INSTITUTE *of*
TECHNOLOGY
CARLOW

Institiúid Teicneolaíochta Cheatharlach

Towards A Technological University
A Design Approach to Knowledge Creation

Date: 20.09.18

Author: Lynne Whelan

Supervisors: Carmel Maher, Colin Deevy

Course: MA in Design Research

Word count: 42403

Abstract

Irish economic strategies, in line with broader global strategies, aim to promote innovation and knowledge creation. The past notion that knowledge was a learned entity which stopped and was repeated as needed no longer fits. It is considered that in order to develop innovative fluid thinking and new knowledge creation, the focus shifts from the actual knowledge to the competencies and skills that the practice and application of the knowledge brings.

In direct response to this, the Irish Higher Education system is witnessing a period of transition. As part of this transition, some of the Institutes of Technology (IOTs) will merge to become Technological Universities (TUs). The TU focus will extend beyond teaching and learning towards innovation and knowledge creation. The Irish design education sector is innovation focussed and is based on a tradition of practice oriented learning. This thesis aims to position the role of practice oriented learning in the context of innovation and knowledge creation within Irish design education. The approach may now be of value as a process in knowledge creation in other disciplines, as they transition to the emergent Irish TU model.

In order to achieve this the overall research area was refined and broken down into the following research questions:

1. What is the strategy behind the focus on knowledge creation and innovation within the transitioning higher education system?
2. How is knowledge created within design education?
3. What role does practice oriented learning play in achieving knowledge creation?
4. How can the value of practice oriented learning benefit an emerging TU culture?

Design research is based upon the ability to identify and implement the most appropriate approach to data collection and the analysis of collected material. The 'research through design' approach was the selected methodology for the project.

Research through design presumes an interpretative understanding of the material or data being collected. It works when there is an openness and readiness to engage in new or surprising situations in the course of research. This methodology has a focus on synthesising information to form creative insights. The approach was selected as it does not pursue verification or falsification, but rather an interactive interpretative dialogue with the design situation (Frayling, 1993). This is appropriate when the research seeks to uncover strategy as opposed to gathering facts or data, we seek instead to make meaning of the data.

One approach to synthesising information involves deep interaction with the data through visual mapping. This approach was selected on the basis that visual mapping would provide a means to deal with the complexity of considering three key areas of research namely; policy, industry and education. The visual mapping enables us to see how and when policy, industry and education interact to arrive at today's strategy for the emerging TU's. This involves decision making throughout the project based on analysis and findings to provide direction. Whilst this method provides a clear rationale for the project direction there is still an amount of subjective interpretation. In order to provide further rigour to this method, a pragmatic approach was taken to test findings through field research using interviews, observations and

workshops. In addition to this, peer review and publications were carried out throughout the project. The peer reviews acted as a test bed for the latest thinking in this research area from an international context.

The findings to date indicate the strategy behind the transitioning Irish Higher education system is to promote knowledge creation as opposed to the traditional knowledge consumption. This is being driven by economic demands in response to the global shift from production based economy to knowledge based economy. The economic demands are both national and International and strive for innovation through knowledge creation. The thesis defines knowledge creation within design education as a specific process of tacit and explicit knowledge exchanges that occur within a shared space or context. Tacit knowledge is explored as informal knowledge based on experiences, insights and intuition. The findings show that tacit knowledge is produced through practice oriented learning approach used in Irish design education. This approach, used by design may be of value to other disciplines as existing structures transition towards the emerging model of TU with the aim of promoting knowledge creation.

Publications

1. Whelan, L., Maher, C., Deevy, C., (2016) **"The Role of Practice Oriented Learning in Design and Creativity in an Irish Technological University"** in: Proceedings of Ireland International Conference on Education (IICE-2016), Dublin, April, 2016

2. Whelan, L., Maher, C., Deevy, C., (2018) **''Timeline – The foundations of Regional Technical Colleges in Ireland to the Emergence of Technological Universities''** International Journal for Cross Disciplinary Subjects in Education (IJCDE) Vol 9, Issue 1 ISSN 2042 6364

3. Whelan, L., Maher, C., Deevy, C., (2016) **"Learning in practice"** in Madden, G.ed. ITERATIONS Design Research & Practice Review, Issue 3, pp 70-75

4. Whelan,L., Maher, C., Deevy, C., (2017) **'Towards a University Design School - Restoring the Value of Tacit Knowledge through Assessment'** in proceedings of European Academy of Design 'Design for Next', 12th EAD Conference in Sapienza University of Rome, 12-14 April 2017www.designfornext.org

5. Whelan L., Maher, C., Deevy, C., (2017) **"Towards a University Design School. Restoring the value of tacit knowledge through assessment"** The Design Journal Volume 20, 2017 – Issue Sup1: Design for Next: Proceedings of the 12th European Academy of Design Conference, Sapienza University of Rome, 12-14 April 2017

6. Whelan ,L., Maher ,C., Deevy, C., (2017) **"The Role of Tacit Knowledge in Merging Educational Cultures – Towards a University School of Design"** International Journal for Infonomics(IJI) Volume 10, Issue 4, ISSN: 1742-4712(Online)

Contents

Table of Figures

1.0 Introduction

Society is witnessing a paradigm shift in the drivers of economics. We are moving from the Industrial Age of production economy, to the Knowledge Age of innovation based economy. The European Union recognise education as being pivotal in creating a knowledge based economy. In Ireland, the Department of Education is responding to the drivers and has created and begun implementation of, a National Strategy to 2030 in Higher Education, also known as The Hunt Report (Hunt, 2011). The role of teaching and learning is being reviewed and attempts are being made to promote a climate of innovation for Ireland's future workforce. The aim being to achieve an innovation based economy, growth and a competitive edge within EU & global markets.

As part of the transition, some Institutes of Technology (IOTs) will merge and become Technological Universities (TUs). The TU focus will extend beyond teaching and learning towards innovation and knowledge creation.

Having a future strategy for higher education in Ireland is therefore important. However, how it is interpreted, applied and implemented is equally important. Past methods of teaching and learning were primarily aimed at addressing industrial production. In order to address todays demand for rapid knowledge based innovation, a new approach may be needed. As Frans A. van Vught contends;

> ''knowledge transfer is a broader encompassing concept than technology transfer''
> (Vught, 2012)

The thesis aims to explore the design approach of practice oriented learning in the context of innovation and knowledge creation. This approach may now be of value as a process towards knowledge creation within other disciplines as they transition to the emergent Irish TU model.

In order to achieve this the research area was refined and broken down into key research questions. The first question to be addressed was the strategy behind the focus on knowledge creation and innovation within the transitioning higher education system. In other words, what has triggered the changes in Irish educational strategy? This also raises the next research question, as the strategy is for knowledge creation and innovation, how exactly is knowledge created, specifically within design education? Practice oriented learning is identified as a significant value to the knowledge creation process. This brings the research full circle to ask how the value of practice oriented learning can benefit an emerging TU culture.

The overall approach deemed most appropriate for this particular research was 'research through design' which is an interpretive method. This methodology has a focus on synthesising information to form creative insights. The approach was selected as it does not pursue verification or falsification but rather an interactive interpretative dialogue with the design situation (Frayling, 1993). This is appropriate when the research seeks to uncover strategy as opposed to gathering facts or data, we seek instead to make meaning of the data.

The chronology of research activity is captured in graphic form (Fig 1). This represents the actual unfolding and occurrence of data collection, analysis and write ups throughout the project. The thesis content however, has been arranged and presented in a manner which

ensures the reader clarity of narrative. This begins with a literature review, followed with methodology, field research, discussion and conclusion.

The literary review is divided into two main chapters. The first deals with the context of Irish educational strategy. This chapter explores the rationale behind Irelands transitioning higher education system to understand the aims and objectives and focus on knowledge creation. A graphic timeline is presented to visualise the impact and influences of economic demands on educational policy from the period of 1958-present. This begins with the First Programme of Economic Expansion (Irish Dept. of Finance, 1958) prepared by secretary of Dept. of Finance T.K. Whitaker, through to the National Strategy for Higher education to 2030 (Hunt, 2011). The focus is on the aims of the National strategy to promote knowledge creation as opposed to knowledge consumption.

The second chapter defines knowledge creation and presents a graphic chart which provides a framework how knowledge is created. This begins with a theoretical understanding of knowledge creation and is further more explored to a design education perspective. The graphic illustrates how the design process is a process of knowledge creation.

The methodology chapter gives an overview to the research through design approach used throughout the project. This methodological approach is based on an interpretative qualitative framework which relies on the input of the researcher, their prior experience, intuition and interpretative understanding of the data collected. The validity of this method was established through several methods. An audit trail provides a clear description of the methods and procedures used. Triangulation between different data sources of observation and interviews was conducted with focus groups from multiple educational disciplines. Member checking was conducted throughout the research through conference attendance at both educational and economic conferences. The researcher also used prior experience which is presented as epistemological positioning, as a design undergraduate and business owner to provide reflexivity to gain further insights. The data and findings were drawn up on a large white wall to ensure contextualisation of information. Peer review was gathered at multiple points throughout the thesis to ensure the broadest and most current feedback on findings. Finally thick description of the entire process is presented through thesis preparation.

This methodological approach also used visual mapping to analyse the literature review data. This resulted in two key graphics; 'Timeline' and 'Knowledge Creation Theory & Practice'. The steps of development of each of these graphics are presented in the methodology chapter. This demonstrates the process and provides a rationale to the conclusions. Three key themes were selected to conduct the field research; policy, education and industry. The methodology chapter provides the rationale for using these themes and how they provided confirmation and validation of literature review findings.

The field research chapter presents the activities and engagements that took place with the aim of validating the literature review findings. They are presented under the three key themes of policy, education and industry for clarity to the reader. The policy section considers the most current thinking in relation to the Dail Eireann debates on TU and Minister for

Educations addresses. The educational section presents interviews with educational providers which aim to provide insight into differences of approach to teaching and learning within different disciplines. This is followed up through workshops with students to observe any differences of approach to problem solving. The industry section, through interviews with design practitioners, provides an insight into graduate attributes which are sought after in the workplace. This demonstrates how they are clearly in line with current educational strategies. The final stage of field research is the validation through publication, peer review and conference attendance. A key conference, The European Academy of Design is presented to demonstrate the peer review as part of a test bed for the interpretative methodology.

The final section to the thesis is the discussion and conclusion. The discussion considers the findings in the context of existing literature. This includes researchers such as Polanyi and Schon and more recently Guillot and Jorgenson. These authors have presented various understandings and theories on knowledge, specifically tacit knowledge gained through practice and reflection. This was combined with recent reports such as Hunt and Action Plan for Education which present the current strategies for Irish higher education. The thesis built upon this to provide a context for design education. The conclusion highlights the global shift from production based economy to a knowledge based economy. This has been the driver behind current European and national economic policies. The Strategy for Irelands Higher education to 2030, reflects this as it is aimed at producing graduate attributes suitable to a knowledge based economy. The findings demonstrate knowledge creation not only as a process of explicit knowledge exchanges but also of tacit knowledge exchanges. These exchanges are enabled within a shared context such as the design studio. Tacit knowledge is shown to be gained through experience and produced through practiced oriented learning approach as used in Irish design education. This approach is therefore important to retain when advancing toward a TU model in order to achieve the strategic aims. It is also an approach which may be of value to other disciplines with the aim of promoting knowledge creation.

The research is intended to inform academic management within Institutes of Technology and Technological Universities as they emerge and also academic policy makers such as HEA. The findings inform academic management of design pedagogical methods which may be of value to achieving the current strategic aims of a transitioning higher education system. The findings also inform HEA of possible future needs arising from the implementation of current strategies such as resources to promote tacit learning, for example, studio space/interactive spaces and assessment criteria model reviews which may be needed.

A3 version of this available in the hardcopy publication, IT Carlow library
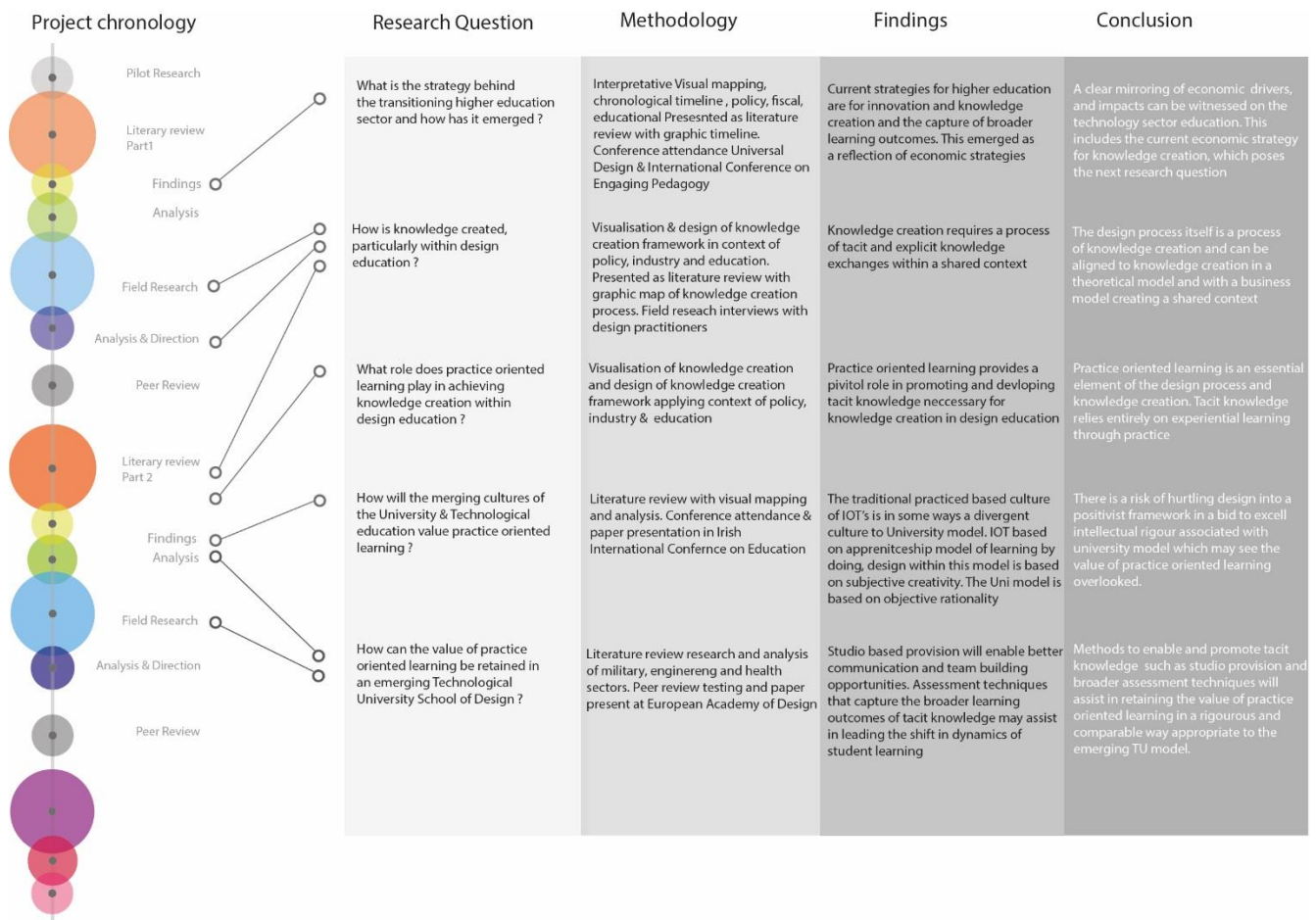
Figure 1 Project Chronology of Research Activity

2.0 Literary Review
2.1 Chapter One – Development of Irish Higher Education Policy 1958-Present

2.1.1 Introduction

Framing an overview of the Higher Education Sector and its organisation from 1958 to the present, is key in addressing the research question. In doing so we provide an insight into the policy drivers which have guided its development as well as the administrative structures which enabled it to function. Furthermore a visual timeline of policy formation and implementation and implementation, commencing with the 'First Programme for economic Expansion' (Irish Dept. of Finance, 1958) through to the 'National Strategy for Higher Education to 2030 (Hunt, 2011), which assists in demonstrating how macro policy has impacted key decisions.

It is from this timeline that we can identify correlation in fiscal crisis and investment streams with strategic planning and reports and thus uncover the drivers of change. This process identifies the stakeholders for the project and enables a further look at the influences, agendas and aims of each.

At this point we find that today the majority of stakeholders are mainly agreed in the focus direction and necessity for change towards an innovation based economy. The means to achieving this however are not so clear. Two streams of response are emerging, firstly the investment streams response, which is to streamline, standardise and uniform to achieve efficiency, as was traditional in our Industrial Age and to produce tangible research results in a quick period of time.

'' funding should (be) more directly linked….. to measurable outputs and outcomes'' (C&AG , 2010)

This applied to an educational system may produce the desired result in financial efficiency but streamlining, standardising and uniforming is less likely to produce innovative thinkers. Secondly, the educational response is to consolidate for efficiency but also as a means of enhancing quality of teaching & learning. The emphasis is on a flexible approach to expanding levels of participation and ensuring pedagogical methods are fully utilised to develop innovative critical thinkers.'' a new emphasis on nurturing creative & innovative minds'' (Hunt, 2011). The opportunity for enhancing teaching & learning methodologies for an innovative economy is explored, focusing on practice oriented learning within the design sector and the metrics of assessment.

Having reviewed the policy instruments underpinning the Irish Higher education system from 1958 to present, the associated visual graphic (Fig 2) provides a clear timeline of how national and international policy for skills to support economic growth has been a key driver in the development of Regional Technical College infrastructure. It is this infrastructure from which the existing Institutes of Technology have emerged and now seek to merge and be delegated as Technological Universities.

A3 version of this timeline available in the hardcopy publication in IT Carlow library
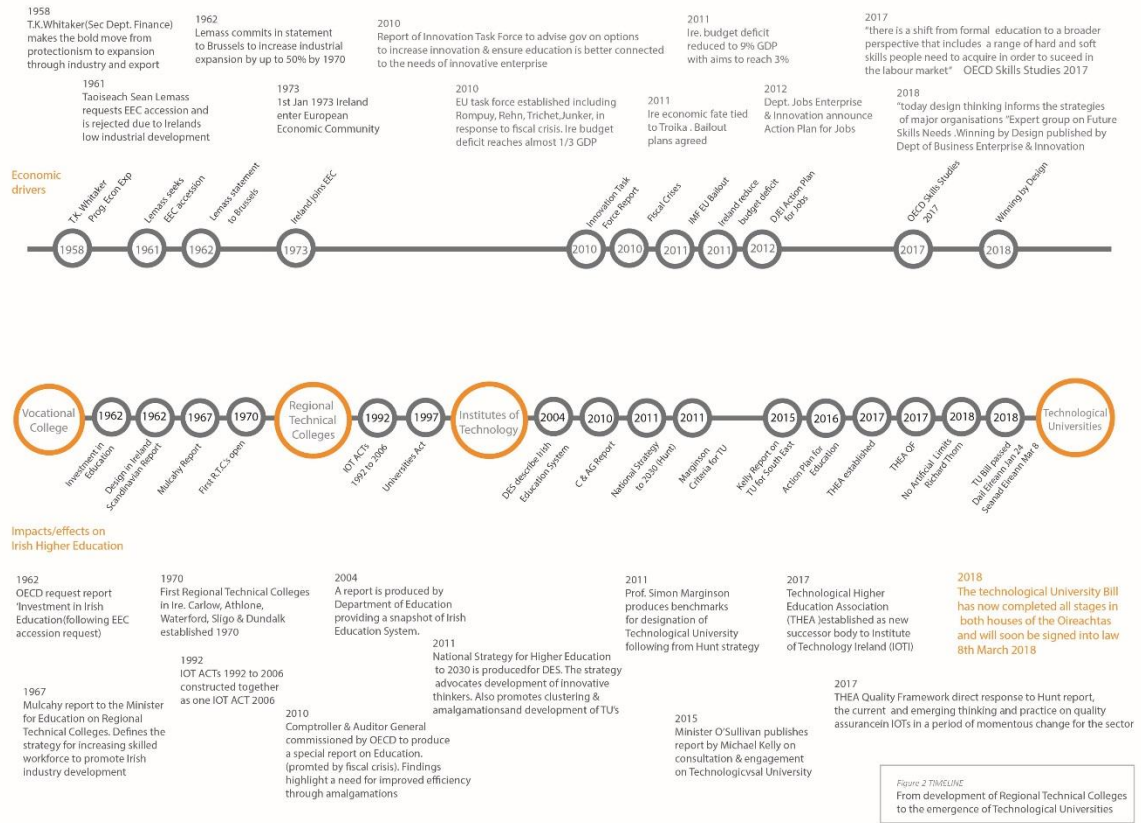
Figure 2 Timeline - From Emergence of Regional Technical Colleges to the development of Technological Universities

2.1.2 Foundation of Regional Technical Colleges

In understanding the initiative for developing technical colleges in Ireland we must start our timeline with a look back to the First Programme for Economic Expansion 1958, driven by the vision of T.K. Whitaker which marks the beginning of Irelands Industrial capacity being realised (Fig 4.). The GDP which averaged 1% throughout the previous decade, had reached 5% by 1960 (Lemass, Statement to Brussels 1962, 1962)
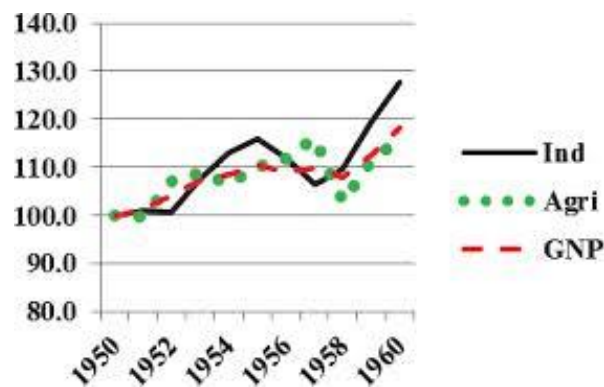
Figure 3 Irelands Industrial capacity increases following 1958(Breen, 2015)

Figure 4 T.K.Whitaker 1960 (Chambers, 2014)

It was through this development that Ireland was in a position to apply for accession to EEC to avail of European integration and most importantly open markets. Ireland had for many years availed of open markets with the UK and were now in a position to seek the larger benefits of joining the open markets of Europe. Ireland had begun application for accession to EEC in July 1961 which was rejected.
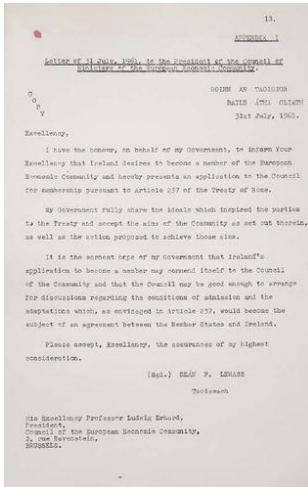
Figure 5 Letter to Brussels requesting accession to EEC by Taoiseach Sean Lemass 1961 which was rejected (the Journal 2013)

Figure 6 Taoiseach Sean Lemass 1962 (Irish Photo Archive2011)

"I have the honour, on behalf of my government, to inform Your Excellency, that Ireland desires to become a member of the European Economic Community" (Lemass, 1962)

A following statement to Brussels on application to EEC by Irelands then Taoiseach Sean Lemass in 1962 acknowledges that agriculture is classed as the main economic significance to Ireland.

''Agriculture …has a particularly important place in our economy. It generates about one-quarter of the national income, employs over one-third of the gainfully-occupied population and it is responsible ….for three quarters of our exports (Lemass 1962).

However, it is highlighted that Ireland's strategy is for an increase in industrial production. The aim is to increase industrial production in line with existing EEC members and that Ireland has the capacity to achieve this.

''…a total increase in production of 50% by 1970 is within the capacity of the Irish economy, Ireland can reach the collective target ….set by …Organisation for Economic Cooperation and Development(OECD) '' (Lemass 1962).

This highlights the beginnings of Ireland's relationship with OECD and our alignments to EU targets which continues today. The primary driver for economic expansion was the desire to join the expanding EU open market and increase Ireland's industrial production to capitalise in doing so and to meet with OECD targets for members.

1958 — 1961 — **1962** — **1967** — 2004 — 2010 — 2011 — 2014

'Investment in Education 'was a pilot study , commissioned by Dr Patrick Hilary Minister for Education, driven by Lemass, initiated by OECD the same year that Lemass put forward the statement to Brussels for accession to EEC. Europe and Ireland recognised the need to create the future work force for industrial expansion through improved educational strategies.

> ''Investment (report) offered the essential rationale and blueprint for the transformation of the Irish educational system'' (Walsh et.al. 2014))

The following decade saw the introduction of free education in Irish secondary schools, the publication of the 'The Steering Committee on Technical Education' also known as the Mulcahy Report and the opening of the first Regional Technical Colleges in Ireland.

The Mulcahy report was published in 1967 and clearly identifies the necessity of trained technical personnel in order to promote industrial development and how Ireland to date has not achieved this.

> '' the availability of increased technical knowledge and skill…is necessary…for further economic growth and the promotion of innovation and enterprise…..Ireland has largely failed to provide this'' (Mulcahy 1967)

Interestingly, Mulcahy also points out the difference between *need* and *demand.* Irish education has never developed in this way before. The people themselves are not creating a demand for education but rather the government has recognised the need for a technically trained work force for the reasons of economic development.

> ''if the demand for needed skills does not arise naturally, it must be stimulated artificially'' (Mulcahy 1967).

The Regional Technical Colleges were seen as a solution. Leaving Certificate courses were also considered as provision in the R.T.C's as a means of creating a greater transition to Higher Education at the early stages.

Mulcahy and his committee now had to go about the task of assessing the current state of play and formulating a strategy to advise the Minister for Education, Donagh O'Malley, on technical education in Ireland.

Ireland was admittedly somewhat behind in relation to UK & Europe with regards its natural industrial development.

> '' ..for historical reasons, the industrial development of Ireland was retarded until well on in the present century'' (Lemass1962)

The reasons for Irelands lack of Industrial development is seen by some as the result of British rule. However there would appear to be several contributing factors such as the Act of Union 1801 and the leap forward in transportation such as steam ships and railways. Both of these factors created a free market for trade between Ireland and Britain and through Britain to

International markets. Daly (1981) notes that a competitive market realises the most successful industries to the top and that this was the case in relation to Ireland, namely that it could not compete with British industry.

> ''the law of International comparative advantage dictates that when the single market came into being those Irish industries inefficient by British standards would be wiped out by their more efficient British counterpoints'' (Davies G 1992 P. 57)

Ireland was competitive in a few specialised area which were successful such as the Linen industry in NE Ulster, Harland & Wolf shipbuilders, Guinness brewery Dublin. Overall however it could be said that Ireland was in effect overshadowed by the industrial giant that Britain had become. It could equally be argued that the original cause of our inability to compete, stems from the impact of previous generations of British rule.

The outcome remains the same; Ireland is behind the EEC members in industrial production which is recognised as key to economic development and therefore strategically must invest and drive forwards our industrial development including a technically educated and skilled workforce.

