feet</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>

<b>UNIVERSITY OF LIMERICK, IRELAND</b> (Guerrero <i>et al.</i> , 2014)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>• Program for Research in HEIs awarded €1.22 billion in funding for investment in research infrastructure and staff hiring</li> <li>• Positive attitude regarding entrepreneurship in Ireland since the 1990's has legitimized in the society, with support from government programs and firms as Ernst &amp; Young Entrepreneur of the Year Award initiative</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>• Operates as a foundations since 1989 with core state grant for funding</li> <li>• Change in governance, by establishment of an Executive Committee to manage the university's affairs</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Co-operative education program for undergraduate student work placements as integral part of degree programs</li> <li>• Engagement with experienced entrepreneurs as role models in educational formats</li> <li>• Offers sabbaticals for staff to develop research transfer and start-ups</li> <li>• Establishment of technology transfer office and policy to split IP revenues 50%-50% between inventor and university</li> <li>• Establishment of interdisciplinary research teams</li> <li>• Policy to attract international researchers as staff and PhD candidates</li> <li>• Engagement with public initiatives, as Enterprise Ireland</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of centralized Research Center and a number of multidisciplinary research institutes</li> <li>• Interaction with external stakeholders via partnerships and networks</li> <li>• Licensing of university IP to industry and spin-offs success stories</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>

<b>UNIVERSITY OF NOVI SAD, SERBIA</b> (Stankovic, 2006)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>National legislation for Science Parks in Serbia incentivised the development of parks around universities</li> <li>In the 1990's the international sanctions in place were a barrier for universities that were isolated and unable to acquire books and journals. This changed in 2000 with the election of a new democratic government</li> <li>Serbia created a new Law for Higher Education in 2002, giving more autonomy to HEIs and officially joined the Bologna process for HEIs reforms in 2003</li> <li>"Devastated Economy" had to be restored and HEIs were expected to take active role to contribute to this process</li> <li>Reduction in public jobs have increased student's interest in entrepreneurship</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>University had no institutional policy to manage industry relationship, which was an informal and on personal level</li> <li>Culture of isolated strong departments and weak central administration started to change with establishment of new university leadership in 2001</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>In 2001, new university leaders defined the vision to be an entrepreneurial university</li> <li>The European Association of Universities conducted an external evaluation in 2002-2003, results supported strategic planning</li> <li>Participation in the Bologna reform process</li> </ul>	<ul style="list-style-type: none"> <li>Launch Entrepreneurship elective course to all students</li> <li>Establish Incubator services</li> <li>Creates links with external stakeholders</li> <li>Diversify income sources</li> <li>External and self-evaluation initiatives motivated staff to take active role in the ongoing reforms</li> <li>Single campus contributes to "corporate spirit", integration of decentralized units and interdisciplinary teaching and research</li> <li>Hiring new staff for administrative roles</li> <li>Training opportunities for staff</li> <li>Established student-led consultancy company</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of three units for knowledge transfer: Innovation Center (IC), Technology Transfer Centre (TTC) and a Novi Sad Incubation Center (NOSIC), as a first development phase to develop a Science Technology Park (STP), in partnership with Serbian Ministry of Science and Technology and also benefiting from EU funding on an international consortium led by Chalmers University</li> <li>Next step towards venture capital initiative</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

<b>UNIVERSITY OF TOKYO, JAPAN</b> (Yokoyama, 2006)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Government policy (Toyama Plan) to corporatize national HEIs and allocate most public funding to the top 30, based on external evaluation</li> <li>Change in Japan's demography, increasing competition among HEIs</li> <li>Change in demands from industries and commerce who expect an internationally competitive research capacity and collaboration from HEIs</li> <li>Private HEIs are not-for-profit, but are allowed to run profit-raising programmes under Private School Law</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Oldest and largest public national university with a centralized power structure in the university leaders, being all employees public servants. This context has hinder the emergence of an entrepreneurial culture</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Defined new mission including accountability to society, set-up strategic planning and accountability measurements accordingly</li> <li>Governance changes in response to government policies related to the "Corporatisation of National Universities Law"</li> <li>Barriers for transformation related to public funding dependence and Ministerial policy restrictions regarding sectors and objects of universities' investment</li> </ul>	<ul style="list-style-type: none"> <li>Encourages staff and departments to collaborate with private sector via research, ventures and licensing agreements</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

<b>WASEDA UNIVERSITY, JAPAN</b> (Yokoyama, 2006)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>• Government policy (Toyama Plan) to corporatize national HEIs and allocate most public funding to the top 30, based on external evaluation</li> <li>• Change in Japan's demography, increasing competition among HEIs</li> <li>• Change in demands from industries and commerce who expect an internationally competitive research capacity and collaboration from HEIs</li> <li>• Private HEIs are not-for-profit, but are allowed to run profit-raising programmes under Private School Law</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>• Changes in governance, increasing Heads of Departments leadership ("Gakubucho")</li> <li>• Establishment of a central governing body University, including academic and administrative staff</li> <li>• Focus on a more cost-effect finance management</li> <li>• Establishment of links between departments, faculties and research centres</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>• Growing expectation from the industry</li> <li>• Increased competition in higher education sector in Japan, due to societal changes and policy reforms on public funding</li> <li>• Corporatisation of Japanese national HEIs</li> <li>• Mission to promote the practical utilisation of knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• "Sangaku Renkei" the partnership with industry is a key agenda of current reforms</li> <li>• Some academic staff object "Sangaku Renkei"</li> <li>• Entrepreneurial activities at the Waseda refer to education</li> </ul>	<ul style="list-style-type: none"> <li>• Waseda does not yet identify itself as an entrepreneurial university</li> <li>• Entrepreneurial and Business-related activities at Waseda are concentrated in two separate corporations: Waseda University Co. Ltd., and Learning Square Co.</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Convergence towards entrepreneurialism and accountability to society in a non-linear process</li> </ul>

# **NATIONAL UNIVERSITY OF SINGAPORE, SINGAPORE**

(Wong, Ho and Singh, 2007)

## **EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Policy making transform Singapore's from an investment-driven economy to an innovation-driven economy, due to globalization pressures, promoting creation and commercialization of intellectual property
- Creation of the National Science and Technology Board and launch Singapore's 1<sup>st</sup> National Technology Plan in 1991
- Creation of public research institutions and centres, changing HEIs share of government R&D spending (NUS share is 4%)
- Return to Singapore from local students trained in the USA: "Brain-circulation" and expansion of networks

## **ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Founded in 1905, NUS is the oldest and largest public HEI in Singapore
- New university vice-chancellor proposes to a globalization strategy, "arguing that, with growing global competition for faculty, students and resources, NUS needs to adopt globally competitive governance and practices to stay competitive". Consequently adopting a "Global Knowledge Enterprise" vision
- NUS is the 3<sup>rd</sup> largest patent holder in Singapore

<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>• From the 1980's onwards NUS placed emphasis on research</li> <li>• National Science and Technology Plan pushes NUS towards technology transfer: NUS grows from 274 to 1002 employed researchers</li> <li>• New Chancellor accelerated the transformation pace with the support from government ministers</li> <li>• Establishment of new organisational vision, focusing on enterprising</li> </ul>	<ul style="list-style-type: none"> <li>• Open Licensing Office in mid-1990's with policy that IP is assigned to NUS and revenues shared equally between NUS, the inventor and his/hers department</li> <li>• Creation of new division: NUS Enterprise to "inject a more entrepreneurial dimension to NUS education and research"</li> <li>• Empowerment of NUS Enterprise CEO to experiment</li> <li>• Make tech graduates more entrepreneurially-minded</li> <li>• Entrepreneurship Center promotes outreach activities via competitions and open events, networking with VCs and Angels</li> <li>• NUS attracts international talent (students and staff)</li> <li>• Need to change graduates mindset who target public or corporate jobs</li> </ul>	<ul style="list-style-type: none"> <li>• New organisational structure creating an Enterprise Cluster, centralizing industry relationship (tech transfer, contract research, consultancy), continuing education and the Entrepreneurship Center focused on promoting entrepreneurialism through education, research and startup support</li> <li>• New Venture support unit with inventor-friendly policy supports licencing and spin-offs</li> <li>• Incubator facilities at NUS and in Silicon Valley</li> <li>• Revision of faculty compensation and promotion policies to attract international talent and incentivise performance</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>

<b>UNIVERSITY OF TEHRAN, IRAN</b> (Salamzadeh and Yadolahi Farsi, 2013)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Business environment in Iran discourages entrepreneurialism</li> <li>Inertia in the Higher Education system in Iran negatively influence the emergence of entrepreneurialism at the University of Tehran</li> <li>Policy variables negatively influence the emergency of entrepreneurialism in HEIs</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>The University of Tehran has not yet become more entrepreneurial</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Iran's business environment discourages entrepreneurialism</li> <li>HEIs inertia and resistance to change prevents the adoption of the "third mission" at Tehran University</li> <li>In a system's simulation the policy variables negatively influence the system</li> <li>Lack of support for academic research commercialisation</li> </ul>	<ul style="list-style-type: none"> <li>The University of Tehran has not been able to ignite the transformation process due to the ignition barriers identified.</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

**CENTRAL UNIVERSITY OF TECHNOLOGY, SOUTH AFRICA**

(De Jager et al., 2017)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIRONMENTS**