As Ireland had no particular national role model for this, Mulcahy and the committee looked to the UK as an obvious reference. This included reports by the OECD on 'education, training & functions of technicians in the U.K.' along with consulting the Department of Education & Science in London.

The strategies which emerged were to cover general education subjects but also to include theoretical with the practical experience. There would be an input of skill knowledge, practice and theory in varying amounts depending on the trade. Nonetheless the main aim was always; to educate people from craft level to professional level in order to provide an industrial workforce.

> '' the main long term function…will be to educate for trade and industry…concerned with providing industrial manpower, particularly in the technician area'' (Mulcahy 1967 P.11)

1958 — 1961 — 1962 — **1967** — **2004** — 2010 — 2011 — 2014

It was well recognised by Mulcahy that the committee was not in a position to quantify much of the future projections with the information available. The overall strategy put forward was for flexibility and most importantly the provision for growth.

The committee actually requested the minister to provide outside consultancy to evaluate the demand for places in R.T.C's. It was envisaged that some of the newly trained workforce would possibly travel abroad to find work and that it would be difficult to balance requirements against uptake and employment potential.

Mulcahy did embrace some forward thinking strategies and advised that colleges should not fall in to 'fixed patterns' but should be flexible to the needs of society, economy and regional

industry. This thinking is as relevant today within the discussions of the developing Technological Universities in Ireland and the future strategies they will adopt, albeit with an extended international and global market approach.

Many areas are addressed in the report but to bring some insight to the project, we can look specifically to the view put forward in 1967 to the area of Art & Design education. It was recognised that because Ireland was behind its competitors in Industrial development, it must rely on 'intellectual abilities which have been added to a high degree of skill' (Mulcahy 1967). The aspiration was to tap the existing design culture and provide the education and training to enhance it. The fact that design was an element that would be internationally recognised it could be easily leveraged as a key export. Carlow was identified as a founding college for design education due to its proximity to Kilkenny Design Workshops.

The decade between the early sixties through to early seventies in Ireland saw the vision of T.K. Whitakers free trade and move away from protectionism propel Ireland in a move from agriculture to industry and the creation of modern Ireland. The logistics of creating a technological industrial economy required a skilled labour force that emerged under the advice of Mulcahy and the Steering Committee, in the form of the Regional Technical Colleges throughout Ireland.

2.1.3 Administrative Structures of Higher Education

Having gained an understanding of the strategy and policy behind the emergence of Technical Colleges in Ireland we can begin to assess their placement within the structure of the Irish education System through to today. This will assist us with understanding the emerging model of the Technological University.

A look to a 2004 report published by the department of Education entitled 'A Brief Description of the Irish Education System' (DES 2004), provides us with a context for comparison to the current changing structure today. It is often within the changes that the strategies can be seen.

A visual chart of the structure which was issued within the 2004 report has been created as a snapshot of the period to assist with overall assessment and positioning.

Bunreacht na hEireann

Taoiseach

Tanaiste

13 Ministers
collective responsibilities

Minister for Education
assisted by

Minister of State DOH

Minister of State Dept of Ed & Sc (DES)

Administrative Agency   DES

Head of Dept. - Secretary General(C.E.O.)
assited by
Management Advisory Committee

PROVIDER OF HIGHER EDUCATION

Universities

University College Dublin, Belfield, Dublin 4   www.ucd.ie
University College Cork, Cork   www.ucc.ie
National University of Ireland, Galway   www.nuigalway.ie
National University of Ireland, Maynooth   www.nuim.ie
University of Limerick, Limerick   www.ul.ie
Trinity College, Dublin   www.tcd.ie
Dublin City Universitywww.dcu.ie

National University of Ireland Recognised Colleges

Institute of Public Administration   www.ipa.ie
Milltown Institute of Theology & Philosophy www.milltown-institute.ie
National College of Art and Design   www.ncad.ie
Royal College of Surgeons Ireland   www.rcsi.ie
Shannon College of Hotel Managementwww.shannoncollege.com

Institutes Of Technology

Dublin Institute of Technology   www.dit.ie
Athlone Institute of Technology   www.ait.ie
Cork Institute of Technology   www.cit.ie
Dundalk Institute of Technology   www.dkit.ie
Dun Laoghaire Institute of Art, Design and Technology www.iadt.ie
Galway-Mayo Institute of Technology   www.gmit.ie
Institute of Technology, Blanchardstown   www.itb.ie
Institute of Technology, Carlow   www.itcarlow.ie
Institute of Technology, Sligo   www.itsligo.ie
Institute of Technology, Tallaght   www.it-tallaght.ie
Institute of Technology, Tralee   www.ittralee.ie
Letterkenny Institute of Technology www.lyit.ie
Limerick Institute of Technology   www.lit.ie
Limerick Institute of Technology Tipperary   www.lit.ie/Tipperary
Waterford Institute of Technologywww.wit.ie

Colleges of Education

The Church of Ireland College of Education   www.cice.ie
Froebel College of Education   www.froebel.ie
Coláiste Mhuire, Marino Institute of Education   www.mie.ie
St. Angela's College   www.stacs.edu.ie
St Patrick's College of Education   www.spd.dcu.ie
Mary Immaculate College www.mic.ul.ie
Mater Dei Institutewww.materdei.ie

Other State-Aided Institutions

All Hallows College   www.allhallows.ie
Dublin Insitute for Advanced Studies   www.dias.ie
Garda College   www.garda.ie
Military College   www.military.ie
National College of Ireland www.ncirl.ie
Pontifical University of Maynooth   www.maynoothcollege.ie
Royal Irish Academy of Music   www.riam.ie
St Patrick's, Carlow Collegewww.carlowcollege.ie

Other State-Aided Institutions

Honorable Society of Kings Inn   www.kingsinns.ie
Law Society of Irelandww.lawsociety.ie

Bodies under Aegis of Dept.

Advisory Council for English Language Schools Ltd.

An Chomhairle um Oideachais Gaeltachta agus Gaelscolaíochta

Centre for Early Childhood Development and Education

Commission on School Accommodation Needs

Dublin Institute for Advanced Studies

Further Education and Training Awards Council

Higher Education and Training Awards Council

Higher Education Authority

Institiúid Teangeolaíochta Éireann / The Linguistics Institute of Ireland

Integrate Ireland Language and Training Ltd

International Education Board of Ireland

Irish Research Council for Science, Engineering and Technology

Irish Research Council for the Humanities and Social Sciences

Léargas – The Exchange Bureau

National Adult Learning Council

National Centre for Guidance in Education

National Centre for Technology in Education

National Council for Curriculum and Assessment

National Council for Special Education

National Educational Psychological Service

National Education Welfare Board

National Qualifications Authority of Ireland

Residential Institution Redress Board

Royal Irish Academy/Acadamh Ríoga na hÉireann

Royal Irish Academy of Music

State Examinations Commission
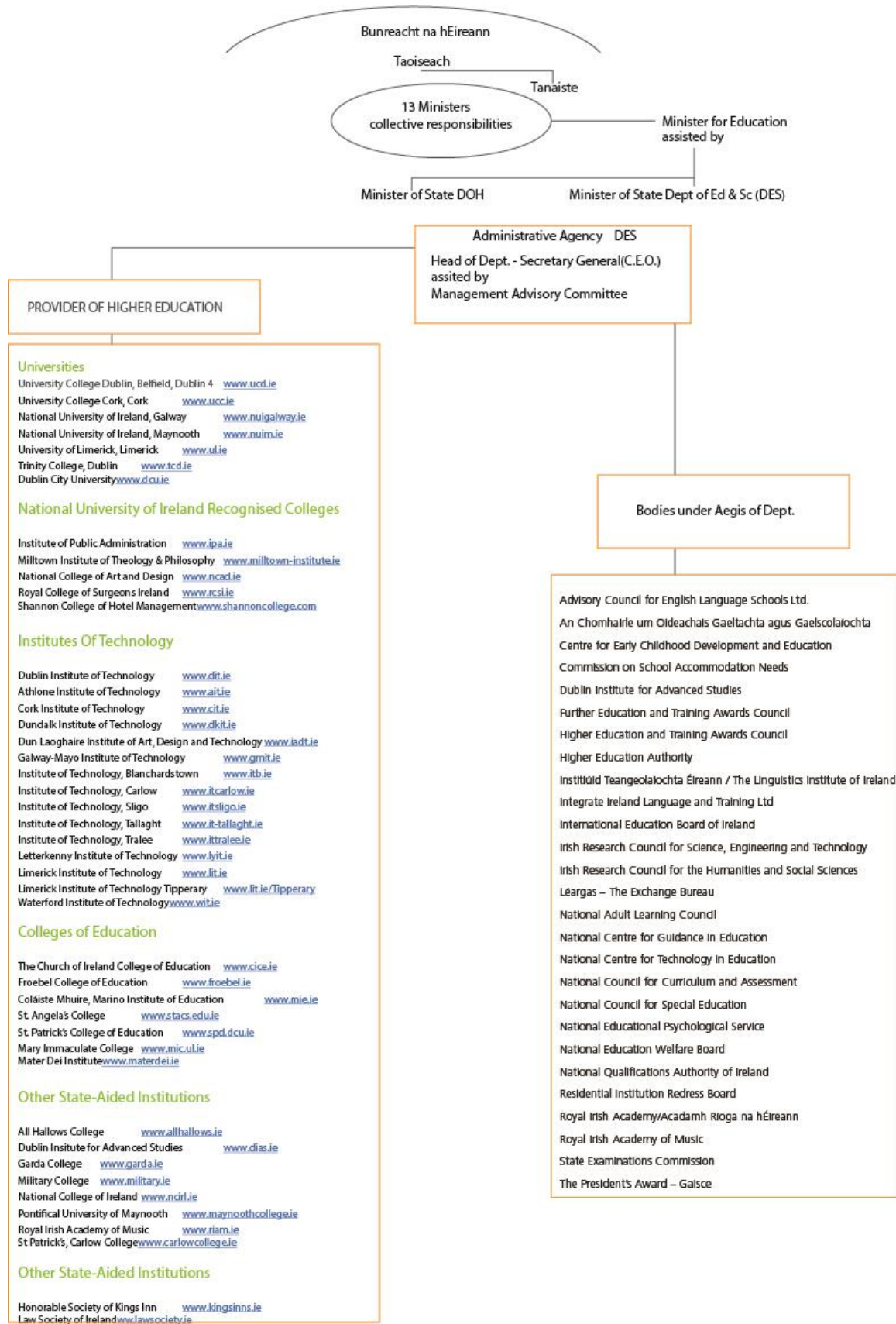
The President's Award – Gaisce

Figure 7 Administrative Structure of Irish Education System 2004 under Bunreacht na hEireann (Authors Own 2015)

The structure at this time in 2004 begins with the Irish Constitution – Bunreacht na hEireann under which is a collective cabinet. There are thirteen ministers to head thirteen ministries over all departments along with the Taoiseach (Prime Minister) assisted by the Tánaiste (Deputy Prime Minister). One of the ministers is the Minister for Education and Science who is assisted by Minister of State in Department of Education and Minister of State in Department of Health and Children. The Department of Education is the administrative body headed by the Secretary General. At this point in 2004 there were twenty seven bodies that came under the Aegis of the Department of Education.

The legislative framework is administered through the Department of Education. The most notable Acts of legislation that relate to Higher Education in Ireland are, NCEA Act 1979, University of Limerick Act 1989, Dublin City University Act 1989, The Regional Technical Colleges Act 1992 and the Universities Act 1997. The significance of these Acts is in the placing of, academic autonomy to the Institutes, the promotion of quality in teaching and learning and the drive towards efficiencies within the Institutions. The NCEA Act 1979 requires that standards set in all approved courses must be analogous to the standards in comparable courses in the universities. This indicates a recognition of the offering in the recently established RTCs and a step to ensuring future development through recognised comparable standards. The emphasis on standards continues to the IOT Act and extends to excellence in research.

> ''promoting….excellence in learning, teaching and research in Higher Education'' (IoT Act 2006 section 52part F)

However, there is most notably a drive for economic efficiency.

> '' A chief officer shall…give evidence to that committee on ….the economy and efficiency of the University in the use of its resources….for the effectiveness of its operations'' (IoT Act 2006 section 53)

It is interesting also to look at changes and amendments within the Acts in order to assist our understanding of emerging strategies. For example, ''a general duty with respect to national aims'' (IoT Act 2006) is substituted for ''national aims of maximising the contribution of Higher education''. The language throughout the legislative Acts and the reports of DES 2004 is beginning to reflect a new striving for accountability, efficiency and output within the Higher Education. This is mirrored in todays strategies for the Higher Education sector which aim for accountability, uniformity, streamlining and amalgamations such as the Technological University models.

2.1.4 Developing Future Strategies

Mulcahy's view of the Institutes as a flexible educational provider which 'must be capable of continuing adaptation to social, economic and technical changes', has remained relevant as we witnessed the Regional Technical Colleges adopt the titles of Institutes of Technology in the mid 1990's. This reflects the broadening, global markets that opened up as a result of the

digital information technology boom which meant the Institutes had a wider impact on teaching and learning than a regional response as reflected in this name change.

At this point in mid-1990's, Irelands economic growth is reaching unprecedented levels (Fig 8), as employment soars to 1.9million and the country booms in what became known as the 'Celtic tiger '.
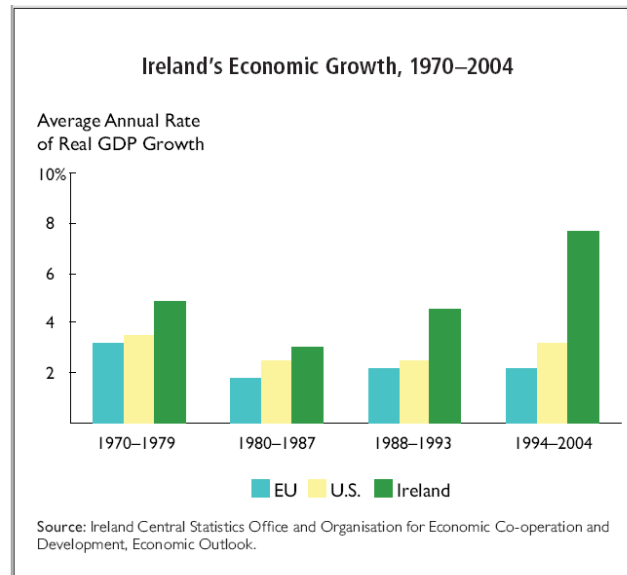
Figure 8 Ireland Economic Growth (Dorgan S. 2006)

Irish education strategy and development is still however high on the agenda as he Oireachteas debate amendments to the Regional Technical Colleges Bill (1999) with the announcement of a new college for Blanchardstown. It is recognised that previously held ideas of class distinction being the differentiator, no longer remains the case, that actually it is now the level of education attained that sets a person apart, regardless of social background. Conor Lenihan, the then Minister for Science, Technology and Innovation, in the Oireachteas debate 1999 notes;

> ''Education is the benchmark of progress in society…societal theorists have moved from that old Marxist perception and now hold the view that educational attainment is what designates a person as advantaged or disadvantaged….this indicates an important shift in thinking in liberal democratic states'' (Lenihan C. 1999)

This also coincides with Irelands signing of the Bologna process 1999. This was an agreement between European countries to ensure compatibility in standards and qualifications, a process which ultimately created the European Higher Education Area (EHEA). Ireland in fact became the first of the fifty countries who signed the framework to verify compatibility of its national framework with that of the EHEA. The aim was to provide a transparent system for learners which would also aid transferability and mobility throughout Europe with recognisable system of credits. The Bologna process was met with scepticism by some as being a commodification of knowledge and the marketisation of higher education. It was seen by some as "an extension on an EU scale of the neo-liberal policies that have been implemented from the 1980's onwards" (Lorenz, 2006). This similar to the debate which is ongoing today with our most recent strategy for higher education in its pursuance and drive towards efficiency.

The most significant impact however has come in more recent years as Ireland and indeed Europe responds to a fiscal crisis. By 2010 the budget deficit in Ireland is up to a third of GDP (BBC 2015), this, the cost of bailing out Irelands banking system. Ireland is forced into a financial bailout involving the European Union (EU) the International Monetary Fund (IMF) and Troika which would oversee financial affairs. The then Minister Brian Lenihan, delivers an austerity budget which would have severe impact on delivery of public services and previous expansion patterns.

Figure 9 Brian Lenihan Minister for Finance delivers the Irish budget 2010 (Irish Finance News 2010)

It is no coincidence therefore that a special report by the Comptroller and Auditor General (C&AG)was published for the Department of Education and Skills in the same year. The conclusions drawn from the audit and evaluation of Higher Education by C&AG, very clearly advise for more collaboration;

'' similar projects were funded…..leading to a risk of overlap….aim of the programme was to induce a greater level of collaboration between institutions'' (C&AG 2010)

There is also a proposal that future funding will be based on 'viable' proposals with more measurable outputs. It is unambiguously linking collaborations and measurable outcomes with efficiencies albeit cautiously

'' …the full impact of collaboration in terms of improved efficiencies…has yet to materialise.'' (C&AG 2010)

In the same year the 'Report of the Innovation Taskforce' was published by the department of the Taoiseach. The report was designed to inform Irish government in strategy for innovation which translates into high value jobs and sustainable growth. The strategy

presented, identifies Ireland as a worldwide innovation hub and included is a number of recommendations such as, the clustering of companies and an education system that provides for an innovative economy;

''the report of the innovation Taskforce sets out a strategy for positioning Ireland as an International Development Hub…. (with) an education system that is better connected with the needs of innovative enterprises'' (Report of Innovation Taskforce 2010)

The National Strategy for Higher Education to 2030, published by Irish Department of Education and Skills, also known as Hunt Report, was being prepared at the same time and published in 2011. The Hunt report responds to, and articulates, the strategies of these government reports into an educational context. It is not surprising therefore that clustering, amalgamations, and consolidations, are top of the agenda.

The recommended consolidations involve not only the education providers but also bodies under the Department of Education such as the Higher Education Authority (HEA). To date, since the 2004 report (DES 2004), these groups under the Department have been amalgamated from 27 to 15.

'a reformed higher education authority should collectively meet the national priorities, without wasteful duplication ' (Hunt 2011)

The proposals for 'clustering' which we have noted from the C&AG and Innovation Taskforce reports is also presented in the Hunt report in the recommendations for the educational providers

'systems should be strengthened by development of regional clusters of collaborating institutions ' (Hunt 2010)

The emphasis however, the Hunt report places on the need to consolidate, is for enhancement rather than purely efficiency driven, encouraging;

' ..the emergence of stronger amalgamated Institutes of Technology..' (Hunt 2010)

However, the overall strategy for amalgamation would appear to be in order to recognise the naturally occurring change within Higher Education to meet the demands for higher levels of education provision, and for higher participatory levels. It is clearly interpreted by Hunt, the need to respond to an innovative economy through education to 'provide sustainable employment opportunities'.

In order to provide sustainable employment opportunities, in transitioning from Institute of Technology to Technological University, it must reflect the global shift from technology production driven economy to the knowledge based innovative economy.

In 2011 Ireland receives €85bn in the form of a bailout from the EU International Monetary Fund (IMF). The following year saw Irish people face huge austerity measures but the results were, according to European Commission; that policy conditions were substantially met and investor confidence restored. Ireland could begin to rebuild its economy and whilst doing so take the opportunity to assess and re strategise going forward. (EuropeanCommission, 2012)

The government introduced the 'Action Plan for Jobs 2012' initiative which was produced by the Department of Jobs Enterprise and Innovation.

The Action plan strategic ambition is for job creation, increase ranking in, International competitiveness, stimulate employment in locally traded sectors, increase exports and build world class clusters in sectors of opportunity. By 2013 Ireland was in the position to officially exit the bailout.

Figure 10 Michael Noonan Minister for Finance 2013 announces Irelands exit from the Bailout Programme (The Irish Times 2015)

By 2014 the Department for Jobs Enterprise and Innovation produced a report of the Entrepreneurship Forum entitled 'Entrepreneurship in Ireland –Strengthening the Start-up Community'.

With increased stability in the economy, funding is becoming available for Start-ups and SME's are seen as a future model for Ireland's competitive edge on innovation. A culture for funding entrepreneurs is nurtured with opportunities through Enterprise Ireland, reflecting the shift in economic drivers towards innovation and enterprise.

As we have witnessed, from the very emergence of R.T.C.'s through to today, frameworks, amendments and adaptations in H.E. sector are mirroring economic demands, the drivers for H.E. sector are relatively clear.

The government strategy and collegiate realms, share the vision of the future H.E. as globally competitive, knowledge and innovation based. The gap in knowledge would appear to be in devising the best methods of achieving these desired outcomes.

As the collegiate sector defend the possibility of imposition of change which may have unintended consequences, coming from the top down. It is equally important that the collegiate realm step forward with frameworks and proposals from the bottom up. This will assist with informing and addressing the current gap in the knowledge as to the methods of achieving the shared vision and desired outcomes for Ireland's H.E. Sector.

In relation to the design sector, this research programme intends to explore the role of practice oriented learning as an approach to address national objectives in developing knowledge creation and innovation. The timing in doing so is important as academic Institutes currently seek to respond to the strategies within the Hunt Report. It is also timely as if we look back across the timeline we note that at each stage of development in Technological education, there is a decline of practice based workshop and studio hours. It has been seen to be necessary to move away from hands on experience to more significant academic approach to teaching and learning which was traditional of Irish Universities as opposed to Institutions. This is having a profound impact on the practice based model of learning. The developing economy is driving the change but we have also reached a stage of forty years since the beginning of our technical colleges. This would indicate that many of the original staff that were responsible for the understanding and the ethos of practice oriented learning have retired or are very close to retiring. The new stock of teaching staff today may have little or no connection or experience with practice oriented learning.

2.1.5 Conclusion

The timeline which we have explored has uncovered the rationale and macro influences on our developing Higher Education sector. As Whitaker drove forward Irelands industrial production, so Mulcahy forged the strategy for developing Regional Technical Colleges to meet the demands of an industrial workforce. Ireland's economy boomed and as it did so, it was recognised by Irish government that education had become the mechanism for economic and social mobility, marking a shift in thinking and establishing education as a core value to society and accessible to all.

The fiscal crisis in recent years has given an opportunity for re strategising but also creates the risk of eroded quality through efficiency drives. The current strategy for Higher Education to 2030 strives to create a balance between investment priorities and the increasing participatory levels, whilst ensuring quality in research teaching and learning. The aims of investment streams is to create a workforce suitable for a new innovation based economy, mirrored in the aims of Higher Education strategy for the development of creative innovative thinkers. (Hunt, 2011)

The gap in the knowledge would appear to be the methods applied to achieving the aims of both the investment streams and Higher Education.

It is recognised that knowledge transfer requires a broader and deeper concept than technology transfer, and therefore the methods of both pedagogy and assessment must reflect this.

The experience, culture and ethos developed since emergence of R.T.C's has a recognised value. It must be a combined top down, bottom up approach in achieving the desired outcomes.

Education in the higher sector in Ireland is inextricably linked to economic progress. The challenge therefore for the next stage is in retaining the cultural values, ethos and method associated with technical education in Ireland whilst creating a future response to global competitiveness. As difficult a task as this may seem, it would be no less relevant to draw a reminder from the beginning of our timeline and T.K Whitaker's original vision and founding ethos that saw the emergence of modern Ireland;

> ''Let us remember that we are not seeking economic progress for purely materialistic reasons but because it makes possible relief of hardship and want, the establishment of a better social order, the raising of human dignity, and, eventually, the participation of all who are born in Ireland in the benefits, moral and cultural, as well as material, of spending their lives and bringing up families in Ireland'' (Whitaker T.K 1960 referenced Chambers A 2014)

2.2 Chapter Two – Towards a University Design School - The value of Tacit Learning in Knowledge Creation

2.2.1 Introduction

Design as a discipline within Irish Higher Education provides the context to the research as by its nature it is a process of creative and innovative thinking. This section, through visual mapping, demonstrates knowledge creation within the context of design in order to address the research question. The divergent cultures of the University and Technological Institutes are discussed to provide the background insight required to identify the shared values for a TU in achieving knowledge creation.

The research has mapped the theorists view on how knowledge creation occurs, and develops within a design educational context. In relation to knowledge creation, the literature mainly becomes saturated with references back to one important contributor Ikijuro Nonaka (Nonaka, 1995), whose theoretical model is known as the SECI model. It was this model which was therefore selected for use as a framework to assist in viewing knowledge creation within design education.

We begin by defining knowledge in this research context. The SECI model stands for a process of Socialisation, Externalisation, Consolidation and Internalisation. It is this model that has been used as a framework to view the process in a design education context. The results identify knowledge creation as a cycle of tacit and explicit exchanges. In design education, the importance of the design studio in providing the platform and environment for enabling knowledge creation is recognised. Most interestingly however is the uncovering of how the design process itself mirrors the SECI model as a cycle of tacit and explicit conversions, necessary in knowledge creation.

The findings highlight that knowledge creation requires a process of tacit and explicit conversions within a shared context or place. Tacit knowledge is significantly overlooked in an educational context because it is difficult to communicate, assess and grade. The difficulty identified for design education, as we progress towards a university model is that explicit knowledge has traditionally been what is valued in the university model, as it is more easily evaluated and graded. Tacit knowledge is based on the interpersonal and experiential learning, which is difficult to communicate and measure. Finding a method of assessing such a vital component may restore the value of tacit knowledge as a gradable achievement and ultimately serve to the Irish national strategy purpose of innovation and knowledge creation.

2.2.2 Gaps in Literature

The thesis sought to explore the design approach of practice oriented learning to achieving innovation and knowledge creation. The research therefore looked to authors such as Polanyi, Kuhn and Schon and more recently, Guillot and Jorgenson. These authors discuss learning through practice and tacit knowledge. As Polanyi writes "I shall reconsider human knowledge by starting from the fact that we know more than we can tell" (1966). Polanyi argues that tacit knowledge gained through experience and practice is a crucial part of scientific knowledge. His work paved the way for the likes of Kuhn and many others. More recently

authors such as Guillot have applied this understanding to 'making meaning' of acquired knowledge and what conditions must be present in doing so. This first stage of research informed the thesis of the current educational and economic strategies for promoting knowledge creation and innovation. Knowledge creation appeared throughout the government reports for higher education but also within economic reports and national strategic reports. In fact knowledge creation was being mentioned frequently but rarely explained. This was an identified gap in the literature and now became the focus of the thesis. In order to inform methods of achieving the higher educational strategies, knowledge creation would need to be more clearly understood.

2.2.3 Defining Knowledge

In order to address the research questions we must first explore and define 'knowledge' in the context of this project.