- Among sub-Saharan countries, South Africa has the lowest rate of entrepreneurship intent among youth population

**ENDOGENOUS FORCES FROM THE MICRO ENVIRONMENT**

- Establishment of agreement between the university and the municipality to cooperate and a Quadruple-Helix task-force to promote regional economic development
- Increased research output since 2010

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• “any successful movement starts from the smallest of initiatives... through smaller incremental steps that may not permeate the whole curriculum, but selected programmes within it”</li> <li>• Establishment of a university “Vision 2020” to become entrepreneurial to positively impact in the regional economic development</li> <li>• Development of Innovation and Entrepreneurship strategy in November 2015: incubation and IP technology transfer</li> <li>• Benchmark University of Twente</li> </ul>	<ul style="list-style-type: none"> <li>• Redirection of educational offers to promote an entrepreneurship culture with a dynamic and holistic learning approach</li> <li>• Develop problem-based learning offers</li> <li>• Development of multi- and inter-disciplinary entrepreneurship education modules</li> <li>• Practical work and traineeships in partnership with industry</li> <li>• Internationalisation strategy to promote entrepreneurship</li> <li>• Competitions and students clubs around entrepreneurship</li> <li>• Mentorship program for students and staff</li> <li>• Quadruple-Helix task-force to develop a regional entrepreneurship ecosystem</li> </ul>	<ul style="list-style-type: none"> <li>• Secured resources to build a new facility: “Idea Generator” and integrated it with the existing “FabLab”, which is open to high-schoolers and students from other universities</li> <li>• Establishment of a “Virtual Incubation” programme and a 6-month physical incubation followed by an optional post-incubation support service</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on small initiatives</li> <li>• Innovation as key component of the entrepreneurship education initiatives</li> </ul>



<b>CATHOLIC UNIVERSITY OF RIO DE JANEIRO, BRAZIL</b> (Almeida, 2008)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>• Brazil's 1988 constitution, post-military regime, defines teaching, research and "extension activities" as integral elements of HEIs</li> <li>• National and Regional agencies have support towards knowledge transfer programmes</li> <li>• 2004 Technological Innovation Law promotes scientific and technological research aiming to reduce the country's dependency on foreign innovations. It encourage Triple-Helix partnerships</li> <li>• 58 public federal universities created a Commission for Science, Technology, Innovation and Entrepreneurship to evaluate the university system commitment towards entrepreneurship</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>• It's a not-for-profit private university founded in 1941 by Jesuits to develop knowledge with humanistic values</li> <li>• Innovation and Entrepreneurship is part of the university's mission and institutional policy</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>• External pressures in the 1990's, including government funding cuts led the university to search for new opportunities in amid crisis</li> <li>• Ignited collaboration with industry and establishment of a technology transfer office</li> <li>• 1995 federal government program incentivize the rethinking of engineering education, towards transformational technology and entrepreneurship</li> </ul>	<ul style="list-style-type: none"> <li>• Electives in Entrepreneurship for undergraduates are offered from 1997 onwards</li> <li>• Genesis Institute for Innovation and Entrepreneurship is created to promote the agenda, including a "Coordination for Entrepreneurship Teaching"</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of an incubator, resulting in changes in laboratories, transforming research teams into quasi-firms.</li> <li>• Internal consensus, particularly among its Directors established entrepreneurship as an integral element of the University's mission</li> <li>• "Finally, institutional space was built for students, researchers and professors to create companies based upon research in the incubators linked to the Genesis Institute"</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• "A series of external pressures and internal debates combined to create new opportunities"</li> </ul>

**FEDERAL UNIVERSITY OF ITAJUBA, BRAZIL**

(Almeida, 2008)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Brazil's 1988 constitution, post-military regime, defines teaching, research and "extension activities" as integral elements of HEIs
- National and Regional agencies have support towards knowledge transfer programmes
- 2004 Technological Innovation Law promotes scientific and technological research aiming to reduce the country's dependency on foreign innovations. It encourage Triple-Helix partnerships
- 58 public federal universities created a Commission for Science, Technology, Innovation and Entrepreneurship to evaluate the university system commitment towards entrepreneurship

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Founded in 1941 as a public HEI for mechanic and electric engineering it became a federal university in 2002
- The university's mission regarding its extension activities is "socially responsible", committing to regional development
- University Dean is a former incubator manager