Knowledge can be seen as contextual. In other words, knowledge can mean different things to different people in different environments. Knowledge therefore cannot be stored and moved and necessarily retain the same meaning in every context. ''Knowledge itself is mutable' (Krogh, 2000). Each individual has an inherent viewpoint and experience and therefore open to using and interpreting knowledge in many ways. Knowledge is a construct of reality and not merely data compiled that can be memorised and consumed to be regurgitated at a later interval. ''the creation of knowledge is not simply a compilation of facts'' (Krogh, 2000). This method of compiling facts and memorising content, is reminiscent of educational methods based around the needs of a production economy where it could be said knowledge was consumed or acquired rather than created. Students may memorise information but have difficulty when asked to make meaning of the information by applying it in a different context. Guillot discusses and describes examples of how in the past students simply acquired knowledge without making meaning, contending that ''when a student is making meaning, he is struggling with the new learning and attempting to own it and evaluate his own ideas'' (Guilott, 2012). This suggests that in an educational context, making meaning or knowledge creation is about learning for understanding, it is difficult to define and to assign as a teaching and learning method. It would appear to require tacit knowledge as well as explicit knowledge. Michael Polanyi classified human knowledge in this way describing explicit knowledge as;

> ''Codified knowledge that can be transmitted in formal, systematic language….. It can be expressed in words and numbers and shared in the form of data, scientific formulate, specifications, manuals and the like.'' (Polanyi, 1966)

Tacit knowledge on the other hand is described as;

> 'highly personal and hard to formalize, making it difficult to communicate or share with others. It is deeply rooted in an individuals' actions and experience as well as in the ideals, values, or emotions he or she embraces'' (Polanyi, 1966).

Similar to Blooms Taxonomy(1956) of learning objectives being described as cognitive, affective and psychomotor, the knowing head, the feeling heart and doing hands. It is the combination of these elements which inform tacit knowledge. Krogh would also define knowledge as being both tacit and explicit;

> "knowledge can be on paper, formulated in sentences, captured in drawings …. yet other kinds of knowledge are tied to senses, skills in body movement, individual perception, physical experiences, rules of thumb, intuition.'' (Nonaka, 1995)

Nonaka is clear in stating however that it is precisely this shifting, context specific quality which makes tacit knowledge a powerful tool for innovation and knowledge creation.

2.2.4 Knowledge Creation Theory

As the research question aims to uncover the role of practice oriented learning in knowledge creation, it is therefore necessary to define knowledge creation for the context of the research. In doing so it is possible to provide a backdrop to designing in an educational context and how and where knowledge is created within the process. In this section, the SECI model is used as a reference model of theoretical knowledge creation. From this it is possible to directly align design practice in an educational context to a process of knowledge creation. "three elements, which when brought together, enable knowledge creation". (Krogh, 2000)

The first element, the knowledge assets are the resources available. These are broken down into four categories of assets; conceptual, systematic, experiential and routine. In a design studio environment these assets are the prior learning of the design students, the inherent knowledge they bring, the physical skills they have acquired and the experience of mentors and teachers.

The second element of the theory is based on the Japanese element of 'ba' (or place) as integral to knowledge creation. This is what Krogh is referring to when describing 'enabling knowledge'. The provision of a shared space that fosters emerging relationships. By providing this space, it creates a shared context ''the idea of 'ba' or place, context can be physical, virtual, mental or more likely all three.

In a design education context, the ba (or place) may be viewed as the design school studio as this is a space which enables the exchanges , interactions and observations of others, ultimately providing a shared context. It is also part of the knowledge assets, as it provides the physical space and tools to conduct the work. ''knowledge is embedded in ba, and that supporting the whole process of knowledge creation requires the necessary context or 'knowledge space' (Nonaka, 1995)

Figure 11 Design Studio providing creative space enabling free movement and informal discussions (Designthinking.org, 2016)

The third element is a process of Socialisation, Externalisation, Combination, and Internalisation known as the SECI model (Fig 12). This sees knowledge move through a series of tacit and explicit interactions. Tacit to tacit knowledge converted through socialisation, tacit to explicit knowledge converted through externalisation, explicit to explicit conversion is created through combination and explicit to tacit conversion is created through internalisation.

This third element, the SECI model is of particular interest to the research in the context of design education, as it mirrors the design process in knowledge creation in design practice. The' Irish National Strategy for Higher Education to 2030' (Hunt, 2011) has specified the need for knowledge creation. However, educational providers still struggle with what this may mean in formal education contexts. The SECI model may assist us with interpreting the strategies in this context.
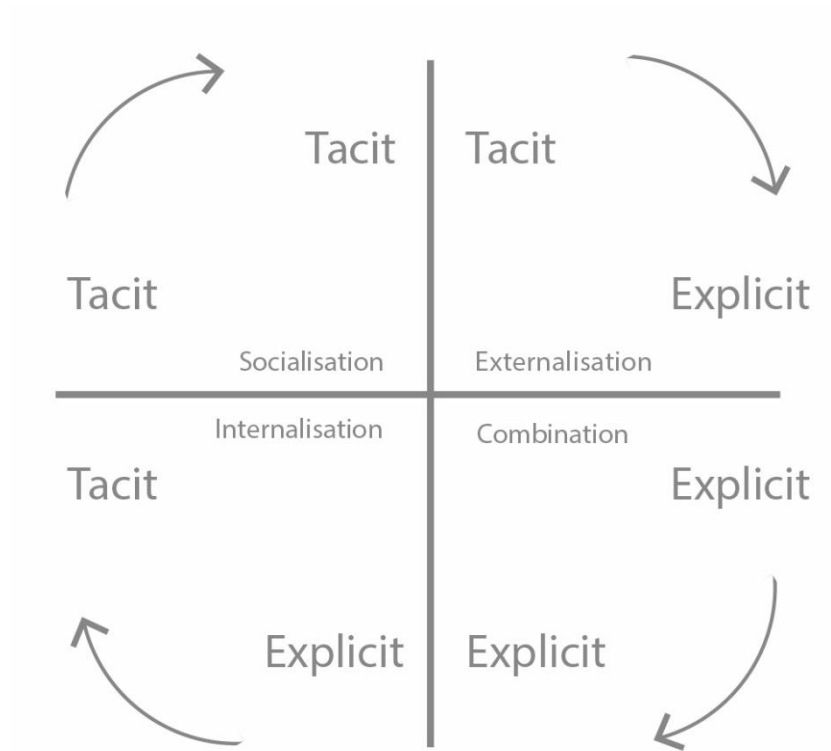
Figure 12 Authors visualisation of SECI model of knowledge creation

In figure 12 we see the theoretical model of knowledge creation as a continuous cycle of tacit and explicit knowledge conversions. If we look at the SECI model in an educational context (Fig 13) and bring the theory to practice, we can begin to better understand the value and recognise a familiarity of the process in action.
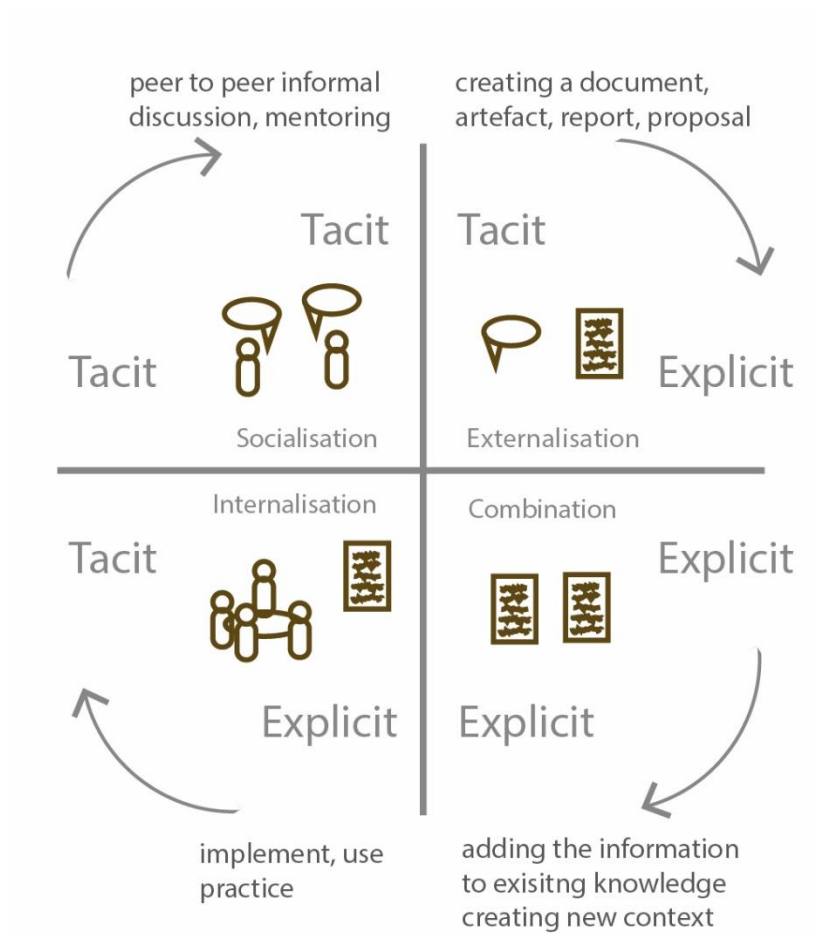
Figure 13 Example of educational process in context of SECI process

Socialisation involving peer to peer informal discussion or mentoring.

Externalisation, creating a document, artefact, report or proposal.

Combination, adding the information to existing knowledge creating new context

Internalisation, implementation, use and practice

To consider knowledge creation in the context of design education further, we can look at the eight steps of the design process from a standard Industrial Design educational process (Massachsetts, 2016). It is possible to align the design process as a series of tacit and explicit knowledge exchanges on to the SECI model and demonstrate how it, in itself is a process of knowledge creation. Again, we are bringing the theoretical SECI model to a practice level, one that is familiar to design and we recognise in action.
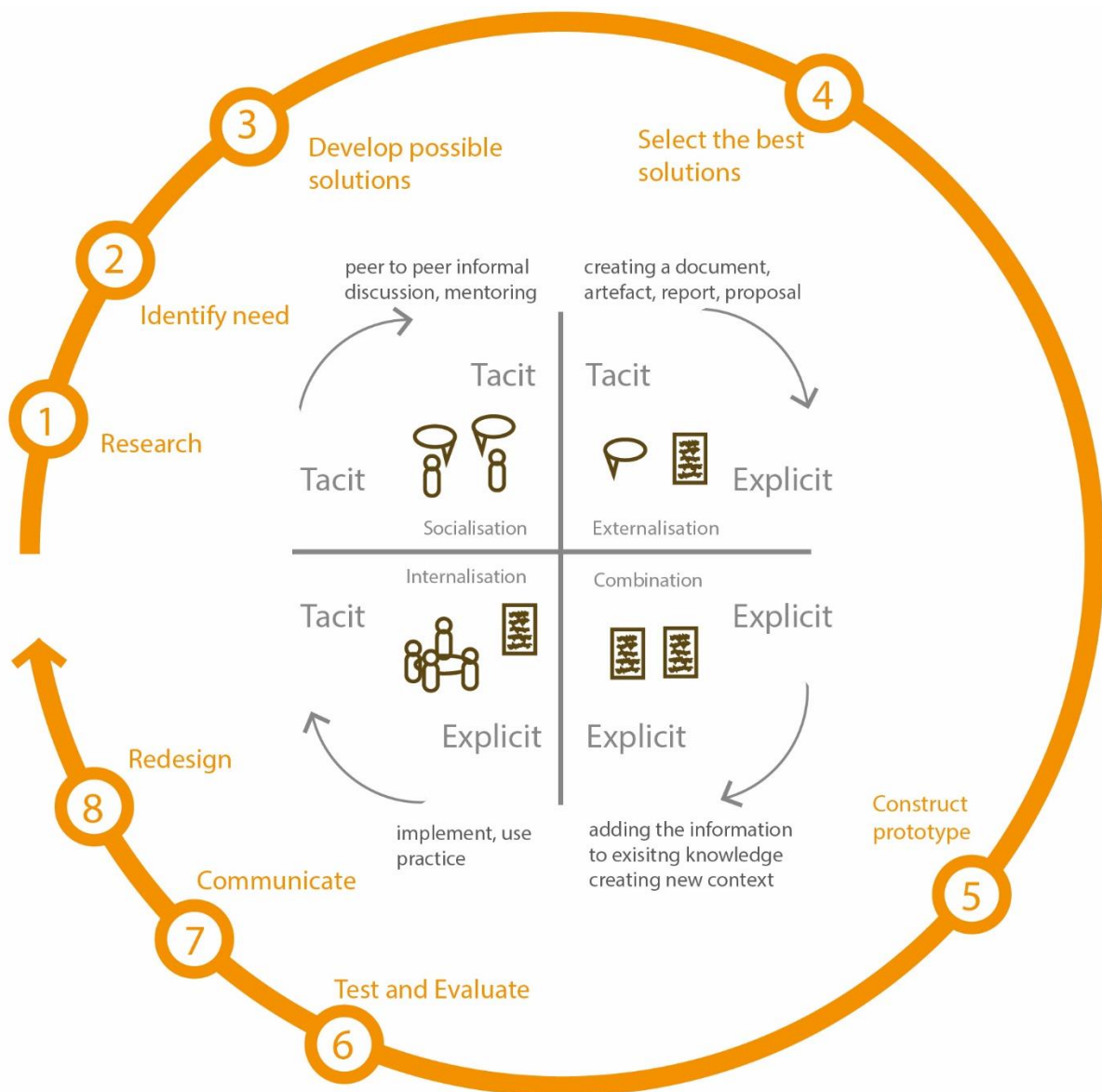
Figure 14 Knowledge Creation Theory & practice - Authors visualisation of a traditional design process (Massachusetts 2016), demonstrated as a process of knowledge

Stages 1-3 of a traditional design process; the research, the informal discussions, the ideation, sit within the tacit to tacit phase. Stage 4 is converting the ideation to concept, taking the tacit ideation and converting it to something explicit, something tangible such as a sketch or report. Stage 5 relates to the constructing of a prototype, sitting firmly in the tacit to tacit phase as extremely tangible and communicable, relatable to other works. Stages 6-8 see the prototype in use and being tested, creating a feedback experience, moving it from explicit back to the less tangible tacit responses.

Beginning with, Socialisation tacit to tacit, we can see how informal discussions are enabled by the design studio space as opposed to traditional lecture room facilities. This enables ideas and suggestions to be aired. In a design studio this can be informal or through the teamwork and collaborations which have been supported by continuous engagement between the participants and the place(ba/studio).

Externalisation, tacit to explicit, is the process of capturing these discussions and ideas into a more formal format. In design education this is reflected in students creating sketch models, prototypes, reports from the ideation and concept generation in the studio space environment.

Combination, explicit to explicit, the bringing together of other past and present findings in combination with the new one. This in design terms involves the research from desk or field being used as a reference against the validity of the design.

Internalisation explicit to tacit reflects the design process testing phase, handling using or observing users. This practice, use and testing of findings, informs the iterative process on which design is based. Which brings us back to socialisation and the informal discussions and ideation.

To place this process of knowledge creation back into the context of the emerging TU, the research has mapped the broader knowledge transfer cycle. This cycle follows the newly created knowledge into the economy through graduate attributes. This is where the skills formed in studio based activities such as practice oriented learning hold a value to employers.

It should be noted that in addition to this route, Knowledge Transfer Ireland (KTI) (KTI, 2017) has been established in 2013 with centres nationally throughout the Institutes and Universities. The aim of the centres is to help business benefit from access to Irish expertise and technology making it simple to connect and engage with the research base in Ireland.

The other route for the newly created knowledge is back into the education syllabus through conferences and teaching and learning centres.

Overall, this demonstrates that the activities of design within the shared context of a studio space provide an environment and a process of innovation. Tacit knowledge is central to design process knowledge creation. The importance of the design studio in the role of enabling knowledge, is also highlighted. Equally important however is the balance of explicit and tacit knowledge, which in turn inform each other throughout the entire design process.

Acetate layering of the SECI model inserted here in the hardcopy version available in IT Carlow library

EDUCATION ← POLICY ← ECONOMY

Infonomic graduate attributes

new research   existing syllabus

3 Develop possible solutions
4 Select the best solutions

2 Identify need

peer to peer informal discussion, mentoring

creating a document, artefact, report, proposal

1 Research

Tacit   Tacit

Tacit   Explicit

Socialisation   Externalisation

Internalisation   Combination

Tacit   Explicit

8 Redesign

Explicit   Explicit

implement, use practice

adding the information to exisitng knowledge creating new context

Construct prototype

5

Communicate

7

Test and Evaluate

6

KNOWLEDGE

SECI model of knowledge creation
SECI model activities and interactions
Standard industrial design process aligned to SECI model
Knowledge Creation within broader knowledge transfer cycle

Figure 15 SECI model of knowledge creation demonstrating design process within the broader knowledge transfer cycle

Acetate layering of the SECI model inserted here in the hardcopy version available in IT Carlow library

EDUCATION ← POLICY ← ECONOMY

Infonomic graduate attributes

new research   existing syllabus
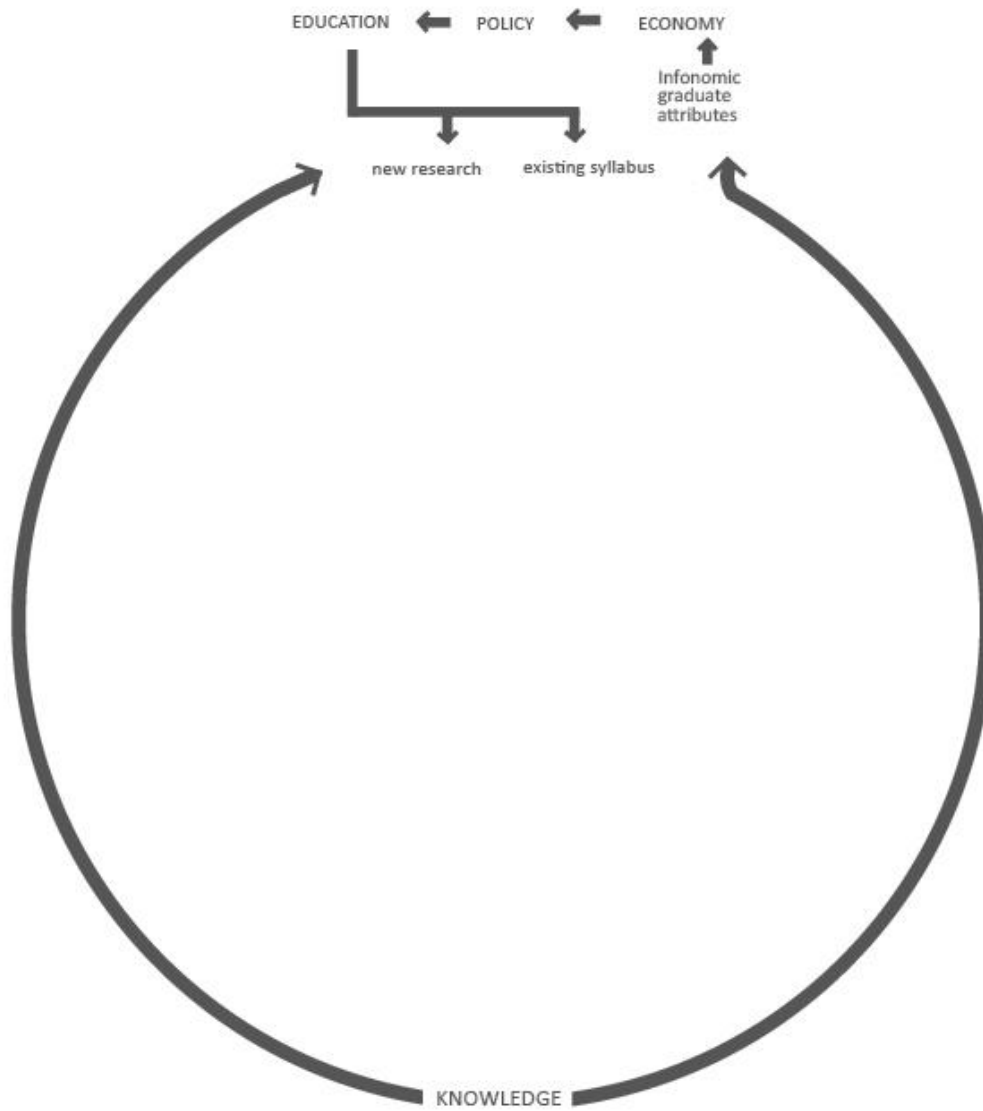
KNOWLEDGE

Knowledge Creation within broader knowledge transfer cycle

Acetate layering of the SECI model inserted here in the hardcopy version available in IT Carlow library
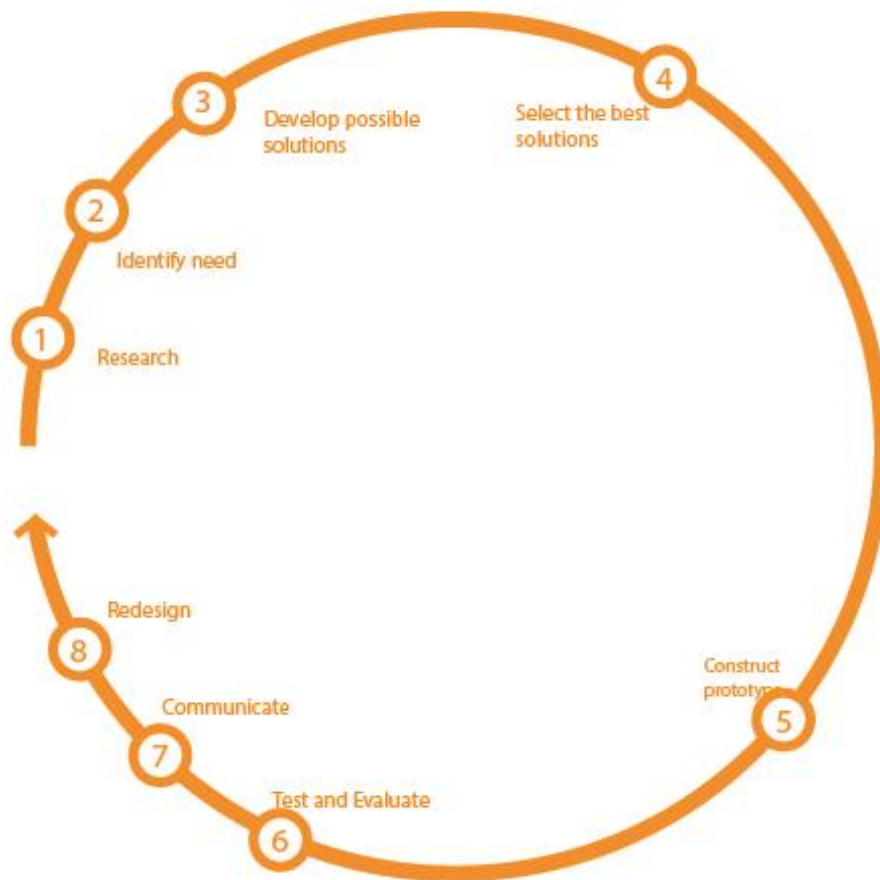
Standard industrial design process aligned to SECI model

Acetate layering of the SECI model inserted here in the hardcopy version available in IT Carlow library

peer to peer informal discussion, mentoring

creating a document, artefact, report, proposal

implement, use practice

adding the information to exisitng knowledge creating new context

SECI model activities and interactions

Acetate layering of the SECI model inserted here in the hardcopy version available in IT Carlow library

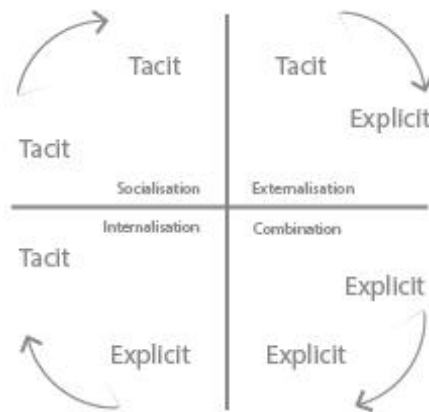|	Tacit	Tacit	
Tacit			Explicit
	Socialisation	Externalisation	
	Internalisation	Combination	
Tacit			Explicit
	Explicit	Explicit	

SECI model of knowledge creation

2.2.5 Balance of Tacit and Explicit Knowledge

According to Nonaka, knowledge is contextual and requires a shared context or knowledge space to support a process of tacit and explicit knowledge conversions which he describes in the SECI model. Polanyi supports the theory, describing knowledge as both tacit and explicit and specifies that tacit knowledge is the central feature of knowledge in our world.

In a design education context, we can recognise the importance of the design studio in providing the platform and environment for enabling knowledge creation. The design process as we can see from (Fig 14), design itself sits firmly in the model as a cycle of tacit and explicit conversions towards creativity and knowledge creation.

It is unsurprising therefore that we see design thinking and the design process being embraced by industry, policy makers and educational providers alike in this infonomic era. Infonomics is an emerging discipline of managing and accounting for information with the same rigor and formality as other traditional assets such as finances. (Gartner, 2018) Design thinking is however often misunderstood or misapplied as design practitioners themselves struggle to communicate the tacit and subjective nature of the process. In an educational context this is a relevant and serious threat to how future models of design teaching and learning are provided. This may be the reason design has traditionally been marginalised by the university structure that we now appear to be moving towards. (Wang, 2010) As Wang puts it,

''design is focused on subjective creativity, but the positivist university paradigm is focused on objective rationality'' (Wang T. 2020)

It would appear that a new model is required that embraces the subjective creativity but equally provides the rigour required to communicate through design research and publications the objective rationality of the process and findings.

Kuhn believes the answer lies in the 'complexity approach' replacing positivism. This refers to the idea that where seemingly chaotic and random activities are taking place, they are in fact part of a structured process, and that this relates more appropriately to the increased complexity of contemporary social experience. This is particularly true of design, onlookers may perceive the activities in the design studio to be random which appear chaotic, students are in fact following a specific process, understanding the rationale for iteration and learning by doing. Kuhn argues that although complexity values subjective creativity, it does not disregard objective rationality and refers to it as shift of paradigms from positivism to complexity theory on the articulation of design education.

'' as a paradigm, complexity maintains a fine intellectual balance between two contrasting claims of design education'' (Kuhn 2008, ref Wang)

This statement draws alignments to the SECI model for knowledge creation as a balance of creativity and rationality through a balance of tacit *and* explicit knowledge conversions. Cook & Brown describe it as ''the generative dance between organisational knowledge and knowing', they suggest that knowledge creation is a product of the interplay between them.

As the National Strategy for Higher Education (Hunt, 2011) aspires to achieve knowledge creation and the development of Technological Universities, sits precisely in the centre of this debate for achieving balance between the existing dichotomies of objectives. There is a risk of hurtling design into a positivist framework in a bid to excel the intellectual rigour and fortify the university model. This route would risk the demise of the design school studio, risk the erosion of the subjective creativity which provides the tacit learning through practice and ultimately fail to achieve the desired outcome for knowledge creation, toward development of an economy based on creative and innovative thinkers.

2.2.6 Value of Tacit Learning in Design

The SECI model has covered both the tacit and explicit forms of knowledge. The research now looks specifically at practice oriented learning within the process, to answer the final piece our research question as to its value.

Many studies have been conducted into the value of learning by doing and practice oriented learning but it is an important time to communicate the value in today's terms. Some may be of the impression that the practice oriented nature of design education is linked in the past production era and is therefore unnecessary today. The ability to harness computer technology for design and prototype build may be looked upon as the replacement to the model making and craft element of industrial and product design. However, it would appear that tacit knowledge itself depends entirely on experience. Polanyi explains it as 'we know more than we can tell' meaning, there are many things we know but cannot communicate verbally or in writing. The example Polanyi uses is our ability to recognise a face but not to describe it in a way that others may recognise it. This instinctive or intuitive knowledge Polanyi describes is tacit.