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• Entrepreneurial focus influenced "partly by internal factors and partly by the new pedagogical project designed during 2004–2008"</li> <li>• The University's Dean (former incubator manager) proposed "to transform the University's isolated entrepreneurial activities into an institutionalised and cohesive university mission"</li> </ul>	<ul style="list-style-type: none"> <li>• Entrepreneurship trainings offered at all departments, encouraging start-up formation at its incubators and outside</li> <li>• Besides reinforcing its research and teaching activities, university start to be more involved in local development projects and on international programs</li> <li>• University's Restaurant management transferred to student organisation a real action-learning entrepreneurial project</li> <li>• Business plan competitions</li> </ul>	<ul style="list-style-type: none"> <li>• University "with an entrepreneurship project under development"</li> <li>• Establishment of three incubators: 1- to the support technological firms; 2- established in partnership with local government to incubate firms in traditional economic sectors; and 3- a social cooperative incubator for "marginalised social sectors"</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>

**FEDERAL UNIVERSITY OF MINAS GERAIS, BRAZIL**

(Almeida, 2008)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Brazil's 1988 constitution, post-military regime, defines teaching, research and "extension activities" as integral elements of HEIs
- National and Regional agencies have support towards knowledge transfer programmes
- 2004 Technological Innovation Law promotes scientific and technological research aiming to reduce the country's dependency on foreign innovations. It encourage Triple-Helix partnerships
- 58 public federal universities created a Commission for Science, Technology, Innovation and Entrepreneurship to evaluate the university system commitment towards entrepreneurship

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Establishment of a role model: Google acquisition of one of its spin-offs
- Entrepreneurship is not a mission/vision, depending on professors' initiatives

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• Single initiatives from professors</li> <li>• 2 professors start offering entrepreneurship elective for computer science undergraduates in 1993</li> </ul>	<ul style="list-style-type: none"> <li>• Interdisciplinary classes for undergraduate students from Physics and Engineering Departments</li> <li>• External network to support the incubator"</li> <li>• Establishment of 2 technical incubators</li> </ul>	<ul style="list-style-type: none"> <li>• University Dean merge the 2 tech incubators to synergise resources</li> <li>• Establishment of a new incubator at the business faculty in 2006</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• Absence of centralisation enabled "flexibility in the creation of an entrepreneurial environment, albeit without any commitment that the institution of formal academic programmes would have warranted"</li> </ul>

<b>Regional University of Volta Redonda, Brazil</b> (Amaral, Ferreira and Teodoro, 2011a)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>• Brazilian Innovation Law of 2004 makes mandatory that public universities establish a ‘nucleus of technology innovation’</li> <li>• Regional economy is strong, production efficiency is achieved by importing innovations from other countries</li> <li>• Cultural distance between local industry and the university</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>• Originated in 1960’s as an engineering HEI to train workers from/for local steel company</li> <li>• Since 2004 it’s a regional federal university in south or Rio de Janeiro state, an adjunct to the Fluminense Federal University. Hence, administratively dependent</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>• Difficulties to respond to 1988 constitution change that universities should have extension activities, besides teaching and research</li> <li>• Dependency on the Fluminense Federal University for managerial decisions, as establishment of industrial partnerships</li> <li>• New university leaders plan to establish research groups as quasi-firms</li> </ul>	<ul style="list-style-type: none"> <li>• Industry-University interactions defined by knowledge transfer via consultancy services, established in a passive/reactive manner</li> <li>• Professors are unaware of collaboration mechanisms available to establish collaboration with industry</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>

<b>CATHOLIC UNIVERSITY OF CHILE, CHILE</b> (Bernasconi, 2005)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Privatization of the Higher Education system (1981) under the military dictatorship (1973-1990), inspiring a 'neo-liberal' agenda</li> <li>Public funding reform (1981) making part of funds allocated based on university performance. In the 1990's with the democratization public spending in higher education raised 85%</li> <li>Set up in 1982 of a National Fund for Scientific and Technological Research (FONDECYT)</li> <li>Chilean economic crisis in the early 1980's, followed by significant economic growth in the 1990's, increasing significantly the populations purchase power and consequently access to higher education</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Founded in 1888, it is as a comprehensive research university, the second largest in the country. In 1968, a reform movement changed its governance to become more democratic and decentralized. Current the university is a private holding owning many businesses, among them: University hospital founded in 1942 and a private upscale clinic in 1988. Its most profitable enterprise is a commercial TV station founded experimentally in 1959 to became the second largest in the country</li> <li>Financial crises in the 1980's due to low revenues, dependence public funding (that received cuts) and operational deficiencies and redundancies</li> <li>First non-military University president was appoint in 1985 (remaining until 2000) and intended to increase autonomy and return to its catholic origins. Since the 1980's decreased the dependence of public funding through revenue diversification</li> <li>Performance-based salary policy for professors. More than half of salary is variable</li> <li>Focus on catering the needs of businesses and upper-class society (i.e. elitist profile)</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Increased autonomy and reduced public funding in the 1980's</li> <li>Peculiar format: Private University operates as a Holding maintaining autonomous businesses, as University hospital, upscale private health clinic, engineering/business consultancy and even a commercial TV channel, that produces significant revenues</li> <li>Dr. Juan de Dios Vial, university president 1985-2000 leadership and vision towards financial independence and decentralized governance</li> </ul>	<ul style="list-style-type: none"> <li>In 1959 founded a TV channel as an experiment</li> <li>In 1947 created the Scientific and Technological Research lab (DICTUC) at School of Engineering's Department to offer consultancy to industry</li> <li>Professors are paid for 3 work-days. 1 day is variable salary for extension activities (e.g. DICTUC) and the 5<sup>th</sup> day is "free" to allow them time in the industry</li> <li>Small number of Professors work as "CEOs of their research groups..." 'quasi-firms'" fostering entrepreneurial culture in a slow mindset change process</li> </ul>	<ul style="list-style-type: none"> <li>TV Channel became 2<sup>nd</sup> largest commercial station in Chile, thanks to its professional management and autonomy from the university holding</li> <li>In 1994 DICTUC Inc. was spinned-out and as a consultancy. It's autonomous and 99% owned by the university holding</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