To teach or learn tacit knowledge requires both the teacher and the learner to rely on an inherent understanding. If we cannot fully describe all that we know we rely on the other persons understanding to fill in that, which we cannot describe.

''our message had left something behind that we could not tell and its reception must rely on it that the person addressed will discover that which we have not been able to communicate''(Polanyi 2009)

We could at this point suggest that the 'something' that is understood by both parties relies on 'experiential' learning. It would be reasonable to say that if a person has experiential understanding, it enables a bridging of the gap in tacit knowledge exchanges, thus

''the outcome of an active shaping of experience….this shaping or integrating I hold to be the great and indispensable tacit power by which all knowledge is discovered.'' (Polanyi, 1966)

Polanyi describes experiments conducted by Eriksen & Kuethe in 1958 whereby a person had to read a series of vocabulary, and on reading certain syllables they would receive a shock. The test subjects began to recognise shock words and avoid them although when asked afterwards how they identified them they could not actually explain. An experiential process had happened and they had gained the knowledge of some form of recognition and more

importantly anticipation of what they could not describe. It is through this experiment that Polanyi describes the point at which we make meaning

''when the sight of certain syllable makes us expect an electric shock, we may say that they *signify* the approach of a shock. This is their *meaning* to us.'' p11

Through the experience, even if we cannot fully describe it, we have gained the knowledge to anticipate the shock. We have made meaning. Guillot earlier also describes this very act of gaining knowledge and identifying how and when to use it correctly as making meaning. In this case we have learned what happens when we experience the shock but more importantly we have learned to anticipate it, we have made meaning or created knowledge.

Similarly we understand that we cannot teach a student to ride a bicycle by theory in a classroom. The student may embrace all the theoretical knowledge of the activity but this cannot prepare them for the feeling of balance combined with movement whilst self-propelling through pedalling. It must be experienced and practiced to synthesise the nuances of riding a bike, the acquisition of tacit knowledge.

Figure 16 Learning to ride a bike (florida biking 2012)

Gaining tacit knowledge is also described by Howell (Howell, 1982)as the 'Four Stages of competency ' Unconsciously incompetent, consciously incompetent, consciously competent, unconsciously competent.

Unconscious
Competence — Right Intuition

Conscious
Competence — Right Analysis

Conscious
Incompetence — Wrong Analysis

Unconscious
Incompetence — Wrong Intuition

Hierarchy of Competence
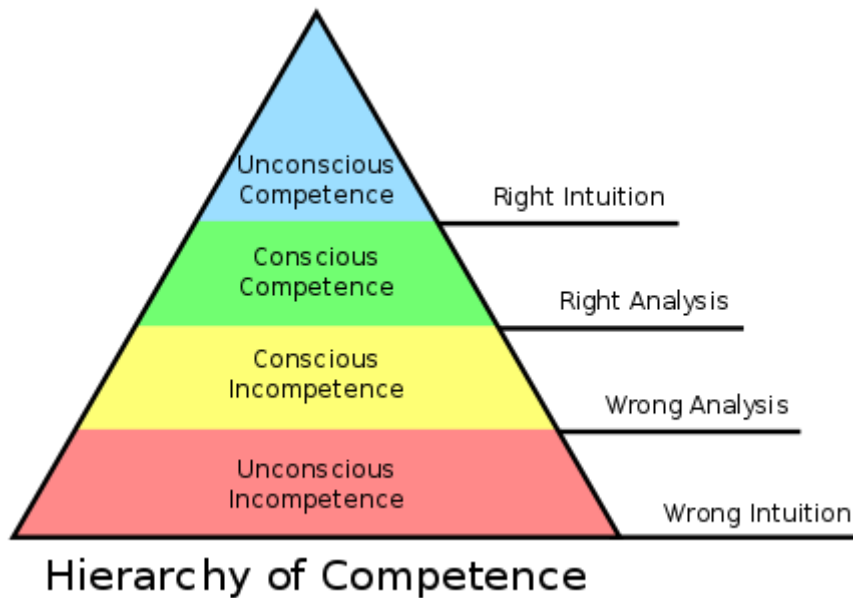
Figure 17 Hierarchy of Competence (Effectiviology, 2016-2018)

Howell describers that one must pass through all four states in order to learn. A good example of this theory may be learning to drive a car. At first the learner doesn't know what they don't know, they are unconsciously incompetent. As they begin to practice, they begin to understand all that they must master which as yet they have not achieved, they are consciously incompetent. Having practiced until they can perform the required task, they become consciously competent. When they have practised for long enough they begin to perform the action without the necessity to think about, it now comes automatically, and they are unconsciously competent. As Howell explains ''learning tacit skills takes time to become naturally competent…all they know is that it feels right when they do it'' (Howell, 1982)
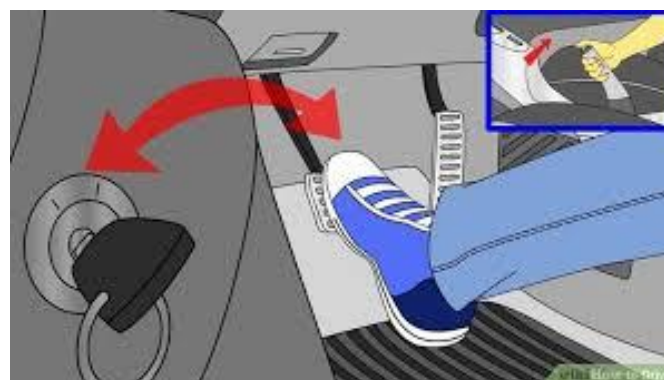
Figure 18 Learning tacit *(Lesson, 2016)*

The very nature of practice oriented learning, however, means making mistakes. As Aristotle explains ''For the things we have to learn before we can do them, we **learn by doing** them''.

In a design education context, for example, if a design student wishes to create a hand held object, they may discuss, observe, research, sketch, and generate concepts. This in itself is a

mixed process of tacit and explicit activities within a context, or in the design studio. However, to fully understand the artefact, the student must go through the process of making and using the artefact, similarly to the experience of riding the bike. Only then will they fully understand the feel of the object, the balance, the movement. By reflecting on this new tacit knowledge and experience, they are in a position to iterate, to remove flaws and introduce improvements. They have achieved a deeper understanding of the design by making and using, they have learned by doing.

Figure 19 Hands on - Learning by Doing Magdalena Musia Marmrin design studio

Other theorist go one step further to say that we learn from doing specifically through reflection of the experience. As Dewey describes it ''we learn from doing after we have reflected on what we have done''. (Dewey, 1916)

Schon describes this in 'The Reflective Practitioner' as reflection in action and reflection on action which enables us to think on our feet.

> ''The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understandings which have been implicit in his behaviour. He carries out an experiment which serves to generate both a new understanding of the phenomenon and a change in the situation.'' (Schön 1983)

This infers we make meaning and understanding in learning similar to Guillots making meaning from one experience and understanding how or when it may be applied in different

situations that present themselves. There is an initial experience followed by reflection to provide us with the tacit knowledge or understanding of 'thinking on our feet' or '' to see the unfamiliar, unique situation as both similar to and different from the familiar one, without at first being able to say similar or different with respect to what. The familiar situation functions as a precedent, or a metaphor, or… an exemplar for the unfamiliar one'' (Schön 1983).

This indicates that through a process of practice and reflection within a shared context, we are making meaning and creating new knowledge. These are the specific values being sought by our National Strategy as we move towards the emergent Technological University. We have mapped the process of knowledge creation as a series of tacit and explicit knowledge exchanges. Practice oriented learning has been demonstrated as a key component within the process but one at the most risk of erosion within the merging cultures of Technological and University models.

2 .2.7 Merging Cultures of University and Technological Institutes

A 'University Design School' may in itself appear a contradictory expression, as traditionally the university model of education has been far removed from the design school approach. University College Dublin was established by John Henry Newman author of the classic work 'The Idea of a University'. Newman was of the view that Universities should be a place of teaching universal knowledge. His aim however was not that of improving science, art or literature but of improving the person. This was introduced with the objective of;

 "training them to fill their respective posts in life better, and of making them more intelligent, capable, active members of society" (Newman, 1852).

This is a very different philosophy to that of the Institutes of Technology. The drivers behind the development of RTCs, IOTs and the emerging TU are clearly set on developing skills and knowledge to contribute to economic progress. As the Irish National Strategy for Higher Education (Hunt, 2011) aspires to achieve knowledge creation in tandem with the development of Technological Universities; design within an emerging TU model sits precisely in the centre of this debate for achieving balance between the existing dichotomies of objectives.

Design, by nature is an innovative and creative process. This national strategy therefore is an opportunity to promote design education within the emerging framework. It also explains why it is unsurprising that we see design thinking and the design process embraced by industry, policy makers and educational providers alike in this infonomic era. As stated, it is often misunderstood or misapplied with design practitioners themselves struggling to communicate their own tacit and subjective process. This may be the reason design has traditionally been marginalised by the university structure that is being embraced. As Wang (2010) explains ''many teachers of design believe that their discipline is marginalised, and they appear to yearn for greater academic respectability''. Included in the Hunt strategy is the transition of Institutes of Technology to Technological Universities. The aim is to amalgamate regional Institutions in order to develop better efficiencies and collaboration and ultimately provide university level offering.

''Together, the Institutions will form coherent and inter related systems and collectively will have the requisite critical mass for optimal quality and efficiency.'' (Hunt, 2011)

It would appear that a new educational model is required that provides a form of rigour while embraces subjective creativity; it is yet unclear how to provide both.

''in order for design education to become more rigorous – and more academically respectable – it must embrace a new paradigm that values creative experience'' (Wang, 2010)

There is a risk of hurtling design into a positivist framework in a bid to excel the intellectual rigour and fortify the traditional university model. As Wang puts it ''design is focused on subjective creativity, but the positivist university paradigm is focused on objective rationality'' (Wang, 2010). If design were moved into a positivist framework it would risk erosion of the design school studio, risk the subversion of the subjective creativity; ultimately failing in fully achieving the desired outcome for innovation and knowledge creation, called for in national strategy.

2.2.8 Conclusion

Global economic strategies signify the shift from production based economy to knowledge-based economy. This is recognised in Ireland's national strategy for higher education and has been further developed into a skills specific report. This report, 'Ireland's National Skills Strategy 2025' (Department of Education & Skills, 2016) is about prioritising specific skills that are relevant to the needs of learners, society and the economy.

''We need to create an environment where ideas flourish, not to produce drones with skills, our graduates must have a strong emphasis on creativity and flexibility and think outside of the box'' (Department of Education & Skills, 2016)

The report indicates specific skills of importance in the future development of graduate attributes; skills we recognise as taci,.

'' skills as identified by enterprise include creativity, innovation and entrepreneurship, critical thinking and analytical thinking, team work, communication and business acumen'' (Department of Education & Skills, 2016)

In Irish Higher Education, the Institutes of Technology seek to respond to national strategies. Some are transitioning to Technological Universities. This brings the opportunity to create appropriate frameworks for design education, which reflect the merit of design in achieving creative, innovative and critical thinkers. The challenge is in providing the rigour and transparency of an appropriate framework to communicate and transfer these skills.

This study demonstrates the process of design as a model of knowledge creation and pinpoints how it maps to stages for tacit knowledge. This assists in communicating the necessity for both explicit and tacit knowledge in order to achieve knowledge creation within

creative, innovative and critical thinking contexts called for under national strategies.. This informs the strategy for TU by contributing to *how* the aims are to be achieved. The 'Knowledge Creation Theory and Practice' is a graphic which can be used by other disciplines who wish to access the design approach as we transition towards a new tertiary educational model; Technological University.

3.0 Methodology

3.1 Epistemological Approach

This chapter outlines the epistemological and methodological approach taken for the research. Design research is based upon the ability to identify and implement the most appropriate approach to data collection and the analysis of collected material. This forms part of the research project planning and management.

The overall approach deemed most appropriate for this particular research was 'research through design' which is an interpretive method. The approach was selected as it does not pursue verification or falsification but rather an interactive interpretative dialogue with the design situation (Frayling, 1993). This is appropriate when the research seeks to uncover strategy as opposed to gathering facts or data, we seek instead to make meaning of the data.

Christopher Frayling (1993) as professor at the Royal College of Art, distinguished between three types of design research. Research into, for and through design. Research *into* design is a straightforward conventional approach from the perspectives of history, society, cultural studies etc. Research *for* design supports the design process of producing product or artefact. It may involve semantics or materials research. Research *through* design, however, is an approach which is not focused on verifying a fact or theory- an approach better suited to positivist frameworks but seeks to make meaning from synthesis of facts and observations. Research through design requires direct input from the researcher. As Erlhoff & Marshall (2008) describe it "researchers interact with it "and that "design research and theory at their most intelligent could be described as experience-based judgement". In other words it relies on input from the researchers themselves, prior experience and judgement calls. Research through design presumes an interpretative understanding of the material or data being collected. It works when there is an openness and readiness to engage in new or surprising situations in the course of research.

Research through design is a qualitative approach but also being interpretative it is a subjective approach. Interpretivisim is a socially based research paradigm that bases its assumptions on reality being socially constructed by and affected by people. The researcher seeks to understand or make sense of the experiences through interpretation. This approach is demonstrated in Fig 1 which is the project overview. This chart presents the chronological time frame of the project and indicates how and where the research questions were formulated and refined as the project progressed. It is from each research question that the methodology of approach is taken, findings analysed and conclusions made. The conclusion also informs the next research question. This demonstrates the interpretative approach used throughout the project. Whilst this method provides a clear rationale for the project direction there is still an amount of subjective interpretation.

 This methodological approach is based on an interpretative qualitative framework which relies on the input of the researcher, their prior experience, intuition and interpretative understanding of the data collected. The validity of this method is established through several methods. An audit trail provides a clear description of the methods and procedures used.

Triangulation between different data sources of observation and interviews were conducted with focus groups from multiple educational disciplines. Member checking was conducted throughout the research through conference attendance at both educational and economic conferences. The researcher also used prior experience which is presented as epistemological positioning, as a design undergraduate and business owner to provide reflexivity to gain further insights. The data and findings were drawn up on a large white wall to ensure contextualisation of information. Peer review was gathered at multiple points throughout the thesis to ensure the broadest and most current feedback on findings. Finally thick description of the entire process is presented through thesis preparation.

One approach in research through design to synthesising information involves deep interaction with the data through visual mapping. This approach was selected on the basis that visual mapping would provide a means to deal with the complexity of considering three key areas of research namely; policy, industry and education. The visual mapping enables us to see how and when policy, industry and education interact to arrive at today's strategy for the emerging TU's. It also uncovers the process of knowledge creation and enables a demonstration of the process in visual representation.

3.1.1 Researcher Positionality

Using an interpretative methodology and yet coming from a design background meant it was unavoidable that in the study the author introduces a certain level of subjectivity and bias. As research through design was the overall methodological approach to the project there is much interpretation of findings which requires input from the researcher. Previously gained knowledge and experiences will therefore inform much of the decision making and interpretive perspective. The researcher in this instance has two main influencing factors in relation to the project. The first is background as a business owner/manager of an Irish Small to Medium Enterprise (SME). (WhelanL, 2018) According to latest figures from Central Statistics Office (CSO, 2017) there are 248,344 SMEs active in Ireland which accounts for 99.8% of all enterprises. Based on the researchers experience the very nature of enterprises being small is a key factor in the type of employee attributes which are sought after. The employees are very often required to be multifunctional and diverse in abilities. This provides insight into the research in so far as it frames the actions and activities which produce desired graduate attributes appropriate for todays and future industry needs.

The second influencing factor from the researcher is the experience of being a graduate of design from an Institute of Technology. This has provided an understanding of activities of design within a studio setting. More subtly it also provides an insight into the nuances of studio interactions. These may appear almost incidental to the process from an outside view but in fact they play an intrinsic part in building and scaffolding of new idea and innovations which is informative to the research. The researcher is currently based in an IOT and as such is also part of the dynamic of the transitioning IOTs and emergent TU movement, providing an internal perspective.

3.1.2 Limitations

Time limitations on the project both in general and as a result of publishing throughout, meant that the original plan to produce an actual framework towards the TU only reached a point of providing a foundation for future work.

The mapping of design interactions as a model of knowledge creation was beneficial in understanding how and where specific activities take place which are essential to the process. It would have been equally beneficial to conduct this exercise with a range of other disciplines to measure the effect of the model as a template.

Using an interpretative methodology and yet coming from a design background meant it was unavoidable that in the study the author introduces a certain level of subjectivity and bias.

In conducting interviews with commercial practices, the research was limited to design practices. It would be of value to interview non design industry to ascertain the graduate attributes they are seeking. This would inform the research of the transferability of design graduate attributes and provide insight into industry needs in general for critical thinkers.

3.1.3 Context

Throughout the research, the key area of consideration was education. The additional areas of economy and policy were used throughout the project as a supporting contextual pillars. These themes were captured in an initial co-aligned timeline throughout the literature review. The field research is also presented in the main context of education but with the supporting sections of economic and policy pillars. Publications also spanned design, education and economic journals and conferences. In considering the educational context it is important to note the IOT setting as the perspective viewpoint. In doing so it is possible to recognise historic cultural norms which the IOTs present. This is a historic culture of experiential learning, apprenticeship models and close industry relations. It was therefore relevant to the research to provide the supporting context of economy and policy as they have traditionally been so closely linked to the IOT sector as influencing factors.

3.1.4 Research Design

The first approach in designing the research was to conduct pilot research into the terminologies and definitions of the research title. This enabled the overall research area to be broken down into more refined and specific research questions. As the research area is dealing with a transitioning higher education structure, the first question to be answered is in relation to the historic structures and strategies of Irish higher education. This will provide clarity and a contextual background for exploring the elements of knowledge creation within design. The research design to approaching this question is to begin with a literary review into the historic developments that led to today's IOTs and the strategies behind them. The aim being that this approach may reveal the drivers behind the current strategies and provide insight into the purpose of the focus on knowledge creation today. The literature most relevant to this is primarily government reports which by their nature are factual, detailed

and in some cases complex. The research design towards analysing this data is to produce a visual timeline which will assist in extracting and positioning relevant information and also provide a shared contextual backdrop for multiple sources of data.

Early findings from this timeline indicate that higher education is greatly influenced and impacted by economic and policy drivers. The research design for approaching the rest of the project takes this in to account and introduces two supporting strands or themes of economy and policy throughout the project.

This clear mirroring of economic drivers and impacts can be witnessed on the technology sector education, this includes the current economic strategy for knowledge creation. As per the research design, in using an interpretative methodology, this answer now informs the next research question; how is knowledge created, specifically within design education?

This question is seeking a very specific understanding of activities and interactions with the design education setting. In order to address this, the research design focussed on a second phase of literary review, followed by extensive field research. This included interviews, observation, interactions with students and academic staff and attendance at conferences.

The research design is to observe in a studio setting the practical application of the theoretical process of knowledge creation within design education.An educational provider will be selected for interview on the basis of having at least three years' experience in an IOT, who delivers classes to design and non-design students, who is not from a design background. This will provide an insight into how design students are viewed in their approach and how their approach may differ to others. The design students have a culture of practice based learning within a design studio setting and the philosophical lens of this culture may bring a different approach to that of a student from a traditional non-studio based environment with a more objective and rational approach to problem solving.

To further capture these differences the research design is to engage with the students from design and non-design backgrounds. In this case it will require more than an interview approach in order to fully observe and capture the nuances of the potential differences in approach. A workshop was devised which presents hands on activities and a complex team task in order to observe approaches. The workshop activity selected was Kaos Pilots which will present a group a complex task in a chaotic setting. As the selected educational provider to be interviewed teaches both design and marketing students, the research design is to triangulate this and continue to the Kaos Pilots activity with design and marketing students. The full details of this phase of research are presented in Field research 4.2.2 & 4.2.3 of thesis.

The final research question is how can the value of practice oriented learning and tacit skills embedded in the design approach be retained in an emerging TU. The research design is to seek a broad view of how other disciplines nationally and internationally deal with practice oriented learning such as, military, engineering and health sectors. This will provide valuable insights to potential areas of further research such as assessment techniques and provision for team tasks. Also of interest to answering this question is to consider the industry strand. What are the graduate attributes being sought by industry practice today and do they value practice oriented learning and tacit skills. The research design therefore is to select one of

Irelands major commercial design practices, who have an International office and context to inform the research. This will provide the research with insights into whether the tacit skills formed through practice oriented learning such as critical thinking, leadership, navigating in a team for complex problem solving are all sought after graduate attributes in commercial practice today.

Throughout the research the TU may emerge, making this a critical time in how Higher Education policy implement the proposed strategies. The research aims to contribute to the discussion with an understanding of the nuances of a design led approach to achieving the intended strategies. The research design is to therefore ensure the most up to date capture of Higher Education policies in Ireland as they are delivered. In order to do this, the researcher will attend Dail Eireann for the live debates on the TU Bill and attend the launch of the 2017 Action Plan for Education.

The overall project methodological approach is interpretative so the research design also includes varying methods for ensuring trustworthiness throughout the project. This research project, whilst based within the discipline of design and using a design approach, will not involve the design of any product or artefact. It is common within design to use a prototype or artefact to test or demonstrate findings. As this project is embedded in the area of education and policy, in this instance a prototype or artefact would not be the appropriate means for testing or demonstrating findings. The publication of papers and articles, would create an active test bed for findings through formal process of double blind peer review at key points in the project before progressing to next stage.

This will provide the opportunity to member check findings with educators and validate conclusions with other researchers. This will also provide an audit trail and credibility to the findings and conclusion. The research design for approaching the publications is as follows;

- Methodology- provide a test bed as part of interpretive methodological approach
- Data collection point for national and international context
- Network – provide opportunity to build research network
- Dissemination – a tool to disseminate research nationally and internationally

Methodology – Test Bed

As part of the methodological approach, publication will provide peer review in two ways, firstly through the formal double blind peer review process, secondly through the informal peer feedback at conference attendance and discussions.

Publication and presentation will provide the opportunity at key points in the project to receive peer review of findings which will assist the decision making process when using an interpretative methodology. This will provide an opportunity to gain validation of work and also critique, identification of any gaps and reader expectations as to what may come to follow. This will act therefore as a test bed to research throughout the project, ensuring work is in in line with current data and up to date but also that it is covering an area that is explicitly being sought after for answers within the collegiate and policy spheres and adding to the discussion. To ensure further rigour to the process, the conferences selected should be of an

International perspective and include specific educational conferences and publications as well as design. This will provide the transparency and validation of work outside those of the design discipline.

Data Collection Point

The conferences will also provide an excellent point of data collect through the opportunity to hear many other speakers discuss areas of the latest research. This will provide context, relevancy and reflection opportunity.

Network

International conferences offer the opportunity to build a network within the research community. Through informal discussion, gala dinners and coffee breaks, networking is possible. This may provide the opportunity to seek future collaborations for research papers and a sharing of ideas.

Dissemination

The early stage research has highlighted the need for knowledge transfer to serve the aims of a knowledge based economy. In order to demonstrate this, the research design is to disseminate throughout the project to an International audience. Publications and presentations through conference will provide a platform to do this.

The final activity within the research design will be to bring together the overall research design, findings and conclusions to present at International Conference (European Academy of Design) for additional peer review and feedback from other researchers to ensure the most up to date conclusions prior to thesis write up.

3.1.5 Planning

Planning for the project involved three key stages;

1. Preparation for beginning
2. Halfway capture and project positioning
3. Preparation for write up

Preparation for beginning for the project:

An initial list of proposed documentation and data collection filing was created, along with a gantt chart for use throughout the project. Templates were also created where appropriate, for example, minutes of meetings. This was sketched out into a project documentation system which was formalised into a graphic representation (fig21). This informed a filing system prior to entering into data collection or supervisory meetings to ensure efficient project documentation management.
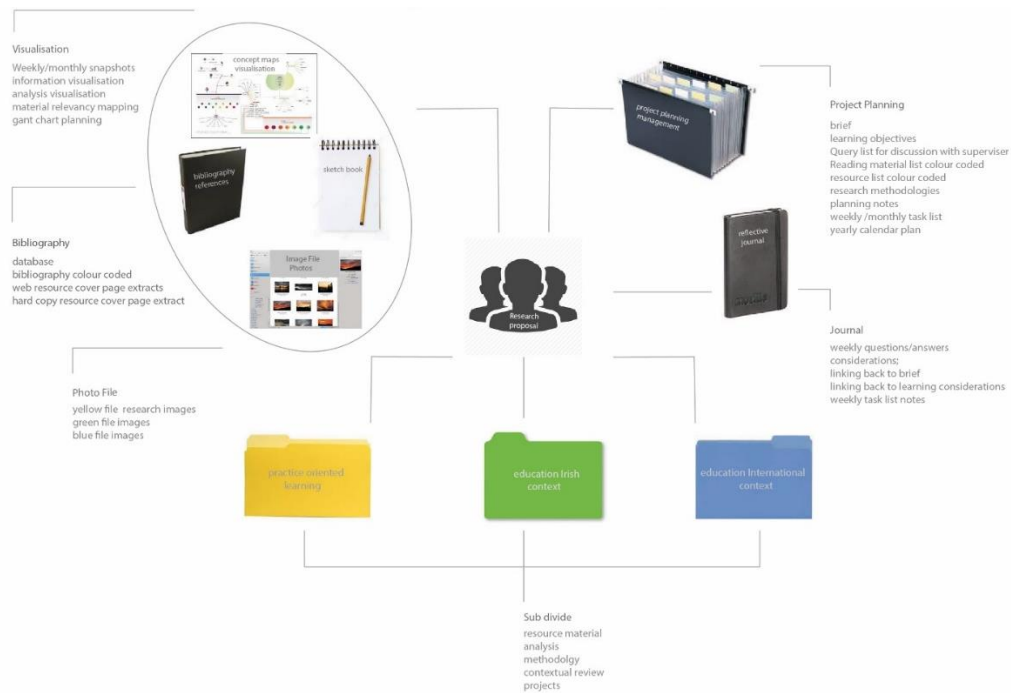
Figure 20 Project documentation planning (Authors own 2015)

Halfway capture and positioning

As part of the project planning, positioning diagrams were created around the halfway point of the project. These diagrams ensured ease of communication with supervisors and peers when discussing the project and before moving forward. The below (Fig 21) diagram provides a broader contextual setting for the area the research is focussed (highlighted in orange).
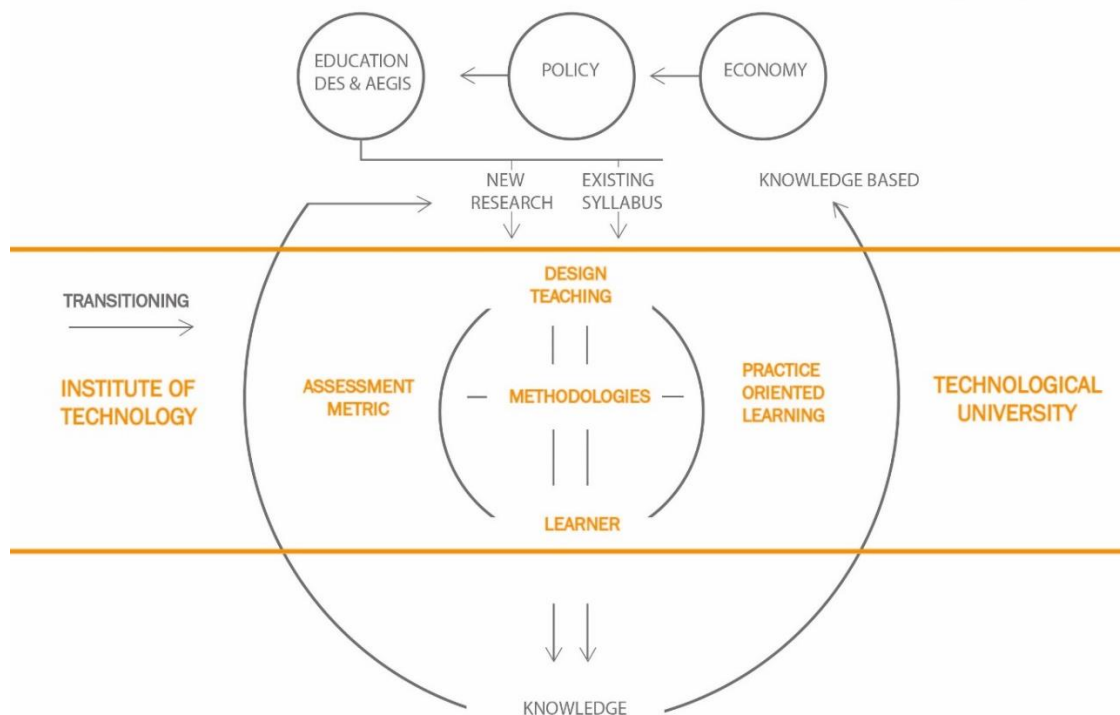
Figure 21 Project positioning (orange) within the broader context of knowledge transfer (grey) (Authors own 2015)

This chart demonstrates a cycle of knowledge transfer. Beginning with economy, we have uncovered in the literature review that economic demands influence policy decisions which in turn are fed to department of education from which strategies such as Hunt (2011) are formulated. These strategies are introduced to the educational syllabus and proceed through the teaching and learning process. The output from the teaching and learning experience should be knowledge, some of which is new. This knowledge in turn can be disseminated directly back into the economy and also back into the syllabus for teaching and learning experience. This cycle of knowledge transfer is represented in grey.