<b>UNIVERSITY OF ARKANSAS, USA</b> (Vickers <i>et al.</i> , 2001)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>State established the Arkansas Science and Technology Authority to promote innovation and university-industry interactions</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Land Grant University, requiring the attention to the local community needs</li> <li>Entrepreneurship is part of the university's mission</li> </ul>				
IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>Research initiatives developed through the 20th century</li> <li>Add entrepreneurship as a university mission in the 1980's</li> <li>State establishes the Arkansas Science and Technology Authority</li> </ul>	<ul style="list-style-type: none"> <li>Establishment in 1998 of first technical-interdisciplinary degree In 2000 university received funding from the NSF to close a technology transfer gap and create links between research and industry</li> <li>Success of an interdisciplinary research group (HiDEC) motivated the formation of others</li> <li>Establishment of entrepreneurship in degrees curricula</li> <li>Existing identified gap is the lack of interdisciplinary offers, bringing technical and business students together</li> <li>"Passionate leadership" from faculty members</li> <li>University management efforts towards Triple-Helix partnerships and bootstrapping expenses</li> <li>New professors hiring strategy to attract industry professionals</li> </ul>	<ul style="list-style-type: none"> <li>Genesis Incubator established in 1986 with state government funding in an old factory building purchased by the university, also leased to research centers and technology transfer offices</li> <li>Developing a new interdisciplinary proof-of-concept innovation incubator</li> <li>"The University of Arkansas (in partnership with governmental and private entities) is on the edge of becoming a center of entrepreneurial activity in the state of Arkansas."</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>"Establishing a culture of new venture creation within a university requires significant energy and resources... Decisions must be made to do things differently..."</li> <li>Performance and return-on-investment evaluations are difficult to conduct to justify new investments</li> </ul>