The project aims to research the area, highlighted in orange, of the methodologies of practice oriented learning, and assessment techniques within the context of the broader knowledge transfer cycle throughout the transition of Institutes of Technology towards Technological University.

Planning for final phase write up

Fig 24 presents an overview of the research project chronologically over a two year period. The distinction between this overview and the thesis content list, is that this is the actual unfolding and occurrence of data collection, analysis, and write ups throughout the project. However the thesis content has been arranged and presented in a manner which ensures the reader clarity of narrative. This chronological overview however, highlights the iterative and interpretive nature of the process by demonstrating how descriptive data and events were gathered, analysed synthesised and finally interpreted to form the next research question. It also visually represents the convergent/divergent nature of the process used. The research begins in a divergent or broad sweep of information and data. This involves, scoping and visual mapping. This is followed by convergent activity of identifying and framing the research questions and findings. This approach ensures a wide capture of data, deep analysis through visual mapping and clear framing of findings to direct the next stage as an interpretive process.
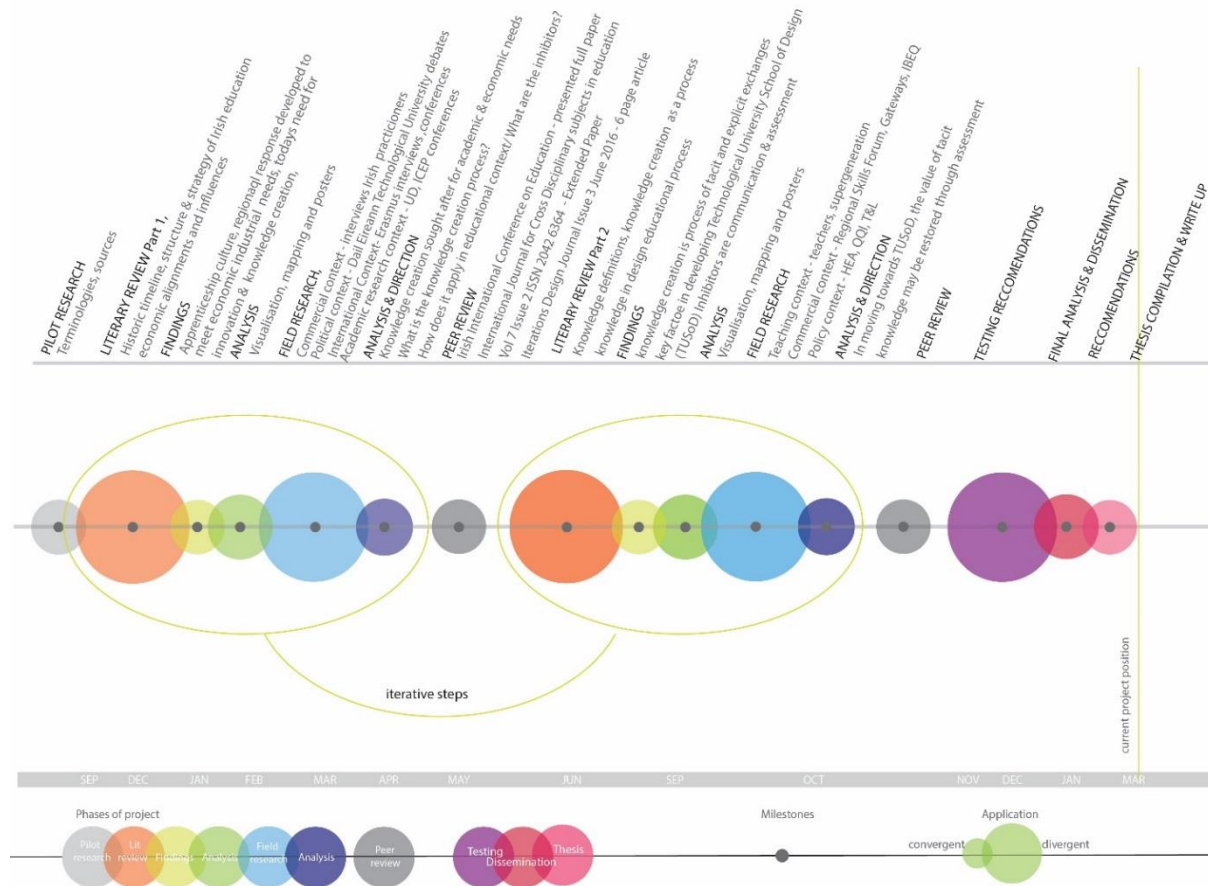
Figure 22 Project Chronology overview

The project activities were mapped chronologically. Reflecting on the project activities it was possible to map the research questions as they were formulated. (Fig 23) This provided a platform to build in methodology of approach in answering each question and to record the findings and conclusions that were drawn. This ultimately visualises the project in its entirety and provides clarity of narrative to frame in the overall abstract to communicate the project to others. This final visualisation of total project overview was captured as a graphic (Fig 24)
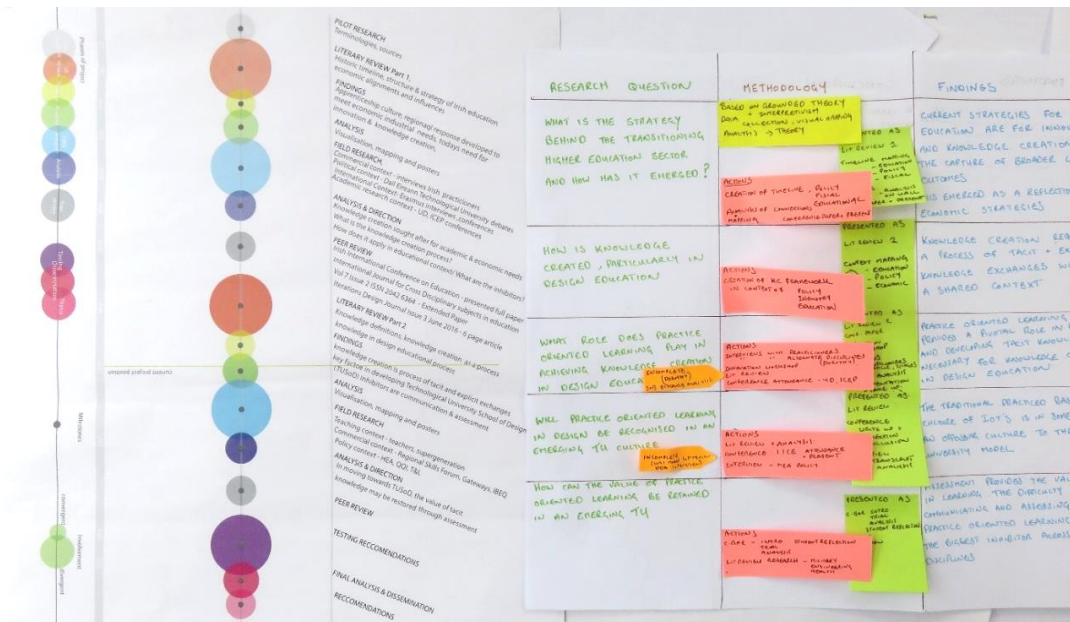
Figure 23 Research questions captured and aligned with methodology, findings and conclusions
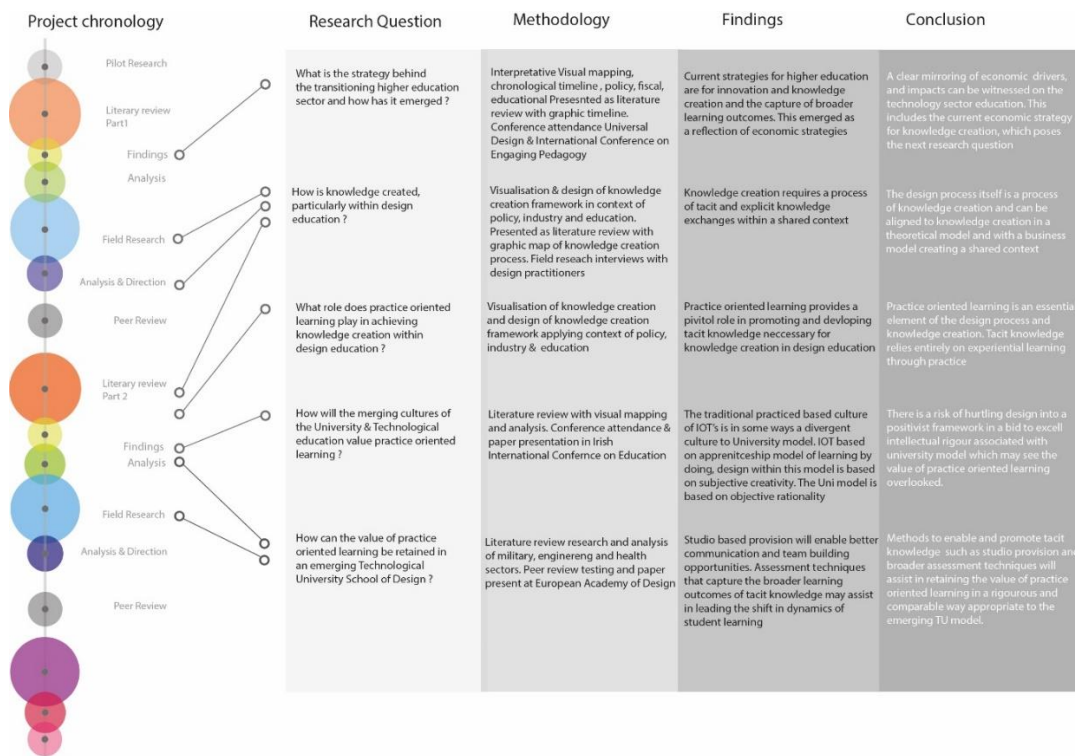
Figure 24 Project Chronology and research activity

3.2 Creating a Visual Timeline 1958-Present

To explain this project chronology, we begin with the pilot study. The pilot study identified the three categories of context to the research; EDUCATION-POLICY-ECONOMY. A literature review was conducted to uncover the strategy behind the transitioning higher education sector policy. An historic capture of the foundation of Irish Regional Technical Colleges and the events that surround it was reviewed and subsequent developments to the present time.

This began with the structure of Irish higher education fig 25. In order to begin uncovering the strategies of higher education, it was necessary to gather the data on the existing structure of higher education. This process began with a 2004 report on the structure of the education system being listed into an overview and then placed into the context of the national governance structure.
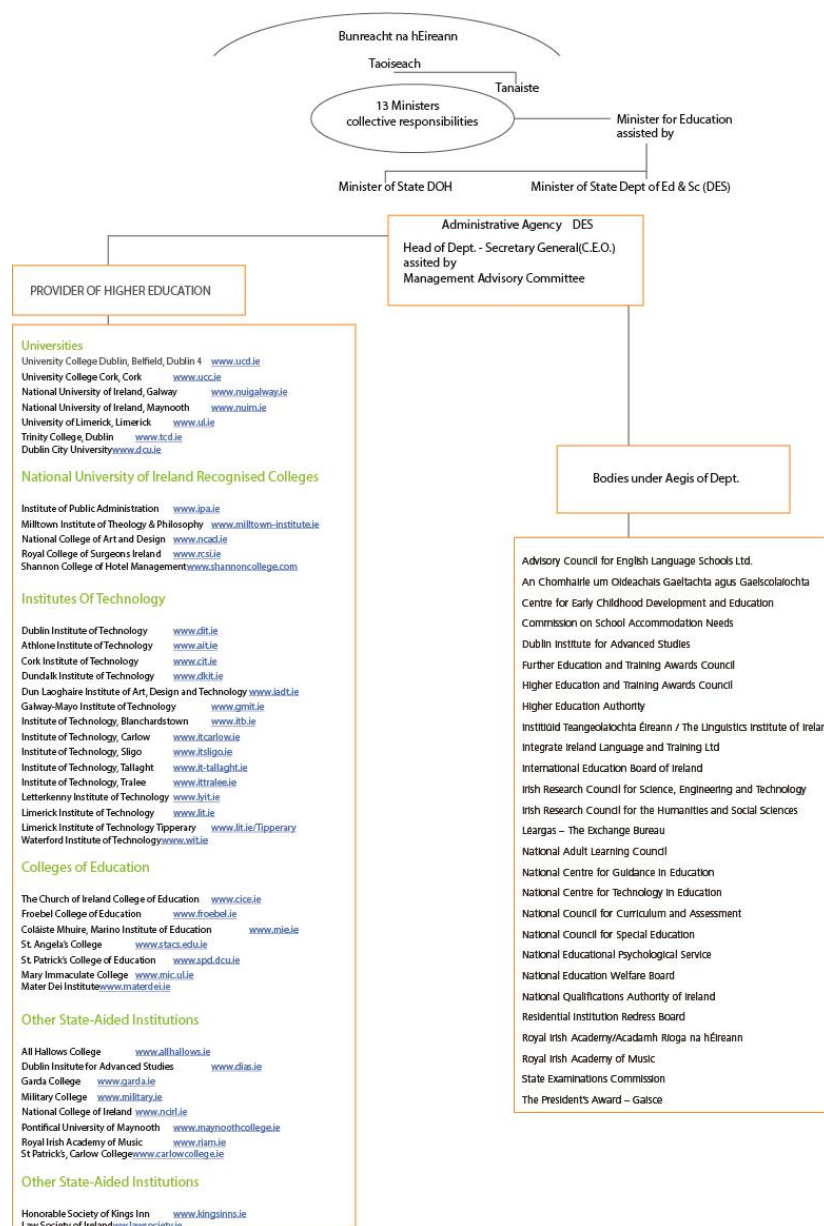
Figure 25 Irish Higher Education structure in context of National governance structure (Authors own 2015)
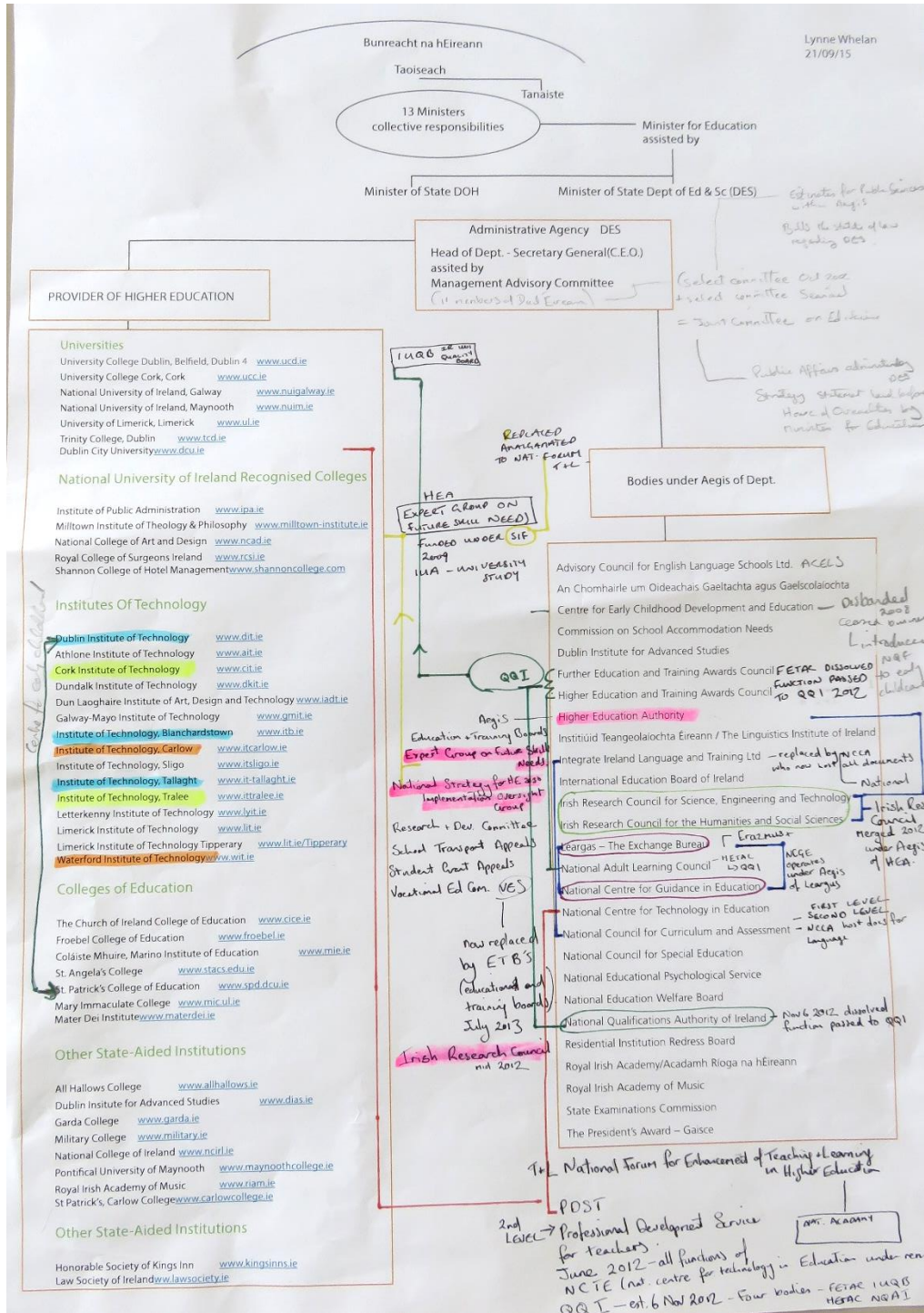
Figure 26 Analysis of amalgamations, changes and developments of Irish higher education structure

By creating a visual of the structure it was possible to analyse the changes and development which have taken place. Amalgamations are mapped, development of new departments and a synthesis of the information begins which assists with uncovering the strategy. This information was developed further by applying the structure, or more notably, the changes in the structure, to a chronological timeline.
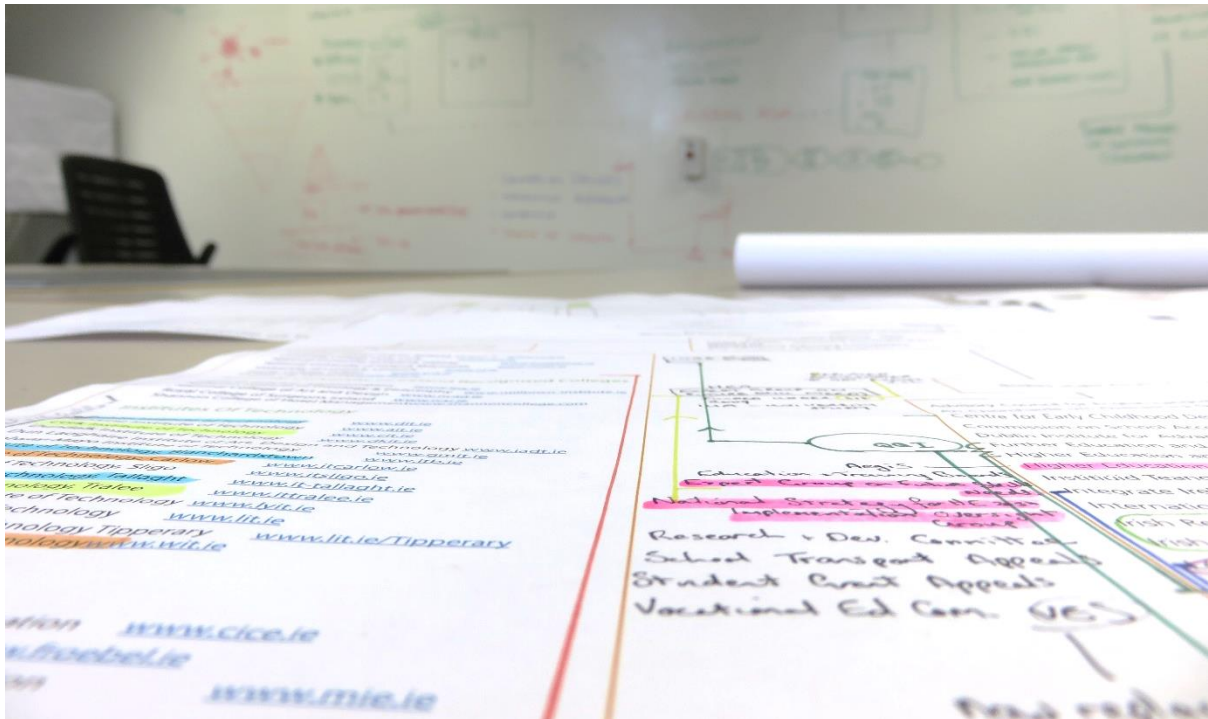
Figure 27 Expanding the data to mapping on the wall in chronological timeline
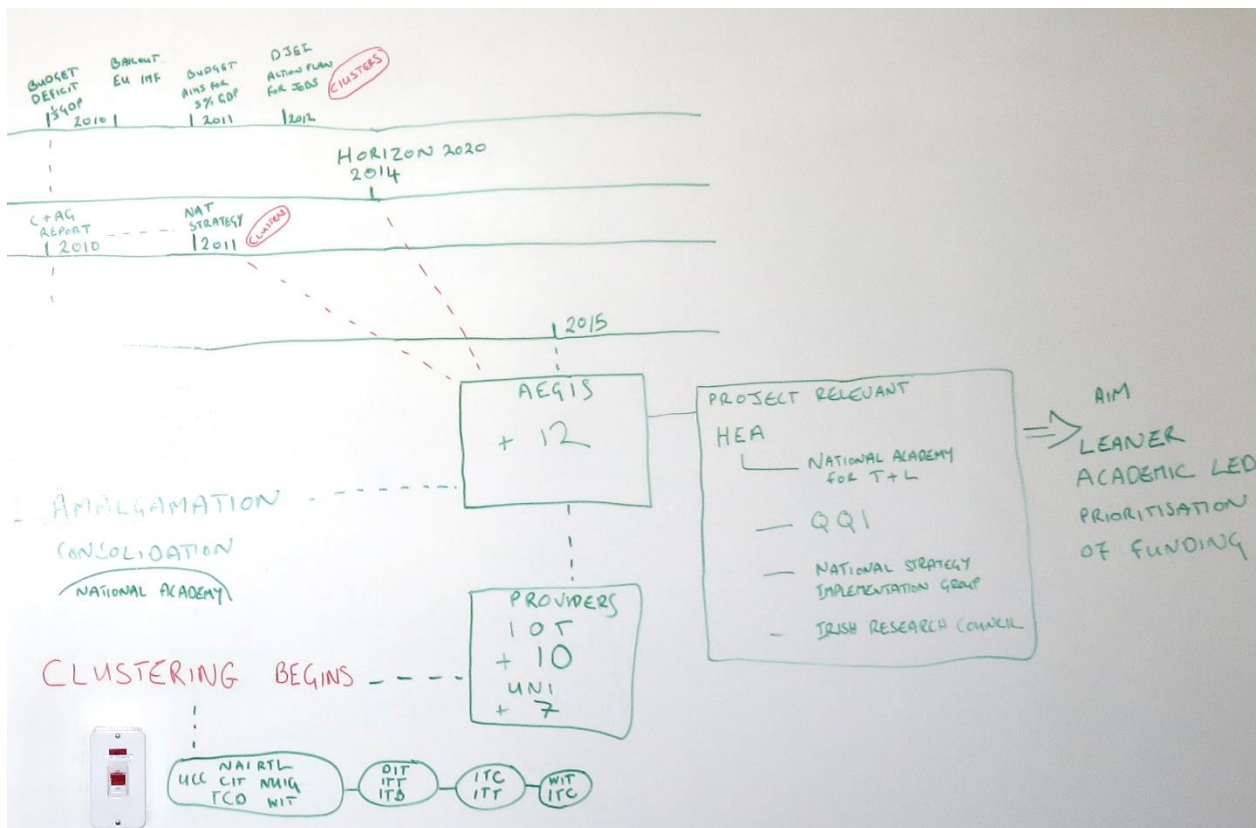
Figure 28 Alignments become visually clear enabling analysis

Figure 29 Process of mapping chronological fiscal, policy and educational activities

The timeline began as a mapping process on the wall (Fig28) recording, initially the changes in the educational structure over a time period. Added to this was the release of new policy reports or policy changes in an economic and educational context both nationally and Internationally .The time period covers the lead up to the foundation of Regional Technical Colleges in Ireland to the emergent Technological Universities which is C,1958 - today.

This process of visualising all the data in this shared contextual way, enables deeper analysis of data. Connections and parallels become apparent. This process, through logical reasoning, uncovers strategies behind the developments in Irish higher education. This data could now be translated into an infographic timeline (Fig 30), which demonstrates the influences and drivers behind the transitioning higher education sector that are discussed within the literature review.
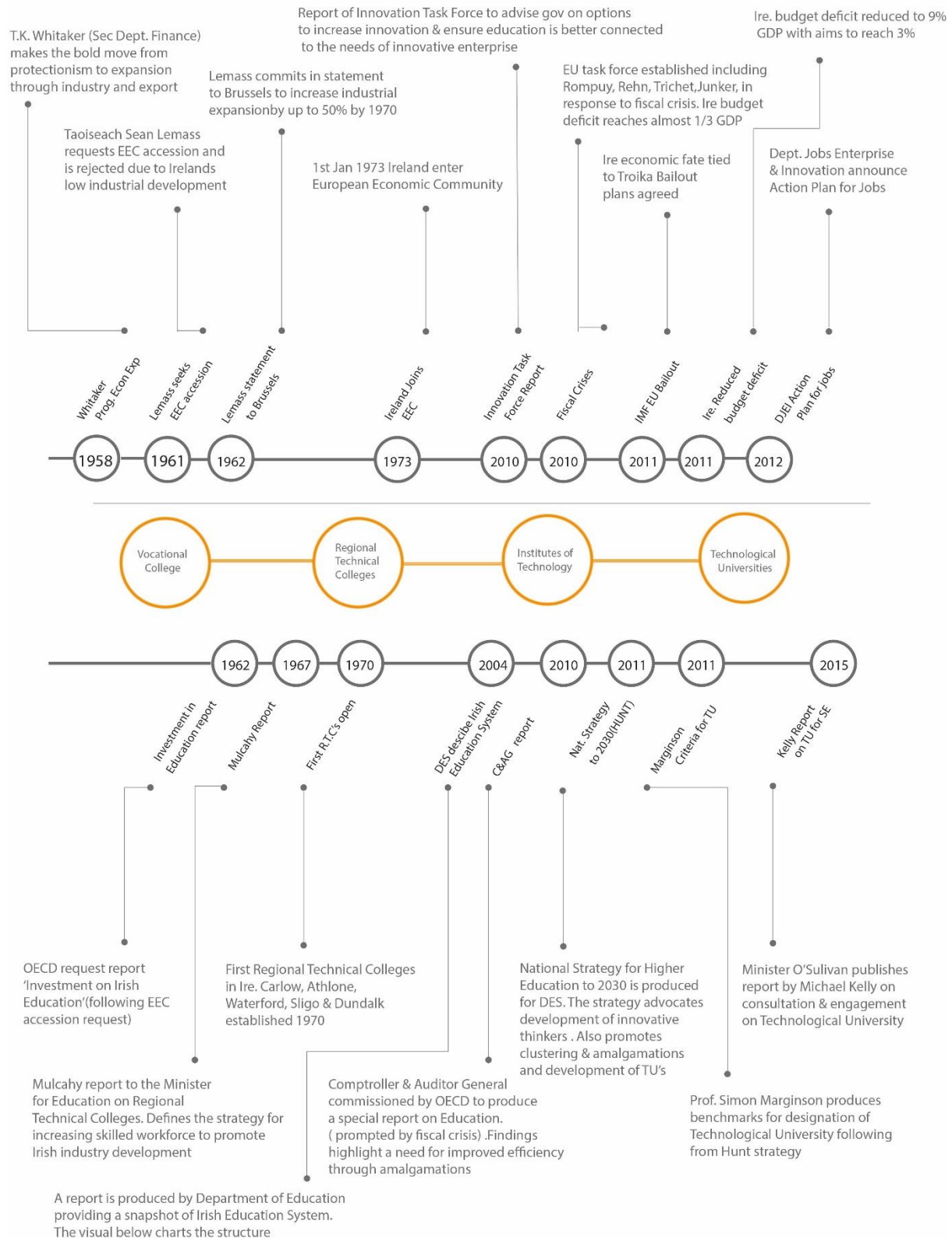
Figure 30 Timeline - demonstrating the economic drivers behind transitioning higher education

The literature review discusses the documents and reports throughout this timeline and the European and National economic policy and the follow on educational policies which reflect the strategies. Visually mapping the literature information in this way enabled deeper analysis and uncovered the interplay between economic and educational strategy.

The second stage literature review followed from a period of field research which was used to capture further data but also to act as a design research evaluation process. The findings are that strategies for higher education are founded in precursory economic strategies and policy. The second stage literature review built upon these findings and analysis. The methodological approach was again visual mapping to assist with interpreting the information but more importantly to test theories on the information.

3.3 Creating a Visual Demonstration of Knowledge Creation

To explore and define knowledge creation, the SECI model of knowledge creation was mapped out as a series of tacit and explicit knowledge exchanges. This was then drawn up on the white wall in order to begin creating a context around it.
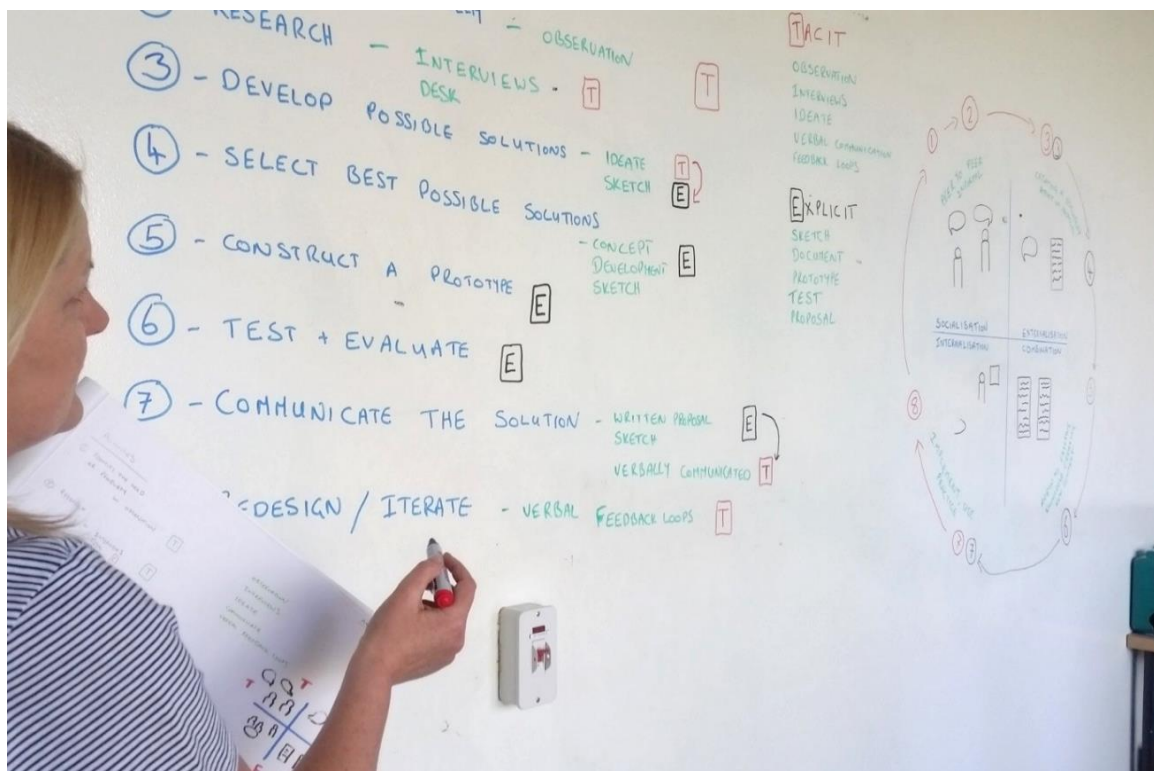
Figure 31 listing the design process in context of the theorists view

The design process is listed out as an eight step process and considered in context of the knowledge creation process mapped from SECI model.A letter 'E' for explicit and 'T' for tacit is them marked at each step of the design process to map the exchanges throughout the process from tacit to explicit knowledge .

The information can now be considered as a whole and it becomes apparent through this visualisation, that the design process can be clearly mapped over the theoretical view of knowledge creation to demonstrate design as a working example of the theory in practice.

Figure 32 the design process mapped in red around the theoretical view

A graphic representation was then produced to assist in communicating and demonstrating these findings .
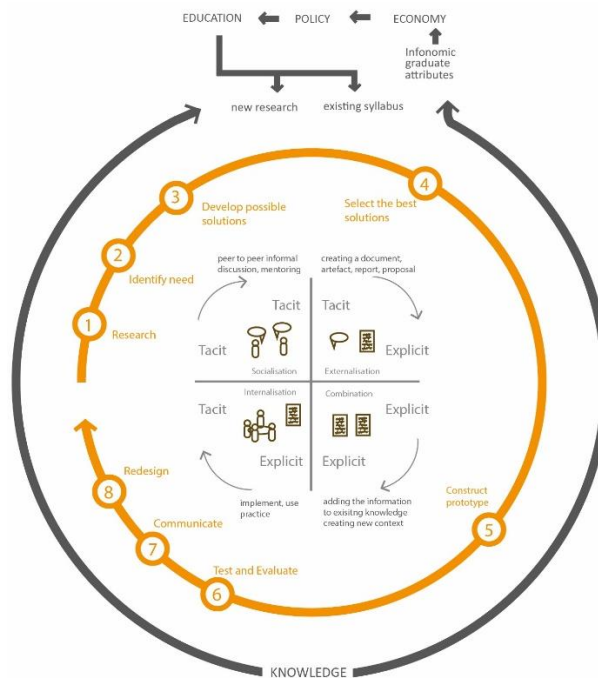
Figure 33 Design as a process of knowledge creation within the broader context of knowledge transfer

3.4 Field Research Approach and Methodology

Early findings indicated that higher education is greatly influenced and impacted by economic and policy drivers. The research design for approaching the rest of the project took this in to account and introduced two supporting strands or themes of economy and policy throughout the project. The field research focus was therefore on education but also included the themes of policy and economy.

Field Research Educational Context

The research design devised an approach to the educational field research including selectivity of the activities and participants. The first research question to be addresses in the field research was 'what is knowledge creation, specifically in a design education context? The research to this point has identified the theoretical process of knowledge creation within design education. In order to verify these findings, interviews and observation exercises with students and academic staff were devised.

The research began with an interview with a lecturer who teaches both design and non-design student groups. The interview was semi structured and the approach was to ask open ended questions. Open ended questions are most appropriate when you want to elicit higher level thinking such as application, analysis, synthesis and evaluation. In this case the aim is to extract the subjective and interpretive view of the interviewee based on their own experience of teaching both design and non-design students. Questions such as 'What are your observations of student approaches to a task from design or non-design backgrounds?' This may be followed with prompts such as 'tell me about that'. The interview was recorded with permission which enabled a more natural discursive interaction without the need for excessive notetaking. Once the interview was complete, the recording was transcribed and analysed. A thematic analysis approach was used. This involved colour coding themed areas of text (Fig 34); key points of relevance to project –new information, – verifying information, and authors' observations in order to extract and better reflect on specific points of relevance to the project.
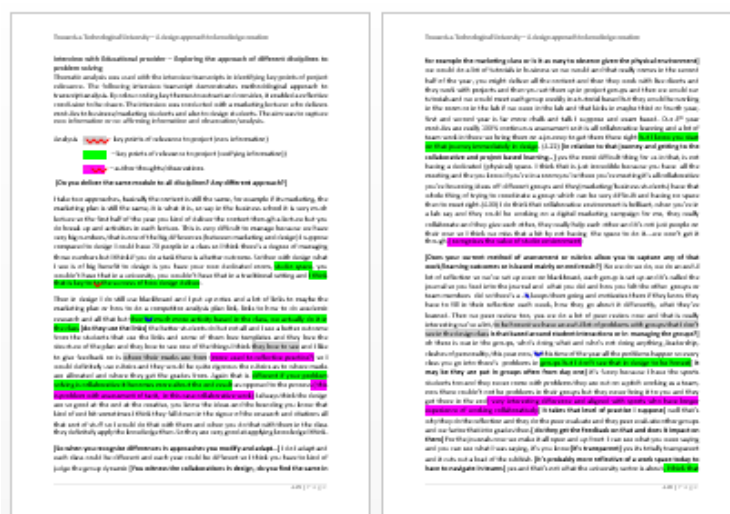
Figure 34 Colour coding themes to analyse interview transcript

Following the interview, the research design informed the selection of an innovation workshop programme in order to observe student approaches from design and non-design backgrounds. The research design selected the following exercise to observe a design team and a non-design team entering just such a chaotic space. The exercise selected was 'Lego & Creative Collaboration 'created by KAOSPILOTS(Fig 35), a world class 3rd level school for social innovation and entrepreneurship in Aarhus, Denmark. This presented a complex problem to be solved as a team. The specific constraints that the workshop presents such as; no one is allowed to speak, no one is allowed to show their instruction, no one person has the answer etc, create a situation which can become chaotic and through which the students must navigate as a team. This exercise therefore requires particular tacit skills such as, complex problem solving, and the ability to work in a team, critical thinking, and accommodating alternate objectives. The workshop provided the opportunity to observe first hand any difference of approach between a design team and a non-design team to working as a team on such a complex task.
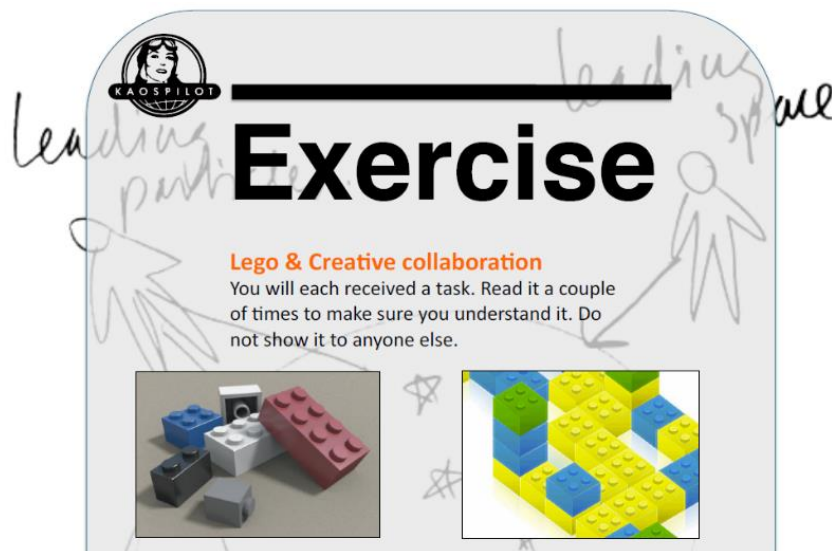
Figure 35 Kaos Pilots Lego & Creative Collaboration used for Observation Field Research

In preparing for the activity, the researcher trialled the exercise alone in order to better understand the activities from a first-hand perspective. This provided some understanding of the process and assisted in in preparing the physical space and equipment required. In order to fully trial the team dynamic of the exercise, a group of research colleagues took part in the exercise (Fig 36). This provided further understanding that informed further planning. It was decided following this pre-trial that a repeat of the exercise when the students had finished, would be of value to the research. This would provide the opportunity to apply any learning outcomes which may be demonstrated on the repeat exercise. This further informs the research of tacit learning outcomes from experiential learning.

Figure 36 Pre-trial to prepare for Innovation Workshop

The first innovation workshop took place with design students who were, selected based on criteria devised in the research design. The equipment, space an environment were noted in order to replicate for the second workshop. The workshop must also be specifically timed and instructions given in a precise manner in order to replicate. The workshop was observed by the researcher and notes taken. Images were captured throughout the entire process of the activities. The team also took part in a reflective practice(Fig 38) which was a group discussion captured in note form.

Figure 37 Images assist in creating a replicable environment
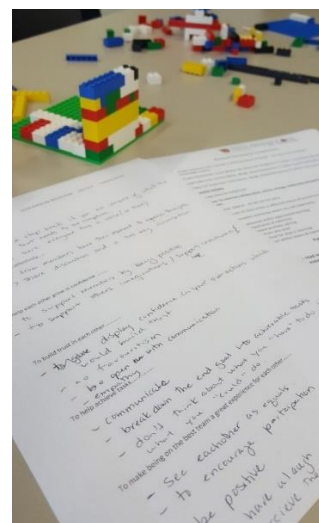
Figure 38 Reflection capture

The second innovation workshop was conducted with marketing students who had been selected through research design criteria. The innovation workshop was repeated as per the first workshop with design students. Special attention was paid to ensuring wherever possible the exercise was delivered in a similar manner to the first. This assists in providing the best opportunity to draw conclusions in relation to the influence of different educational backgrounds from any difference in approach observed. A reflection was carried out and captured.

The results of this activity in field research was the demonstration of a difference in approach to problem solving and experiential learning which Lawson describes as "a direct result of

different educational experiences" (Lawson, 2005). This informs the research conclusions of how group work, complex problem solving in unknown spaces and innovation seeking approaches are part of the tacit skills formed through the design led approach. However, it can be said that ultimately the experiential approach still provided valued learning outcomes from all disciplines even when approaches differ, thus verifying the research findings that the design led approach may be of value to other disciplines.

The analysis of the workshops was through reflective practice and thematic analysis of participant's reflective practice. The thematic analysis sought to identify positives and negatives of team/group work, levels of comfort with no set parameters and perceived outcomes. A facilitated short reflection on what had happened took place. The participants were asked to consider what worked well, what didn't and what they would have done differently. This stage of the exercise provides the research with some observations on the approach of design students to working as a team to deliver a task that is undefined and without parameters. The skills demonstrated included being comfortable with an undefined problem, working as a team, allowing leaders to emerge, working without parameters, problem solving towards a joint goal. These are all tacit skills which are developed through design activities which the research has identified as being sought after by many disciplines.
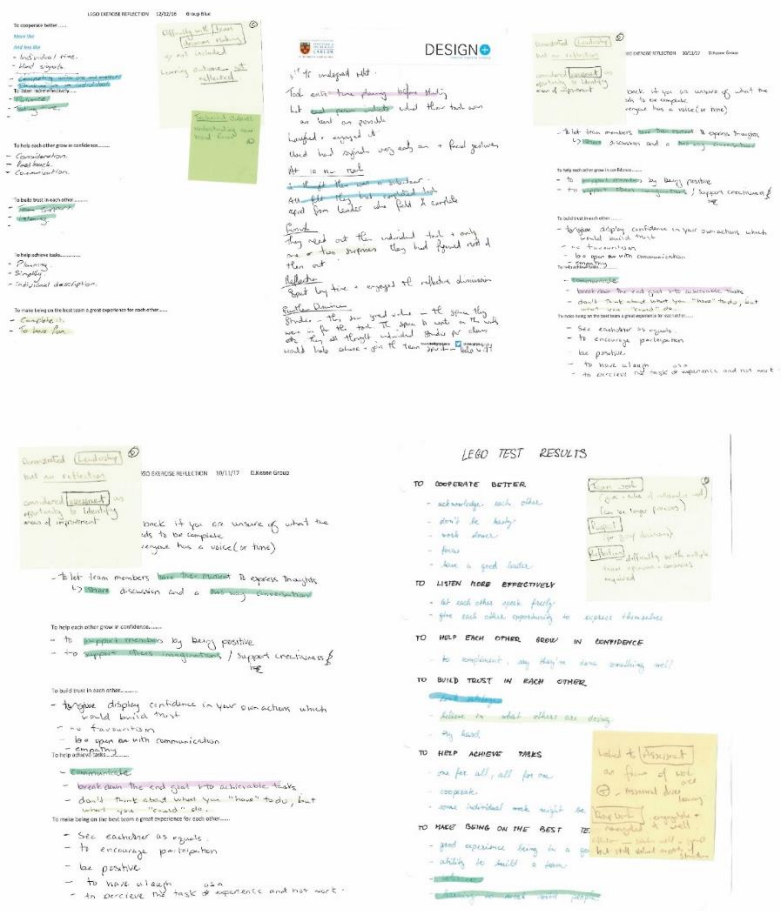
Figure 39 Sample Thematic analysis of Participants reflective practice

Conferences

In order to fulfil the research design intent for publishing and conference attendance, a significant amount of planning was required. Submitting a paper to be presented at a conference can require a six month lead time once the paper is complete. The conference selectivity and rationale is presented In (Research Design 3.1.3) and in (Publications 4.3.4) and reflection of the EAD conference is in (Appendix C).

The Irish International Conference on Education (IICE) was the focus of the first conference and publication. Once the planning had been carried out in relation to the timeline of events for the submission, the abstract and paper were prepared and once accepted the planning for the conference begins.

The research question at this point is 'what is the strategy behind the focus on knowledge creation within the transition higher education system?' The research design identifies the opportunity to use the conference, not only as, a means to present or disseminate the information but also to gather new data. Therefore consideration was given to the method of capturing and collecting such data. In order to address this, a handout was prepared which provided a brief synopsis of the presentation including the key timeline graphic, an image and contact details of the researcher. This ensures other researchers can easily identify you and the research on returning home from the conference as opposed to a business card. This proved successful with contact being made following the conference from a French researcher who is interested in follow on collaborative work and is still in communication.

The final conference was the European Academy of Design 2017 held in Rome at the Sapienza University. Similar planning went into place in order to achieve the required timelines for submission of work. In preparing for attending the conference, particular focus was on the digital presentation. The research now encompassed two years of research work. In order to ensure a clear and concise presentation to an international audience, consideration was given to visual images and terminology and context used.
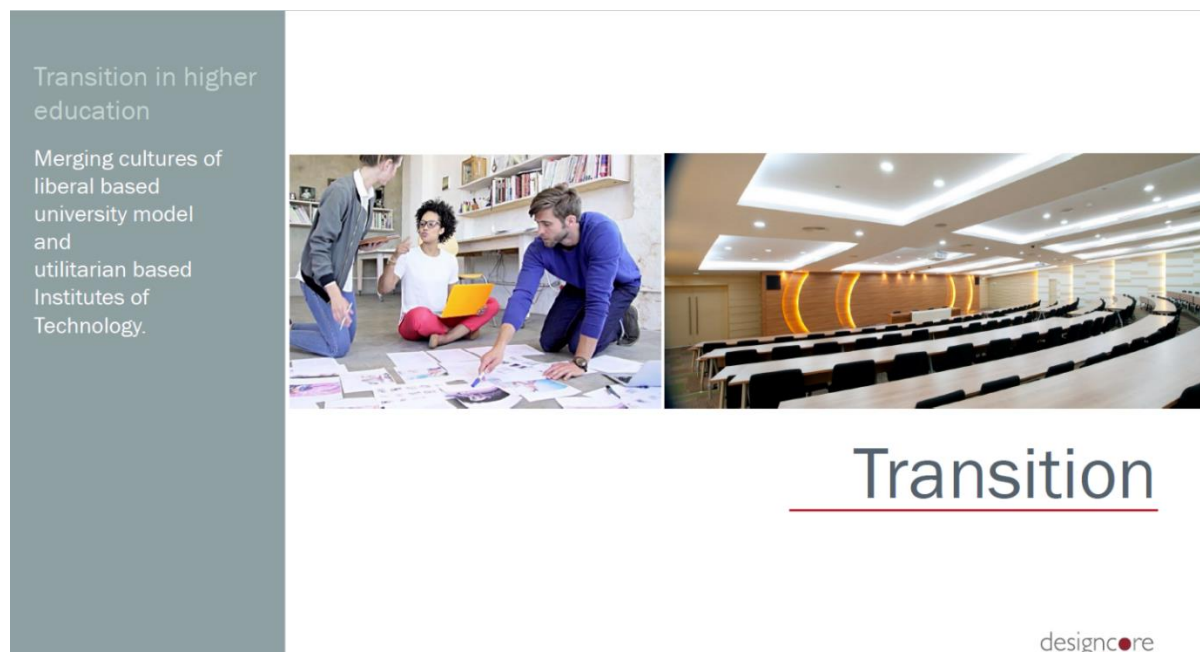
Figure 40 Example of slide used for International presentation at Conference providing visuals

In addition to educational field research, the supporting themes of economy and policy were considered. The findings in the research indicate that economic strategies are currently aimed at producing critical and innovator thinkers and may therefore hold a value on tacit knowledge,. In order to seek verification of this and assist in answering the research questions 'What role does practice oriented learning play in achieving knowledge creation? And also 'what graduate attributes are sought by industry?' The research design identifies the selection criteria for conducting an interview with an Irish design practitioner.

The interview was semi structured and the approach was to use open ended questions. The interviewee has vast experience in commercial practice both nationally and internationally, therefore open ended questions will provide the opportunity to capture the interviewee's personal experience and interpretive views. The questions asked were 'What do you do?' What have you learned?' and 'What are the graduate attributes you value in graduates today?'

The responses and findings from the interview were very concise and informative. The attributes valued are very much in line with national strategy of critical thinkers, and are equally tacit based skills as well as hard design skills. This further verifies the finding that the design led approach is an approach towards achieving national strategy for creative, critical thinkers and innovators.

Figure 41 Interview with Design Practitioner, assessing valued graduate attributes

Policy Approach - The Technological University is emerging throughout this research project. Irish Higher Education system is transitioning. Strategies have been released and attempts are currently being made to implement them. Ensuring an understanding of the strategies is therefore vital to the project but also the capture in live time of events as they unfold. The research design identifies key points in time, such as the Dail debates on the TU Bill and the launch by The Minister of Education and Skills of the Action Plan for Education 2017. The

overall project concludes with the release on Mar 8th of the passing of the Technological University Bill in both Houses of the Oireachtas (Legislature of Ireland).

Figure 42 Attending the TU Bill debates in Dail Eireann 2017

The TU debates in Dail Eireann required planning and permissions to attend the public galleries. This was obtained by request from a local TD. The debates are recorded but to ensure key thoughts are captured as the debate unfold, notes were taken by the researcher. Informed discussion took place with other members of the public in the galleries who were mainly from academic backgrounds. Whilst there were still many concerns raised in relation to elements of the Bill, overall there is support for the development of the TU.

The launch of the Action Plan for Education in the Institute of Technology, Carlow was also a pivotal moment in the live time development of the Irish Higher Education system. The Minister for Education and Skills, Richard Bruton (TD) launched a three year action plan to implement the strategies proposed in the release of the Hunt (Hunt, 2011)report. Full notes on the launch in (4.4.2)

Figure 43 President of Institute of Technology, Carlow, Patricia Mulcahy and Minister for Education and Skill, Richard Bruton (TD) Launch of the Action Plan for Education 2017

3.4 Ethics

Ethics was then considered in relation to the research question and potential project participants. A full ethics application is available including participant information sheet and participant consent form (Appendix B).

3.5 Methodology Conclusion

Research through design approach was the selected methodology. This approach was selected on the basis that visual mapping would provide a means to deal with the complexity of considering three key areas of research namely; policy, economy and education. The visual mapping enables us to see how and when policy, economy and education interact to arrive at today's strategy for the emerging TU's. To assist in answering the research question two key graphics were created from visual mapping activity; 'The Timeline 1959- present' and 'The Knowledge Creation Process'.

The timeline assited in uncovering the strategy behind the emerging TU. This visual timeline provided the opportunity to identify the influences and imapcts of policy and industry on the higher education system in Ireland. The Knowledge Creation graphic provides a demonstration of knowledge creation with a design educational context. It is possible through this visualisation to communicate the need for both explicit knowledge and the tacit knowledge produced through studio based and practice oriented learning. This answers our primary research question in relation to the role of Practice oriented learning within knowledge creation.