<b>STANFORD UNIVERSITY, USA</b> (Etzkowitz, 2003; Etzkowitz, 2004; Etzkowitz, 2013; Leih and Teece, 2016)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIRONMENTS</b>				
<ul style="list-style-type: none"> <li>In the late 19th century, San Francisco was a shipping, trading and financial centre. The inexistent tech industry in the region when Stanford was found presented an opportunity to help create one. By the 1930's the tech industry was flourishing with main players founded by Stanford graduates</li> <li>Growth of the Silicon Valley with Stanford as a key player gave the university a relevant network throughout the years forming an epitome of regional entrepreneurial ecosystem</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIRONMENT</b>				
<ul style="list-style-type: none"> <li>In 1891 Stanford was founded with a "practical academic mission" and a "western-spirit"</li> <li>"Stanford's leaders, while not eschewing federal contracts and other public funds, can be said to have pursued an industry-friendly strategy"</li> <li>Frederick Terman shaped Stanford, as Engineering Dean and later Provost, between 1930-1970, sometimes being referred as "the father of Silicon Valley". He experienced MIT research transfer pioneering initiatives during the 1920s as Vannevar Bush's Ph.D. student in electrical engineering, adapting it to Stanford's context</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>MIT model transferred to Stanford in the early 20<sup>th</sup> century, by integrating academic and non-academic elements to produce research with commercial potential</li> <li>Informal pre-war arrangements between scientists, engineers and practitioners became research centers</li> <li>As a small regional private university, Stanford was poorly endowed, pushing it to be entrepreneurial to be able to fund itself</li> <li>Founders of the engineering school believed in the need to integrate the school with the yet inexistent local tech industry, helping to create one. Professors privately seed funded an alumnus to found the Federal Telegraph Company in 1910. "Academic entrepreneurship emerged as part of the university's development strategy, beginning with faculty and administration support for engineering school graduates, starting firms to electrify the region in the early 20th century"</li> <li>Frederick Terman 'steeple of excellence' strategy to select emerging engineering fields with practical potential to focus research on, including hiring strategy to attract small groups of practitioners as professors and researchers to accelerate development</li> <li>New transformational wave started in 1968 when Wallace Sterling became Stanford's president. He improved the finance by cultivating private donors with support from Terman as provost</li> </ul>	<ul style="list-style-type: none"> <li>Student body founded in 1891 incentivise student-led startups</li> <li>Stanford kept relationship with early spin-offs, who served as role models</li> <li>Dean of Engineering (1930-1954) and later provost (1955-1970) Frederick Terman marketed licences to alumni and industries to fund innovations from current students (e.g. Hewlett and Packard). Terman "ran the virtual equivalent of a TTO from his faculty office" and owned the rights based on university policy and practice". He is "hyperbolic" known as "Silicon Valley's father"</li> <li>Professors expected to work as industrial researchers organising research groups as quasi-firms. They receive funds to have assistants in a "learning-by-assisting" model</li> <li>Arts, sciences and medicine faculty members were among the critics of Stanfords entrepreneurialism</li> <li>Terman acquires public funding for research available on post-war period, accelerating the responsiveness to close research contracts with the US Navy and industries</li> <li>Google's IPO created a new role model for Stanford who holds IP and is a still shareholder</li> <li>Initiative to provide D-school training to all new students as part of their 'general education' will connect them to Stanford's entrepreneurial culture</li> </ul>	<ul style="list-style-type: none"> <li>In the early 1930's Stanford organized the intellectual property generated inside and in firms related to the university (who assigned patents to Stanford) into an integrated project, serving as a repository of economically useful knowledge for all firms in the region</li> <li>Terman had "the goal of integrating an industrial infrastructure for the university with an academic infrastructure for industry". He proposed a 20-year development program for strategic planning to allocate funds, replacing the 2-year financial planning and linking physical sciences and electrical engineering</li> <li>In 1951 Stanford Industrial Park is built and since expanded</li> <li>TTO office founded in 1969</li> <li>In 1985 the Dean of Engineering, James Gibbons (1984-1996), created the Stanford Engineering Venture Fund to fund the department as well as start-ups</li> </ul>	<ul style="list-style-type: none"> <li>"Contemporary Stanford tech-transfer practice relies on an informal dynamic to pull technology out of the university without the need to provide in-depth support"</li> <li>"Google exemplifies the shift from transfer to existing firms to firm-formation due to the vastly greater amount of funds that can be earned from a successful start-up". Nowadays, industries prefer to buy start-ups rather than license early-stage university technology</li> <li>Entrepreneurialism is an integral part of Stanford's culture, as a "founding member" of Silicon Valley</li> <li>"A plethora of entrepreneurship-training and venture-support initiatives can be found in various schools, departments and centers at Stanford. BioX, Spark, D-School, the STVP program and other such projects are elements of a highly decentralized innovation 'system' that individuals and groups seeking support navigate on their own. Word of mouth and websites provide relevant information"</li> </ul>	<ul style="list-style-type: none"> <li>Governance is a critical element to respond to growing opportunity contrasted by resources</li> <li>"Transformation has come repeatedly to Stanford's academic departments... There is a tradition of change..."</li> <li>"Stanford president John Hennessy articulated the need for continuous transformation... Being a university of high degree is not something that can be maintained by standing still. It requires us to re-examine and rejuvenate what we are doing, and it requires us to be bold in launching new efforts and in seeking out new ways to build on the foundation of our predecessors"</li> <li>Stanford's success hides missed potential, in a "paradox of success". StartX was created by students, because Stanford oversaw the need of start-ups pre-incubation support for undergraduates. StartX has since been incorporated</li> </ul>

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY, USA**

(Etzkowitz, 2003; Etzkowitz, 2004; O'Shea et al., 2007)

**EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS**

- Boston region economy in the early 19<sup>th</sup> century was based on textiles and an incipient machinery industry
- New England Council was more receptive than other policy makers towards technological innovations

**ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT**

- Founded in 1862 by William Barton Rogers, former professor of Geology at the University of Virginia, with local industry and political support, by acquiring a share of Massachusetts land grant, a unique application of the law supporting academic foundations with a practical intent
- Professors are expected to act entrepreneurially, also being responsible to fund their activities through consulting and research contracts with industry and government agencies. Tenure is based on achievement
- MIT's mission is to advance knowledge in areas that serve the world in the 21st century