The field research enabled the verification of findings from the literature review and provided an additional source of data collection. The focus was on education to verify the design led approach in the acquisition of tacit skills and knowledge. This was done through interviews with eacademic staff and innovation workshops with students from design and non-design backgrounds. This field reserch provided a platform to idenify a difference in approach to problem solving and experiential learning which comes from different educational experiences. This informs the research conclusions of how group work, complex problem solving in unknown spaces and innovation seeking approaches are part of the tacit skills formed through the design led approach. However, it can be said that ultimately the experiential approach still provided valued learning outcomes from all disciplines even when approaches differ, thus verifying the research findings that the design led approach may be of value to other disciplines. The interview with industry practitioner, informed the research of the specific graduate attributes sought today. These were aligned with those identified throughout the research as tacit skills and knowledge which are acquired through a design led approach.

The supporting theme of policy outlined through the research design ensured the capture in live time of crucial policy implementations such as the TU Bill and the launch of the Action

Plan for Jobs. Attending the address ensures the capture of key statements by the Minister such as,

> "It is the tradition of the Institutes of Technology to be tech bases of everyday companies, of apprentice models but we now have a new applied research capacity that provides the wider competencies of learning bodies"

These are the wider competencies referred to in the Hunt report as 'critical thinking' and referred to in our interview with Design Practitioner as 'creative thinkers asking why' and as witnessed by our design students in their approach to complex problem solving. This links crucially to our research question of 'How can the value of tacit learning benefit an emerging TU?' and as such confirms the design led approach as being one of value as we strive toward an emergent TU.

4.0 Field Research

4.1 Introduction

The field research was undertaken to triangulate the literary review findings, and to add to the data capture of the research project. In order to retain the project context and provide clarity to the chapter, it is presented under the key themes of education with the supporting themes of policy and economy as contextual supports.

In policy the research seeks to validate the literary review findings in relation to the Technological University aiming to produce critical thinkers and innovators. It is also to seek the response from educational providers to the national Strategy and culminates in an opportunity to disseminate research findings and contribute to the process through a strategic focus group representing the student body. Most importantly it seeks to ensure the most current capture of a particular point in time of the emergence of; Technological University

In education the field research seeks to assist in understanding the values within the design led approach. This was approached through an interview with a lecturer who works with both design students and business and marketing student. The aim was to explore any differences of approach to practice oriented learning from alternative disciplines, and through the experiential action of collaborative tacit based innovation workshops. Conference and publications are also presented in the educational field research section. Conferences acted as a large contribution to the field research as an opportunity to receive formal blind peer review, discuss the subject informally with peers, listen and capture data from other presentations. The publications and conferences were an integral part of addressing all three key areas, involving design conference, educational conference, economic journals and educational journals

In economy, the research looks to industry and seeks to ascertain the current graduate attributes relevant for today's design industry. The aim is to discover if the graduate attributes sought after are in alignment with the national strategy for innovation and critical thinker. It also asks the question of how this is achieved within industry practice, to uncover the value placed on practice oriented approach. This was conducted through interviews with design practitioners. It is also another point of dissemination in the form a design industry journal article which was based on an interview with a practitioner entitled 'Learning in Practice'.

4.2 Education Field Research
4.2.1 Interview with Educational Provider

Rationale: Thesis research question;

What role does practice oriented learning play in achieving knowledge creation in design education?

Interview with Business and Marketing lecturer IT Carlow

To assist in answering this question, an insight into the existing value and perceptions of how practice oriented learning is perceived, is sought. The research design involved specific selectivity of an educational provider who has a background in the IOT sector, has a non-design background, and delivers classes to both design students and non-design students. The lecturer selected provides teaching modules for 4th year design students and also marketing and business students and agreed to take part in the research. The lecturer is in the position to observe any differences in approach between the design students who are familiar with collaborative practice based approach and the business and marketing students who traditionally will have come from a class/lecture room environment. The aim is to follow this interview with interactive innovation workshops with students from both groups to further observe and triangulate results.

The following prompts/questions were prepared prior to the interview

> Do you deliver the same module to all disciplines? Any different approach?
>
> Tell me about that
>
> How does your delivery adapt to different types of engagement?
>
> Does the physical studio environment have any input ie studio vs lecture room?
>
> When the work is being presented/communicated back are there any differences?
>
> Group interaction/collaboration…observe any difference?
>
> What may affect those different types of collaboration?
>
> Your personal position about Technological University – culture you came from is very different

The full interview transcript is available in Appendix B Interview transcripts where analysis methodology is shown, forms the basis of reflection and conclusion.

Conclusion

The lecturer observes, the design studio as a physical environment enables the delivery of the module to be more activity based than the marketing or business class.

Design students start the collaborative and project based learning earlier than marketing students who spend the first two years in 'chalk and talk'. The lecturer has observed the benefits within the design students of an intuitive orientation to collaborate and an ability to work as a team. The business and marketing students reach 3rd year before they start team work, the lecturer has observed real problems, whereby these students clash in issues such as leadership, personality, and role. Also observed is the sports students who are experienced in working as a team from the beginning, who approach her modules and team based activities without problems. Interestingly the lecturer pointed out, 'there couldn't *not* be problems in their group but they never bring it to you' in other words, it's not that there aren't any problems but rather the students, in this case, design and sports, have learned to navigate group dynamics, leadership and collaborative problem solving through practice based learning. Our research to date has highlighted this as a highly sought after industry skill in today's economy.

The lecturer recognises the value of collaborative work such as, practice for leadership and how to navigate in a team. Also that this is part of the shaping around the TU 'it's not that rote learning and then a test at the end of it, so that you are just testing a memory, it is, how you've applied, how you've reflected, how you've learned, how you'd approach it again and peer evaluation'. The lecturer notes that with this broader approach to capturing learning outcomes, the students often do better, it would appear to be a deeper level of assessment which reflects the full range of the process, as opposed to grading an end result which may not fully capture participation competencies or contribution. Notes however that the nature of collaborative work is harder to apply rubrics….it becomes more about end result.

It is noted how the design students in particular love to see where their marks are from and relish feedback. This is very different to the marketing and business students who dislike even positive critique. There can be a tendency for these students to take the critique personally. The design students take critique really well and do peer review properly and have a level of maturity about the feedback. This is probably reflective of the early introduction of reflection and peer review with design students, also that the very process of design is iterative and changing and critique assists with this part of design education process.

It was interesting also in relation to how practice oriented learning is perceived, although in principle the lecturer places a value on practice oriented learning, when observing the design students actively working through a project in studio, she could not identify with the process and observed it to be 'not joined up thinking'. This may be a case of observing the iterative nature of the design approach as being indecisive or appearing somewhat chaotic with students changing their mind as they iterate through the collaborative interactions. This highlights again a need to provide a rigour, a transparency and a value to this practice oriented approach to learning.

4.2.2 Innovation Workshop with Design Students

Rationale for conducting Innovation workshop

The aim of this workshop was to answer the research question 'what is the value of tacit knowledge?' The literature review has presented findings which indicate that disciplines such as military and healthcare recognise a value in the ability to enter a situation and have the tacit skills to think on your feet. In the interview with the design practitioners the skills sought after include tacit skills such as critical thinking and problem solving. In the interview with the lecturer it is noted that the approach from design students appears almost chaotic whilst yielding results. In order to assist in verifying these findings from the literature review and from the interviews, the research design selected the following exercise to observe a design team and a non-design team entering just such a chaotic space. The exercise selected was 'Lego & Creative Collaboration 'created by KAOSPILOTS, a world class 3rd level school for social innovation and entrepreneurship in Aarhus, Denmark. The exercise will provide a demonstration of approaches from both marketing and design students to an unknown and chaotic exercise which may reveal a difference in approach and use of tacit skills such as how to lead for innovation projects, how to cooperate in teams, team based problem solving, critical thinking in unknown spaces and thinking on your feet.

Selectivity

The third year Product Design Innovation class was selected on the basis of;

- Third year is specifically focussed on team projects and complex tasks
- From a design background
- All over 18
- From Institute of Technology background
- Indicated willingness to participate

The Fourth Year Business and Marketing class was selected on the basis of;

- The fourth year team was more likely to equate the 3rd year design group in team activity as design students begin team projects from 1st year whereas the marketing students begin group projects in 2nd year.
- From a non-design background
- All over 18
- From Institute of Technology background
- Indicated willingness to participate

Participation was voluntary and participant information forms were provided with background to research and nature of involvement. Participant consent forms were signed It was first come, first serve on a sign-up sheet.

The exercise consists of twelve secret assignment tasks and a selection of Lego pieces placed in the centre of a table. The assignments are cut out and distributed one to each participant. It is explained to participants, the outcome is not given in advance and you must work as a team and trust in the direction that the team moves in, no one person has the answer.

Twelve secret assignment tasks

1. You are the only person allowed to build (put together pieces) in the first 3 layers of the structure.
2. You are to ensure that the 3rd and 4th layers in the structure consist only of yellow pieces.
3. You are to ensure that the 2nd and 6th layers of the structure are made up of exactly 8 pieces.
4. You are the only one allowed to build (put pieces together) on layers 5 and 6 of the structure.
5. You are to ensure that a maximum of 8 pieces are used in layers 3 and 5 of the structure.
6. You are to ensure that the construction is completed as fast as possible
7. You are the leader of the group.

8. You are to ensure that the structure consists of, at the most, 8 layers of pieces. Should the building stop after 8 layers, then you must ensure that the work is resumed on the layers under the 8th.
9. You are to ensure that any pieces next to each other in the 1st, 6th, and 8th layers are not the same colour.
10. You are to ensure that you, and only 2 others build in layers 4 and 8.
11. You are to ensure that max. 3 candidates build (put together pieces) in layers 4 and 7.
12. You are to ensure that layers 2 and 5 of the structure consist only of red pieces.

There must be absolute silence from the time the assignments are received. The candidates then have 15 minutes to build the structure. They will be told when there is 3 minutes left. After 10 minutes, the group are asked to raise their hand if think there is a saboteur in the group. (The task is possible to solve and there is no saboteur in the group). A reflective practice session is held at the end.

Preparation

Before introducing the selected teams to the exercise the research design included a pre-trial to ensure best opportunities for information capture. The pre-trial was held with a group of design colleagues. The pre-trial team completed the task and reflected on the process. They agreed that because they work together on a daily basis, they quickly fell into their existing team structure, and the usual team leader fell into the leader role. Their previous experience of working together enabled them to intuitively take turns and interpret quickly the other signalling, body language and intent, these are however a demonstration of tacit skills formed when working in teams.

It was also concluded during the reflection, that it would be beneficial if the student participants were to repeat the task following their reflection. This would give the opportunity to apply any learning outcomes of working as a team and demonstrate it on the repeat exercise. In other words, if by 'doing the task and 'reflecting' on the task, they could now apply the learning and demonstrate it in the repeat. As Dewey (1916) describes it ''we learn from doing after we have reflected on what we have done'' Schon describes this in 'the reflective practitioner' as reflection in action and reflection on action which enables us to think on our feet

''The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understandings which have been implicit in his behaviour. He carries out an experiment which serves to generate both a new understanding of the phenomenon and a change in the situation.'' (Schon, 1983)

This was fed into the research design and plans to include a repeat of the exercise were included in the preparation.

The Innovation Workshop - Location: designCORE studio space Date: 12/12/16
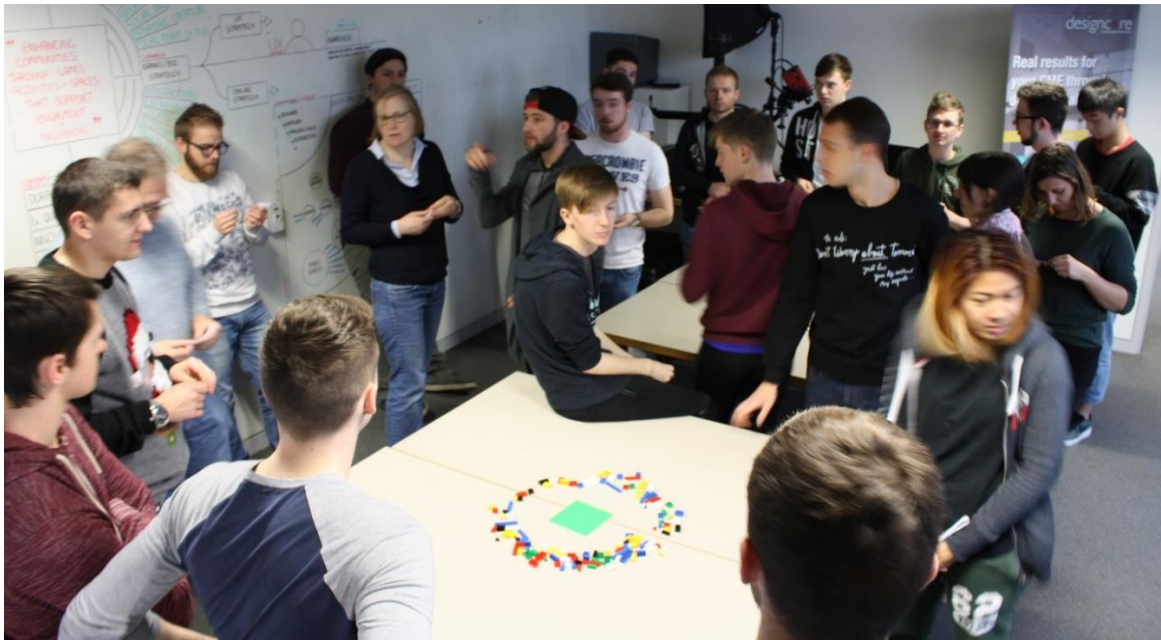
Figure 44 Design students beginning the task
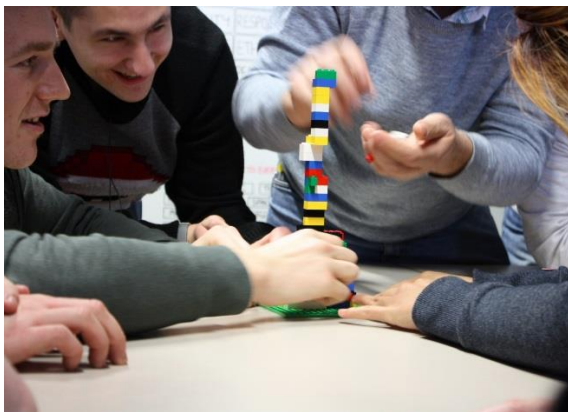
Figure 45 Design students changing the shape of structure

Figure 46 Natural leaders emerged

The design students demonstrated an instant engagement with the Lego and each other indicating a familiarity with working in teams. Once they were given instruction to begin, they immediately started trialling with the Lego. The shape of the structure changed dramatically throughout and at times was reduced to the very starting board and rebuild. Interestingly the student who had received the instruction that they were the leader did not take on that role and an alternative natural leader emerged. Hand signals were developed to assist in communicating. When asked if there was a saboteur in the group most thought there was. They were hugely surprised to find out that there wasn't. This provided an excellent demonstration of a learning outcome when discussed during reflection. This can be related to the workplace were by a team may have a shared objective but individuals may have

specific objectives which must be incorporated and by listening better and understanding, it is possible to navigate everyone's tasks in a collaborative project.

When asked to assist others in the final finish they worked very hard to assist thus demonstrating a team mentality to finishing the project.

Figure 47 Design students engaged with little inhibition

Figure 48 Hand signalling was adopted to assist communication

Figure 49 design students focus hard to assist team members in final finish

Reflection

A facilitated short reflection on what had happened took place. The participants were asked to consider what worked well, what didn't and what they would have done differently. They considered their actions and results and concluded that it is difficult being in an unknown project with a group but they were confident that a result would emerge and interested to

complete the challenge. They also considered what worked such as removing the necessary blocks for the task from the group. This way the group identified a possible indication of what the individual participant was trying to achieve and what didn't but didn't bring it so far as to discuss what they would have done differently. Nobody asked if the final build was supposed to be a particular shape. The team discussed how it had the potential to be a multitude of shapes from the instruction.

Repeat the task

Following the reflection, the team were asked if they would repeat the exercise, all agreed and felt it would be easy. The team improved considerably in their approach. They implemented individual responses such as colour sorting, took individual turns, all looked to each member in turn to try and focus and interpret what the task may be. They built the structure in relatively quick time and demonstrated their team skills in allowing for a leader, taking turns and all contributing and were happy concluding with a different shape.

Summary

This stage of the exercise provides the research with some observations on the approach of design students to working as a team to deliver a task that is undefined and without parameters. The skills demonstrated included being comfortable with an undefined problem, working as a team, allowing leaders to emerge, working without parameters, problem solving towards a joint goal. These are all tacit skills which are developed through design activities which the research has identified as being sought after by many disciplines.

In order to fully triangulate this, the research design had included for a repeat of the exercise with students from a non-design background to observe any differences in approach.

4.2.3 Marketing Students Innovation Workshop

Eight participants took part in the workshop from 4th year undergraduate business and marketing. The activity took place in the same studio and participants were given the same introduction to the project as the design students.

The first observation was their interest and enjoyment of working in a studio space. The next observation of interest was the teams initial approach; nobody touched the Lego, they considered their individual tasks first and then began attempting hand signals and facial gestures to communicate their intent. There was a marked reluctance to begin the actual build**.** This was in stiking contrast to the design students.

There was a sense of fun and some confusion similar to the design students but they kept up an efficient pace in the build. The communication was working well and they worked well as a team.

The participants were now asked to raise their hands to indicate 1-10 level of completeness of their individual tasks, 10 being totally complete . They all put up a 10 apart from one, who revealed that his instruction was 'to be the leader'. He explained that considering his instruction and observing the efficiency of the team, he thought it would be best to sit back

and not potentially add any unnecessary confusion, subsequently he gave himself a 4. On completion, each participant read their instruction to the group. There was few surprises and they had figured out most of the instruction. An interesting observation at this point was another notable difference to the design students. The business and marketing students took it upon themselves without direction to check against each instruction to ensure they were all completed correctly, they measured the completion of their task. This demonstrated an almost forensic approach to providing themselves with parameters when none were given.

Figure 50 Marketing students - no one touching the Lego due to lack of instruction

Figure 51 Marketing students - Had not considered the possibility of a saboteur

Figure 52 marketing students formulating hand gestures to communicate

Conclusion

The differences to collaborative problem solving and innovation observed between the design students and the business and marketing students was in the order of approach. The design students engaged quickly and openly, iterated, repeated this until they got through it with an exuberance of what it might yield. This demonstrates the lack of fear of the unknown with designers and trust in the process. They are very comfortable in non-defined spaces with an unstructured approach. This in fact is what enables design researchers to gain the broadest insights and uncover things which may be unexpected. The business and marketing students had sought out a more forensic approach and set out to create their own parameters as structure was not given. This was evidenced at the end when the marketing students actually checked each individual instruction against the completed structure to ensure they had

adhered to a measurable task. Whilst this is good practice in many situations it can also constrain potential opportunities which are unknown. The design students were open and receptive to the outcomes as being non-measured and interpretive whereby they sought not to uncover if they had completed instructions but more to uncover what the outcomes might mean or what purpose they may serve thus providing potential innovative developments. The learning outcomes for both could therefore be said to differ, the marketing students focused on what they had to do to deliver the completed tasks and measuring the completion, the design students focussed on what the possibilities of the completing the task might yield. This is reflective of comments made by an Irish Design Practitioner who was interviewed for this research (4.4.1) , when asked about what graduate attributes he valued in design students he replied;

> "They need to show an ability to think differently and apply that thinking to design, to an output, they have got to have the 'why?' behind what they are thinking. Core creativity that is the centre of everything" (Mathew Bates, 2017)

A similar study of experiential learning between two disciplines was conducted by Brian Lawson (2005). A group of scientist's and a group of architects were subject to a series of experimental situations to solve tasks. One such task was to complete a design using modular wooden blocks with various 'hidden' rules which meant only certain combinations of blocks would be allowed. Lawson then documented the outcomes and the findings are reflective of the Lego Kaos Pilots exercise differences noted between the design students and the business and marketing students.

"two groups shared quite consistent and strikingly different strategies" (Lawson, 2005)

The scientists in Lawson's group began by trying out a series of design combinations in an attempt to discover a rule. This is similar to the business and marketing students approach to the Lego experiment, whereby they began by creating series of hand gesture instructions or rules before beginning.

The architects in Lawson's group by contrast selected their blocks in order to achieve the appropriately coloured perimeter, if this wasn't successful they moved on to next most favourable combination. This is reflective of the design students approach in the Lego experiment whereby, they launched straight in to a series of 'try it and see' attempts where the focus is on the solution. Lawson sums up the differences by noting "the scientists as having a problem focused strategy and the architects having a solution focused strategy" (Lawson, 2005). This demonstrates a difference in approach to problem solving and experiential learning which Lawson describes as "a direct result of different educational experiences" (Lawson, 2005). This informs the research conclusions of how group work, complex problem solving in unknown spaces and innovation seeking approaches are part of the tacit skills formed through the design led approach. However, it can be said that ultimately the experiential approach still provided valued learning outcomes from all disciplines even when approaches differ.

4.2.4 Publications & Conference Attendance

This research project, whilst based within the disciple of design and using a design approach, did not involve the design of any product or artefact. It is common within design to use a prototype or artefact to test or demonstrate findings. As this project was embedded in the area of education and policy, in this instance a prototype or artefact was not the appropriate means for testing or demonstrating findings. Through the publication of papers and articles, it created an active test bed for findings through formal process of double blind peer review at key points in the project before progressing to next stage. Six publications were completed throughout the research project.

In analysis of the peer reviews two methods were involved; reflective practice and thematic analysis. Reflective practice was conducted on peer reviews of abstract to inform changes or amendments required for that specific paper. Thematic analysis was conducted to extract any emerging themes from a series of peer reviews together. Five areas of capture were devised to organise the data and colour coded. The red editorial typography data was addressed directly to ensure all recommended correction were made. The green editorial content was also addressed directly to move text to improve narrative. The blue and yellow content direction and positives and negatives were further assessed for any repeating themes or patterns of instruction. These highlighted areas of interest to readers/reviewers, tacit knowledge commentary and assessment commentary. Further reflective practice was conducted to address these points. The results were measured against final peer reviews of full papers. For example;

- Editorial/Typographical
- Editorial/Content
- Content Direction
- Positives
- Negatives

Review 1
Comments for the Authors

This paper is focussing on the one of the most crucial challenges of design education and its role in academia between the sciences and art. I am not sure what kind of assessment the authors are proposing, but I am looking forward to learn more about it

Review 2
Comments for the Authors

The abstract content, method and content are not so clear.
In particular, the concept of "tacit and explicit knowledge" have to be better explained, as well as the declaration that "traditionally the

University model of education has been far removed from the design school principle", or "design has been traditionally marginalized by the university structure."

Final review of completed paper

The paper reports an interesting research that points out the value of tacit knowledge in the design educational context as an intrinsic component in the creative process.

The cultural assumption is inspiring and the approach demonstrates some valid outlines. The structure and theoretical basis are clear, well-built and clearly documented with an appropriate bibliography.

Column 1

Thematic analysis of peer review European Academy of Design

Themes;
- Editorial/Typographical
- Editorial/Content
- Content Direction
- Positives
- Negatives

Iterations

Current Text	Corrected Text
Masters by research	Masters Degree by research
The research is within the context of the discipline of design within the emerging Technological University.	This sentence is not required because it is obvious after reading the preceding sentence.
economic drivers, influences and impacts	Even a very brief explanation of these would be useful e.g. are these drivers for the Government, EU, Education Institute
The gap in the knowledge identified in the research to date or is the means of achieving this.	Confusing sentence. Rewrite

E.g. The authors have identified a gap in the knowledge on how this will be achieved in Ireland. |
| In order to address todays demand for rapid knowledge | In order to address today's (or "In order to address the demand) |
| As a correlation between economic demands and educational strategy has and continues to be intrinsic to the model of technical education that exists in Ireland, we can seek some of the cues for future design education frameworks from the commercial sector within design practice both in Ireland and internationally. | long sentence. Rewrite

e.g. The model of technical education in Ireland is strongly influenced by economic demands. Therefore we can develop future design education frameworks based on insights gained from commercial design practices. |
| Understanding what is done on a day to day project basis in a design practice will inform the research of the actual activities taking place and subsequently the varying levels of skill, knowledge and competency required. | Confusing sentence. Rewrite

E.g. Researching the actual activities taking place with a design practice will highlight/provide insight into the varying levels of skill, knowledge and competency required by designers. |
| As we transition from Institute of Technology | As we transition from Institutes of Technology |

Additional Feedback to author
Overall I think this is a very interesting and important topic of research. It could potentially have useful insights for education and educational policy in Ireland. I look forward to reading more about it.

I think the paper should be published as it will provide an insight to a design practice that would be of interest to a wide range of readers.

Having said that, I think the paper needs to make a number of changes. I consider these change minor as it is mostly clarifying the text, shortening sentences. I think the paper works as a shorter interview and not a research paper. This means the abstract and introduction can be merged.

The paper would be improved if it made a clear distinction between the wider research project and this particular interview. For example, based on the introduction I am not fully clear on the overall research aim or research questions. Is the article about "Practice Oriented Learning" in general, what needs to change in design education in Technical Universities (a "new approach") or is it making the case that design education in Technical Universities is best suited to the current or future design practice in Ireland? I was unclear how the one interview helps the reader better understand any or all of these.

The abstract suggests that a "challenge" (for whom?) is to retain "the effective social and cultural values associated with technical education" yet the interview makes no specific reference to technical education. The two education institutions mentioned by the interviewee are not its or future Technical Universities. One sentence explaining what the "effective social and cultural values associated with technical education" are and how they relate to design education.

I suggest reducing the overall length of the paper (the call for papers suggested 1500 words for interviews). I expect the wider research project and other interviews will lead to a longer paper in the future but as it is only one interview it is too long.

I suggest briefly introducing the wider research project, the research questions and research aim and clarifying at the beginning that this is just one of a range of interviews. The introduction can say that in the context of a wider research project this article will focus on the three questions used to frame the semi-structured interview.

I am not sure the conclusion is required. It just summarises just what the reader has read and is focussed on what the authors found interesting and only the last two sentences really relate to the wider research project. The conclusion mentions the Institute of Technology. It might be useful to properly introduce technical education in Ireland as not every reader will understand the context.

Column 2

Irish International Conference on Education (IICE)

Themes;
- Editorial/Typographical
- Editorial/Content
- Content Direction
- Positives
- Negatives

Ireland International Conference on Education (IICE-2016)
Reviewers' Feedback

Paper ID: 204
Paper Title: The Role of Practice Oriented Learning in Design and Creativity in an Irish Technological University
Type of Reviewer: Blind Review
Reviewer: Specialist

	Strong	Weak	Can be improved	Accept with minor restriction	Accept
Relevance to IICE	✓				
Originality and quality					✓
Technical strength				✓	
Science Theory and Practical					✓
Conclusions					✓
English					✓
Format				✓	
Overall				✓	

Comments to the author:

Good paper. Content has merit, but accuracy, clarity, completeness, and/or writing should and could be improved in time. An interesting area of research but requires further exploration.