IGNITION	SENSITIZATION	CONSOLIDATION	INSTITUTIONALIZATION	INNOVATION LOOP
<ul style="list-style-type: none"> <li>• Founded in 1891 by William Barton Rogers with local political and industry support MIT had a practical focus on "real-problems"</li> <li>• In the early 20<sup>th</sup> century, MIT administrators started to incentivise firm formation ignited from university research output</li> <li>• MIT had a narrow focus of engineering disciplines with practical potential. Its technical profile naturally ignited a relationship with Industry. The lack of other disciplines also reduced the barriers, not having suffered from internal philosophical objections from other disciplines</li> <li>• New England Council was more receptive to technology innovation than other policy makers, who considered it the cause of US recession</li> </ul>	<ul style="list-style-type: none"> <li>• During the 1920's Professor Vannevar Bush who also had a consultancy business, integrated his practitioner and academic roles, providing students practical training</li> <li>• Firm formation from research output remained an informal activity for several years</li> <li>• During the 1930's, with the economic depression, President Karl Compton believed research universities could replace the lack of natural endowments in the region, focusing on research-based firm formation. He had a key role funding the firm formation</li> <li>• MIT started to offer entrepreneurship training at their engineering degrees and founded the Business School</li> </ul>	<ul style="list-style-type: none"> <li>• In the 1920's the Research Corporation was founded to market the university inventions</li> <li>• In order to fund research, partnerships with industry and government led to the formation of the first venture capital agreements</li> <li>• MIT's TTO was established in 1945 (formerly known as the Patent, Copyright and Licensing Office)</li> <li>• Establishment of an entrepreneurship center at the business school</li> <li>• Currently MIT's Deshpande Center for Technological Innovation identifies research mit market potential and accelerates its development</li> <li>• MIT develop a strict policy for technology transfer to deal with conflict of interests from its operational mode</li> </ul>	<ul style="list-style-type: none"> <li>• Firm formation is an integral part of MIT culture since its founding. The role models created throughout the 20<sup>th</sup> century consolidated the entrepreneurial culture</li> <li>• A Triple-Helix network for New England's economic development formed an entrepreneurial ecosystem that works as a "virtual incubator"</li> <li>• Metric: Generate one patent per million dollar of R&amp;D investment</li> </ul>	<ul style="list-style-type: none"> <li>• (X)</li> </ul>



<b>UC-BERKELEY , USA</b> (Leih and Teece, 2016)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>Strong public funding flow in the late 19<sup>th</sup> and early 20<sup>th</sup> century</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>Founded through a Land Grant scheme, Berkeley has been always attentive to the developments need of the state</li> <li>Over-reliance on public funding and reactiveness to respond to industry demands prevented the establishment of Triple Helix agreements</li> <li>The university has a broad range of disciplines making some more reluctant towards entrepreneurial agendas. In this sense links to national labs are considered safer than links to industry</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Berkeley leader Benjamin Ide Wheeler (1899–1919) secured public funding, creating a culture of over-reliance on public funding that over the years hindered the entrepreneurial process.</li> <li>Public funding reduced dramatically in the 1970's, forcing engineering leaders to seek industry collaborations. But the university didn't actively seek for private donations or activation of alumni network until the 1980's</li> <li>Micro-management from past chancellors and the natural bureaucracy of a public organisation were also barriers for the emergence of an entrepreneurial culture</li> <li>Richard Atkinson president of the University of California system (1995-2003) pushed collaboration with industry, especially in engineering and technology</li> </ul>	<ul style="list-style-type: none"> <li>Local industry as IBM and Xerox seek to collaborate with Berkeley in the mid-20<sup>th</sup> century, but the university inertia to respond made it unfruitful</li> <li>Attempts to build an industrial park on university land (Richmond Field Station) have been unsuccessful since the 1960's</li> <li>Need to become more pro-active in engaging with industry and need for leaders to act more entrepreneurially</li> <li>Academic staff criticism to industry collaboration has also hinder the transformation process (e.g. Controversial research agreement with Norvatis in 1998). The internal resistance in name of academic values prevails to this day, though more industry agreements are made</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of a TTO office to market university intellectual property</li> <li>Chancellor Robert Birgeneau (2001–2013) successfully made significant efforts to acquire donations and industry contracts to consolidate early initiatives and build infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>Dynamic capabilities to sense and seize opportunities to transform Berkeley seem to have lacked over the decades</li> </ul>

<b>GARFIELD STATE UNIVERSITY , USA</b> (Mcclure, 2016)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>„Higher education policies in the United States reflect the market-driven agenda of the neoliberal state”</li> <li>US society believes in a self-enterprising culture</li> <li>US economy is knowledge-based</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>University leaders established the goal to become an entrepreneurial university and have followed a top-down strategy to achieve it in the past two decades</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Bayh-Dole Act in 1980 ignite the process</li> </ul>	<ul style="list-style-type: none"> <li>A technology transfer office was established as a consequence of Bayh-Dole Act in 1980</li> <li>For the 21<sup>st</sup> century a vision was set towards the entrepreneurial university was set, policies developed, existing educational offers and infrastructure extended to other departments (e.g. the creation of a start-up incubator in the early 2000’s).</li> <li>Some new programs were created in a top-down approach from the provost, without the necessary “buy-in” from departments</li> <li>Until 1998 entrepreneurial efforts were confined in the engineering and business schools</li> </ul>	<ul style="list-style-type: none"> <li>Research Park hosts industry clusters and university research centers started to be build in 2004</li> <li>Consolidation of existing efforts. The president appointed in 2010 established innovation and entrepreneurship as key priority: “The vision is to make innovation and entrepreneurship an integral part of our academic culture; to expand curricular and co-curricular opportunities; to accelerate the commercialization of ideas; to make the University a catalyst for economic vitality in the region”</li> <li>In 2013 the Institute for Innovation and Entrepreneurship was created to centralize the entrepreneurial initiatives</li> <li>Garfield Ventures is a Triple-Helix enable technology transfer project including 2 universities that scouts research outputs</li> <li>Establishment of an living-learning entrepreneurship community linking housing, teaching and start-up initiatives, attracting international students</li> <li>Tenure and promotion depend also on entrepreneurial performance</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

<b>STONY BROOK UNIVERSITY, USA</b> (Wolf, 2017)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIROMENTS</b>				
<ul style="list-style-type: none"> <li>(X)</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIROMENT</b>				
<ul style="list-style-type: none"> <li>It's a public research university just recently actively committed to entrepreneurship due to leadership changes</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>(X)</li> </ul>	<ul style="list-style-type: none"> <li>Incubator created in 1991, one of the first in the state, to develop ideas from the university hospital and the bioscience department</li> <li>TTO office focus on intellectual property only, not providing business development support</li> <li>Launch of MBA program in 2004 with consultancy service to industry and start-ups</li> <li>Launch of interdisciplinary courses</li> <li>Focus on learning-by-doing providing real experiences to students via consultancy to businesses and start-ups</li> <li>Innovation Center launched in 2011 disseminating the entrepreneurial culture with competition, courses and mentoring</li> </ul>	<ul style="list-style-type: none"> <li>A lounge area connecting the business and the physics buildings symbolically consolidated the interdisciplinary entrepreneurial culture</li> <li>Open Maker Space is launched for prototyping</li> <li>2 accelerators for Biotech and energy innovations and 3 high tech incubators</li> <li>Development of network of venture capitalists, angel investors, experienced entrepreneurs for support</li> </ul>	<ul style="list-style-type: none"> <li>'Smart-specialization', focusing of entrepreneurial activities in some fields as biotech, wireless tech, energy and chemistry and mechanical engineering</li> </ul>	<ul style="list-style-type: none"> <li>(X)</li> </ul>

<b>UNIVERSITY OF WATERLOO, Canada</b> (Bramwell and Wolfe, 2008)				
<b>EXOGENOUS FORCES FROM MACRO AND MESO ENVIRONMENTS</b>				
<ul style="list-style-type: none"> <li>Government expects public funding in basic research also produce a measurable economic return, pushing universities towards applied research activities</li> </ul>				
<b>ENDOGENOUS FORCES FROM THE MICRO ENVIRONMENT</b>				
<ul style="list-style-type: none"> <li>University established relationship with local industry since its creation through a cooperative education program. This has been a key cornerstone and competitive advantage over the years</li> <li>Positioning as an entrepreneurial research university actively engaged with regional economic development</li> </ul>				
<b>IGNITION</b>	<b>SENSITIZATION</b>	<b>CONSOLIDATION</b>	<b>INSTITUTIONALIZATION</b>	<b>INNOVATION LOOP</b>
<ul style="list-style-type: none"> <li>Since the foundation of the university there is a close relationship with industry via an Innovative Cooperative Education Program: students complete work terms in industry as part of their curriculum</li> </ul>	<ul style="list-style-type: none"> <li>Technology policy establishes the creator as solo owner of the intellectual property. It is thought to motivate students and staff</li> <li>Focus on academic research excellence</li> <li>Creation of entrepreneurship courses and degree majors</li> <li>Institute of Innovation Research promotes interdisciplinary work in the engineering departments</li> <li>Student-led entrepreneur's association</li> </ul>	<ul style="list-style-type: none"> <li>Established a center for business, entrepreneurship and technology</li> <li>Cooperative Education Program extended to allow students to create their own start-up rather than work for industry</li> </ul>	<ul style="list-style-type: none"> <li>The university is seen as a catalyst in the regional high-tech economy and "good community player"</li> <li>Established network and industry-relation</li> </ul>	<ul style="list-style-type: none"> <li>"University of Waterloo demonstrates a multifaceted capacity for knowledge transfer to the local economy that supports local networks and flows of knowledge, and links them with global ones."</li> </ul>