The following amendments need to be applied:

1. Abstract:
- The 1st sentence of the Abstract must be changed. It should read:

The research was is focused on a Masters by research entitled 'The Role of Practice Oriented Learning in Design & Creativity in an Irish Technological University'.

2. Avoid using "&" sign within the main content of your paper. Instead, use "and"

3. Introduction:
- Indentation: the 1st sentence of the Introduction section must be indented (0.5 cm).

4. Figures:
- When you cite the Figures within the main text, the word "Fig." must be written in full, e.g.: see Figure 1.
- Remove (Authors Own 2016) from Figure 1 title. The title of the Figure 1 should read: Figure 1. Timeline
(Note that if you came up with this timeline yourself, you do not need to mention it within the title).

5. References:
- The title of the References section must be re-numbered. It should read: 5. References
- Use the required referencing style for all the references (follow the format in the paper submission template).
Do not provide the authors' full first names. See example below.

[1] Hayes, N., 1997. Theory-led thematic analysis: Social identification in small companies.

Column 3

European Academy of Design (EAD) Rome

Themes;
- Editorial/Typographical
- Editorial/Content
- Content Direction
- Positives
- Negatives

On behalf of the Review Committee, we are delighted to inform you that your paper of ID1312 - 'Towards a University Design School - Restoring the Value of Tacit Knowledge through Assessment' has been accepted for the conference. Congratulations. Regarding the contents, the Review Committee would like to give you the following feedback:

Review 1
Comments for the Authors

This paper is focussing on the one of the most crucial challenges of design education and its role in academia between the sciences and art. I am not sure what kind of assessment the authors are proposing, but I am looking forward to learn more about it.

Review 2

Comments for the Authors

The abstract content, method and content are not so clear.
In particular, the concept of "tacit and explicit knowledge" have to be better explained, as well as the declaration that "traditionally the University model of education has been far removed from the design school principle", or "design has been traditionally marginalized by the university structure."
A wide and deep analysis and comparison with educational paths in the world (in University and other schools) could be useful; some case studies should be provided to demonstrate the thesis.

Review 3 Full paper

The paper reports an interesting research that points out the value of tacit knowledge in the design educational context as an intrinsic component in the creative process.
The cultural assumption is inspiring and the approach demonstrates some valid

Conference Peers discussions
Themes;
- Content Direction
- Positives
- Negatives

Viola Clemente presented a paper on 'A Future Scenario for a Methodological Approach applied to PhD Design Research', focussed on methodological approaches. Clemente has developed a design research canvas. This was very interesting as Clemente also recognised the need for design to develop methodological approaches that capture the tacit nature of design.

Clemente refers to the work of Frayling (1993)and the understanding of research into,for and through design but went an step further by suggesting there may be an additional category of from design. The' research from design' refers to the new understandings which form following tacit knowledge made explicit through reflective practice.

"research from design arises from tacit knowledge made explicit and communicable, moving from a succession of unique cases to broad explanatory principles through an author's reflection and analysis" (2017)

In relation to industry, a presentation was given by Mariana Fonseca Braga 'The choice of design. From businesses' conditions to businesses' attitudes' (Braga, 2017)

In discussion, Braga refers to an organisational position on the steps of absorbing a design culture and the discussion of what triggers a company to move on the design ladder. This was based on the link between creativity and innovation.

"creativity is the main basis of the design process. Studies have not considered a psychological approach to creativity in order to analyse the role of firms' conditions and attitude during the integration of design into their (not design-oriented) small businesses" (Braga, 2017))

Sara Colombo (2017) discussed 'New Design Thinking Tools for the Next Generation of Designer-Entrepreneurs'

This researcher addresses the idea that not only are graduates with design attributes useful to multidisciplinary industries but also in apply them to designing their own start up. The design approach is compared in start-up with high tech start-ups.

Bo Westerlund & Katarina Wetter-Edman (2017) discuss dealing with wicked problems, in messy contexts, through prototyping.

This was interesting in discussion relating to this thesis as Westerlund refers to the next phase of design education whereby students will need to experience knowledge as situated and particular, which is reflective of knowledge as defined within this project, knowledge as contextual.

Thematic analysis of peer reviews

Seeking emergent themes in thematic analysis

Publication 1

Publisher: Ireland International Conference on Education (IICE-2016), Dublin, April, 2016

Paper Title**:** The Role of Practice Oriented Learning in Design and Creativity in an Irish Technological University

Abstract: This paper submission forms part of a Masters by research entitled 'The Role of Practice Oriented Learning in Design and Creativity in an Irish Technological University'. The research sits within the context of the discipline of design within the emerging Technological University (TU). The project began with the development of a contextual timeline. This timeline captures and illustrates the development of the Irish Educational System from the emergence of Regional Technical Colleges through to the developing Technological Universities. Education in the higher sector in Ireland is inextricably linked to economic progress and throughout the timeline, a clear mirroring of economic drivers, influences and impacts can be witnessed on the technology sector education. The challenge for the next stage is in retaining the social and cultural values associated with technical education in

Ireland whilst creating a future response to global competitiveness. The gap in the knowledge identified in the research to date is in the means of achieving this.

Rationale: This conference was selected specifically because the research and literary review completed to this point was focussed primarily on educational policy. The findings from this first stage literary review indicated that since the emergence of Regional Technical Colleges, Ireland's higher education policy has been directly influenced by economic policy. This indicated the need to consider Ireland's current economic drivers as a means of informing future higher education strategy. In doing so a gap was identified between what economic policy is seeking and how educational policy intend to deliver. This informed the research design to consider International best practice and an educational peer review of findings. Therefore the Irish International Conference on Education was selected for paper submission.

Reflection: The aim of attending the conference was to inform the research question 'what is the strategy behind the focus on knowledge creation and innovation within Irelands transitioning higher education system?" By attending the conference it provided verification of economic influences on higher education. It also introduced to the research further insights into engineering disciplines which were followed up in the next stage of literature review. It also introduced authors such as Guillot and Parker (Guilott, 2012)who were referenced in the next stage literary review.

Publication 2

Publisher: International Journal for Cross Disciplinary Subjects in Education (IJCDE) Vol 9, Issue 1 ISSN 2042 6364

Paper Title: Timeline – The foundations of Regional Technical Colleges in Ireland to the Emergence of Technological Universities

Abstract: In Ireland, the Department of Education has created and begun implementation of, a National Strategy to 2030 in Higher Education also known as The Hunt Report. The role of teaching and learning is being reviewed and attempts are being made to promote a climate of innovation and innovative thinkers for Ireland's future workforce. The aim being to achieve an innovation based economy, growth and a competitive edge within EU and global markets. In order to assist with our understanding of the strategy for our developing Higher Education sector, a contextual timeline was developed. The context covers policy, social and fiscal influences on an EU and National framework which assists our understanding of the strategy for our developing Higher Education sector. This paper outlines and reflects on the significant events on this timeline which spans the development of the Irish Educational System from the emergence of Regional Technical Colleges through to the developing Technological Universities.

Rationale: This paper was an extended version of paper 1 which the researcher was invited to submit. It enabled the inclusion of the additional reflection following from the conference attendance. This was a dissemination activity.

Publication 3

Publisher: ITERATIONS Design Research and Practice Review, Issue 3, pp 70-75

Article Title: Learning in practice – An Interview with Mathew bates, Design partners

Abstract: A correlation between economic demands and educational strategy has and continues to be intrinsic to the model of technical education that exists in Ireland. We can therefore seek some of the cues for future design education frameworks, from the commercial sector within design practice both in Ireland and Internationally. An interview was conducted with Mathew Bates Senior design director at Design Partners to assist in uncovering some of these cues. Tacit skills are highly sought after yet still prove difficult to measure and to communicate. Commercial practice is under increasing pressure through competition to spend less time on learning by doing through activities such as model making, in a similar way that design education is under pressure to reduce the time and resource also on experiential learning through budgetary constraints and efficiency drives. Design Partners however continue to hold those values that they recognise as vital components to the process of providing meaning and depth to a design.

Rationale: The findings from literature review highlighted the correlation between education and economy. The research design therefore was to engage with commercial practice to identify graduate attributes being sought after today. It was also to obtain peer review on these findings from a design discipline as to date the peer reviews were based on educational conferences. The research design was to select one of Irelands major commercial design practices, Design partners, who also have an International office and context to inform the research.

Reflection: The interview was aimed at answering the research question 'how can the value of practice oriented learning benefit an emerging TU?' The findings that informed the research were that tacit skills formed through practice oriented learning such as critical thinking, leadership, navigating in a team for complex problem solving are all sought after graduate attributes in commercial practice today. The peer review verified the interview offered interesting insights and was also a means of dissemination to a design audience.

Publications 4

Publisher: International Journal for Infonomics (IJI) Volume 10, Issue 4, ISSN: 1742-4712(Online)

Paper Title: The Role of Tacit Knowledge in Merging Educational Cultures – Towards a University School of Design

Reflection: The researcher was selected to be published as an extended version of the paper 'the Role of Practice Oriented Learning in Design and Creativity in an Irish Technological University' into the International Journal of Infonomic. This was an opportunity to extend the research to the economic sector which has been identified in the research as being a driving

force in educational strategy. This was a dissemination exercise however as it did not come with additional peer review.

Publication 5

Publisher: European Academy of Design 'Design for Next', 12th EAD Conference in Sapienza University of Rome, conference proceedings.

Paper Title: Towards a University Design School - Restoring the Value of Tacit Knowledge through Assessment

Abstract: A 'University Design School' may in itself appear a contradictory expression, as traditionally the university model of education has been far removed from the design school approach. As the Irish National Strategy for Higher Education (Hunt, 2011) aspires to achieve knowledge creation in tandem with the development of Technological Universities; design sits precisely in the centre of this debate for achieving balance between the existing dichotomies of objectives. The research has mapped the theorists view on how knowledge creation occurs within an educational context. The findings from this research to date highlight that knowledge creation requires a process of tacit and explicit conversions within a shared context or place. Tacit knowledge is significantly over looked in an educational context because it is difficult to communicate, assess and grade

Reflection: This was the most important conference attended throughout the research project. It provided an up to date insight on all contextual areas to the project from an international perspective. The discussions with peers was timely as the main body of research was completed, analysed and could be openly discussed debated and reflected upon. The blind peer reviews were also very positive;

> "This paper is focussing on the one of the most crucial challenges of design education and its role in academia between the sciences and art. I am not sure what kind of assessment the authors are proposing, but I am looking forward to learn more about it"

> "The paper reports an interesting research that points out the value of tacit knowledge in the design educational context as an intrinsic component in the creative process. The cultural assumption is inspiring and the approach demonstrates some valid outlines. The structure and theoretical basis are clear, well-built and clearly documented with an appropriate bibliography."

The peer review of full paper acknowledges that the research has captured and communicated the value of tacit knowledge as an intrinsic component to the creative process. This is exceptionally positive feedback at this point in the research as this demonstrates the thesis answering of the original research question.

The key outcomes from the conference verified the findings to date and highlighted the International research which acknowledges design as an approach to complex problem

solving within industry policy and society and as such is a transferable and contextual skill. Europe recognises the need to create an innovative society to have a strong economy and that creativity is a defacto of innovation. This provides overall verification of the final research conclusions prior to thesis write up.

Publications 6

Publisher: The Design Journal Volume 20, 2017 – Issue Sup1: Design for Next: Proceedings of the 12th European Academy of Design Conference, Sapienza University of Rome April 2017

Paper Title: Towards a University Design School. Restoring the value of tacit knowledge through assessment

Reflection: This was the paper from the proceedings of the European Academy of Design which was selected for publication in The Design Journal 2017

A reflection of the key conference, European Academy of Design, is included in Appendix C. This includes extracts and findings captured from other presenters from a worldwide perspective.

4.3 Economy Field Research

4.3.1 Interview with Commercial Design Practitioner

The rationale for conducting an interview with commercial design practitioner was based on the research question of; How is knowledge created in a commercial design practice, and what are the graduate attributes they are seeking?

The research design was to select one of Irelands major commercial design practices, who have an International office and context to inform the research. This will provide the research with insights into whether the tacit skills formed through practice oriented learning such as critical thinking, leadership, navigating in a team for complex problem solving are all sought after graduate attributes in commercial practice today.

The interview was conducted with Mathew Bates Senior Design Director at Design Partners, based in Bray in Ireland, to assist in uncovering some of these cues. Design Partners are a strategic design consultancy with destination studios in Dublin and Eindhoven. Their mission is to partner with ambitious clients and help fuel their growth by providing exceptional, story-led design. The interview transcript was analysed and prepared as a journal article which was published in 2017 in' Iterations' Design Journal (see publications 4.3.4) and (appendix B – Full Article)

There was some fundamental knowledge to be gained through the interview to assist a broad understanding for future design education frameworks as we progress towards Technological

Universities in Ireland. Understanding what is done on a day to day project basis in a design practice may inform of the actual activities that require varying levels of skill, knowledge and competency. Establishing the learning that Mathew and his colleagues may have gained within a design practice over a twenty year period can inform the learning experiences that are beneficial to design education. Being informed of the graduate attributes that Design Partners value in a potential employee may give direction to attributes to be nurtured in the formation of a design undergraduate. It is also a valuable opportunity to gain insight in to the thinking behind one of the major design practices in Ireland today.

The interview was semi structured and based around the context of three main open ended questions namely, what do you do, what have you learned and what are the attributes that you value in graduates today?

Mathew is a firm believer in, knowledge which is formed through learning by doing, provides meaning and plays an integral role in the innovation process.

> "I think there are certain values that we have from the very start that we haven't lost. I think things like having a physical model as early as possible in the process, there is nothing like a physical model to communicate to a client an experience, product design or prototype. The notion of thinking and doing and getting that balance just right, some agencies focus on strategic thinking a lot and they suffer on the doing."

.

Figure 53 Design Partners value model making

Figure 54 design partners hold the value of learning by doing within commercial practice

In relation to graduate attributes, it was interesting to correlate if Design Partners recognised or held value of the attributes that are reflective of a tacit understanding.

> '' I think what we are looking for is an ability in story-telling, good technical skills, good user experience, general design thinking, they might have had work placement in the field, really well equipped creatively, mature about design. Creativity is the most important thing that we are looking for coming out of college for students. They need to show an ability to think differently and apply that thinking to design, to an output, they have got to have the 'why?' behind what they are thinking. Core creativity that is the centre of everything"

These graduate attributes relate to the core tacit skills discussed throughout the thesis and they are obviously recognised within the design industry but our research question is also about how they will be valued in emerging TU. This will be a reflection of how policy perceives these tacit skills developed through design led approaches. Mathew's opinion is;

> "Having the ability to understand what is relevant so you can almost pitch on the fly, focus on certain areas, emphasize different areas to different clients only comes with experience . If I was trying to explain what it is, I don't think I could"

Again this statement validates the difficulty described in the literature review that practitioners themselves have in communicating these tacit skills, however Design Partners obviously recognize these skills such as thinking on your feet, experiential learning and creativity as being of intrinsic value to industry and sought after. Mathew goes on to explain however that in Ireland today the creative industries are still not fully recognised and it would appear this also comes down to a lack of understanding of these values.

> "In Ireland traditional professions seem to get gravity like engineering, lawyers, accountants where, I don't know, there is a perception that that is where the money is and they are more secure. The creative industry is looked upon as diminished, people don't really understand it."

Conclusion

The interview assisted the research in understanding the views from one of Irelands leading design practices and provides further validation of findings to date. Tacit skills are highly sought after yet still prove difficult to measure and to communicate. This in turn contributes to answering the research question on how tacit skills are valued and highlights that in fact there is significant risk of overlooking skills gained through experiential and creative solutions as we implement our Higher Education policies. Commercial practice is under increasing pressure through competition to spend less time on learning by doing through activities such as model making, in a similar way that design education is under pressure to reduce the time and resource also on experiential learning through budgetary constraints and efficiency drives.

4.4 Policy Field Research

The literature review has provided clear insight into the influence of economic policy on Irish Higher Education policy. Higher Education is transitioning, the TU is emerging throughout this research project. This is a critical time in how these policies are interpreted and implemented. The research sits in the centre with the aim of contributing to the discussion with an understanding of the nuances of a design led approach which may be of value to other disciplines as a method of achieving the desired strategies. This is a momentous time of change and the research design is to ensure the most up to date capture of the Irish Higher Education policies as they are delivered. In order to do this, the researcher attended Dail Eireann (the principle chamber of Irish legislature) to witness the live debate of the TU Bill and also attended the Launch of the 'Action Plan for Education 2017'by Minister for Education and Skills, Richard Bruton TD.

This is a process which began as a top down national strategy (Hunt, 2011). This lays out an aspirational broad strategy for transition reflective of wider international economic strategies (OECD). This in turn has been interpreted by government officials into actionable objectives whereby the Minister for Education Richard Bruton responded with an Action Plan for Education 2016-2019 which was launched 15th September 2016

Action Plan for Education -Foreword by the Minister

> " The basic aim of this Government is to use our economic success to build a fair and compassionate society. Few areas are more pivotal than education to our ambitions as a nation. The quality of the service we provide through our education system will determine whether we can deliver our most important goals: To break cycles of disadvantage and ensure that every person has an opportunity to fulfil their potential. To create sustainable well-paying jobs and strong economic growth. To solve the great problems through research and innovation, and excel in culture, art and every other field of human endeavour. That is why I believe it is crucial that we set the highest ambitions for our education and training service, because the

quality of the service we deliver will directly determine whether we achieve these ambitions for our citizens. In this strategy we are aiming to achieve the best education and training system in Europe over the next decade."

These strategies and reports prompted the discussion and debate around the technology sector in general and particularly around the Technological University. The Technological University Bill was debated in Dail Eireann in Jan 2016. This broader discussion throughout the higher education sector culminated in the establishment of the Technological Higher Education Association (THEA) in 2015. This was the new successor body to the Institutes of Technology Ireland (IOTI). In line with this new body the Technological Higher Education Quality Framework (THEQF) has been redesigned to present the most current and emerging thinking and practice on quality assurance in a period of historic change for the sector (THEQF 2106).

4.4.1 Attendance at Dail Eireann

The Technological University bill was debated in Dail Eireann on the 25th and 26th January 2015. Jan O'Sullivan, then current Minister for Education and Skills was present at the debate. Contact was made with local councillor representative TD Pat Deering to request access to the viewing chamber to follow the debate and to potentially meet other interested parties in the gallery who may contribute perspectives. Access was granted for the two days and over the course of the two days, the researcher met with TD John Paul Phelan who provided a tour of the chambers and expressed full support of the Technological University Legislation. Councillor Phelan also expressed an understanding of the concerns that have been publicly raised in relation to amalgamations, creating potential hurdles between governing bodies.

Dail Eireann was attended for two days to observe the Technological University Bill debate. (Oireachteas, 2016)

Key points of note from debate

Deputy O'Brien highlights the concerns coming from the Teachers Union of Ireland (TUI) about the mergers as a form of rationalisation in reference to the proposed amendment to remove the necessity to merge.

Deputy Jonathan O'Brien (TD)

> "these amendments would remove all references to the term "merged" or " merged institutions" from the Bill…in the absence of an allocation of proper funding for the merger process, it is difficult to regard this bill as anything other than the bandying about of the word "university". Many staff members feel it is just a smoke screen for rationalisation, which would have severe detrimental effects not only on staff but also on students in terms of both access to third level education and the quality of service therein."

Deputy Maureen O'Sullivan also highlighted the concerns of TUI members around the speed of expediting the bill and also of the lack of TUI member consultation opportunity. The main query presented also arises from the merger requirement and what happens if a merger takes place and yet there is a failure to attain TU status.

Deputy Maureen O'Sullivan (TD)

> " the introduction of technological universities is a good and positive idea in principle and one to which no one objects. However the concerns of TUI members have not been addressed. The text (in the bill) as it stands requires colleges to merge before they can apply for technical university status. What will happen in the case of institutes of technology that merge but whose application for technological university status is subsequently rejected?"

The minister responds to explain that the mergers mark a point in a broader stepped process which must be undertaken to validate the transition to technological University status.

Minister for Education and Skills, Jan O'Sullivan (TD)

> "the technological university process is not a rebranding process for the institutes of technology sector. We will continue to have institutes of technology after groups of institutes proceed to technological university status. We very much value the institutes of technology and are offering an opportunity, should institutions so wish, to start on a path of becoming technological universities…..the process will require a step change in the performance of the institutes in question in order that they meet the robust performance criteria."

The amendments relating the merger were subsequently rejected.

> "for the reasons I have outlined I cannot support amendments Nos. 3, 18 and 60 to 79 inclusive, in so far as they provide that applications for technological university status can be made by unmerged Institutes of Technology. It has been clear since 2012 that mergers would be part of the conditions" (O'Sulivan J. 2016)

Another issue raised relates to the access to courses which may be eroded by consolidation. The TU bill refers to the reduction of duplication, this may have unintended consequences as Dept. O'Brien refers to.

Deputy Jonathan O'Brien (**TD**)

> " those living in Cork can do practically every course they want in CIT, but under a merged entity, that is, a technological university, there is no guarantee that will remain the case."

Deputy Charlie Mc Conalogue (TD)

> "there is inevitable concern that courses will be consolidated away from local campuses and, as a result, there will be a reduction in the participation levels of local students"

Minister's response

Minister for Education and Skills, Jan O'Sullivan (TD)

> " the Department is planning for consistent increases in the number of students that will attend higher and further education over the next decade. It is policy to provide those options. Obviously, it is also policy to provide other options, such as apprenticeships and so on, but that choice should be available to students"

The minister's response to this issue is interesting as she confirms the rising student participation rates and that is part of the rationale for the mergers but also indicates that a broader view is appearing in the mention of apprenticeship models. This contributes to answering the research question relating to the value of experiential learning which is now clearly being sought after.

4.4.2 Current Policy Position

Launching the 'Action Plan for Jobs 2017' at the Institute of Technology, Carlow, the current Minister for Education and Skills, Richard Bruton (TD), addressed a large gathering of academic and administrative staff, outlining ambitious three year plan for education. This was seen as an opportunity to access the most current political thinking on Irish Higher education at present.

Figure 55 President ITC Patricia Mulcahy, Chair of Board ITC John Moore, Minister for Education Richard Bruton 20 Jan 2017

Notes on Ministers address

- It is all about the outcomes and the citizens, the return on investment.
- Education is pivotal
- It is important that we have accessibility for industry, for citizens in communities. We need to create bridges outward as drivers of change to economy, community, and citizens.
- 45% increase in STEM investment – which will be our export portal
- Education is core in regional development
- It is the tradition of the Institutes of Technology to be tech based of everyday companies, of apprentice models but we now have a new applied research capacity that provides the wider competencies of learning bodies
- Bridges – graduates with work experience have 25% better chance of employment
- April this year – publish roadmap of Investment in Education
- We need to not just look at old routes but look to new challenges

Summary/Reflection

The main introduction and body of the address was an affirmation of the Action Plan for Education 5 goals, which were outlined. The need to look outside of the Institutes and link and feed into, industry, community etc. aligns with the research findings of the need for graduate attributes to reflect work place practices. An interesting point of note was the mention of the wider competencies of learning bodies which resonates with the research findings to date.

There was no open floor opportunity for comment. However there was a closed select group for questions and answers. The question/observation the researcher submitted was – Current strategies and policy highlight the need for innovation and creativity both in industry and in higher education, but creative industries such as design fall outside of the existing STEM disciplines which receive the majority of supports. Are there any policy moves, to include creative disciplines like design for example – expanding STEM to STEAM with inclusion of Art and Design? Unfortunately the opportunity to present it did not arise.

4.5 Findings and Conclusions from Field Research

The field work complemented and made an important addition to the literature review. The findings brought about a great insight from the varying perspectives of policy, education and industry and enabled a holistic view of the Irish transitioning higher education system. The findings from the literary review in relation to the national strategy are validated in the Dail debates of Technological Universities. The value of practice oriented learning is demonstrated with students in innovation workshops and graduate attributes are discussed with design practitioners.

Education

The innovation workshop with design students highlighted the potential with experiential learning. By taking part and actively attempting to solve the task, the participants were forced to think of other team member's roles, and how their task fitted within the overall project outcome. The reflection of the project enabled the learning to be realised and formulated on paper as to how it may have been done differently or what worked successfully. By working as a team, they achieved an outcome which no individual could accomplish. Leadership conflicts arose and had to be navigated by the participants themselves in order to ensure everybody's tasks were completed. On the repeat exercise, the students not only demonstrated this learning but also demonstrated their improved communication technique, planning and team playing. The key finding however was in the observation of a difference in approach between design and non-design disciplines to addressing a complex problem as a team with unknown parameters. The innovation workshop activity highlighted a difference in approach to problem solving and experiential learning which Lawson describes as "a direct

result of different educational experiences" (Lawson, 2005). This informs the research conclusions of how group work, complex problem solving in unknown spaces and innovation seeking approaches are part of the tacit skills formed through the design led approach. However, it can be said that ultimately the experiential approach still provided valued learning outcomes from all disciplines even when approaches differ, thus verifying the research findings that the design led approach may be of value to other disciplines.

The interview with the lecturer provides the research with unique insights and observation into delivering the same module to different disciplines namely design and marketing. The key observations were in relation to the studio space utilised by design which enable a more activity based approach and a more collaborative approach. Equally in observing the design students iterative approach, the lecturer perceived the approach as indecisive or unplanned which highlights the need to provide a rigour and transparency to practice oriented learning. It also raises the questions of how other disciplines may approach experiential learning should the opportunity arise. In order to observe this an additional innovation Lego workshop was conducted with marketing students. The results demonstrated a difference in approach between both disciplines. The marketing students whilst building valuable tacit skills working as a team, approached the task by creating their own parameters where none were given in order to measure their activity. The design students equally built valuable tacit skills through working as a team but were more comfortable with no parameters and sought to explore what further possibilities the task completion might yield. This demonstrates that the value of the design approach lies specifically in the openness of seeking new opportunities.

The important finding however from running the second workshop with marketing students was that both disciplines benefited from learning through practice and demonstrated the learning outcomes through reflection even if the approaches differed.

Industry

The interviews with commercial design practitioners provided insights into how the commercial design sector views practice oriented learning. Model making and prototyping are recognised as an integral part of their process. Of interest to the research was how the design practitioners value the tacit skills that are acquired whilst working through practice. The commercial practitioner recognises that team work, critical thinking, thinking on your feet, thinking creatively are sought after skills of a tacit nature. These tacit skills are the graduate attributes they seek in commercial practice in addition to core skills of sketching, model making or report writing. It is also recognised by design practice that the industry is still not fully recognised in Ireland and is often overlooked in favour of sectors such as engineering and business.

Policy

The Dail Eireann debates on the Technological University Bill validated the findings from the literature review in relation to key areas of the national strategy. It highlights the concerns however from educational providers about 'how' it might unfold. The unintentional

consequences that were referred to in the literature review were specified as fears over funding cuts, courses being consolidated away from local campuses and mergers happening and not receiving TU status. The Minister for Educations address during a visit to IT Carlow, clearly states education as pivotal but a return of investment is needed. Institutes need to create bridges outwards to economy, community and citizens. Interestingly from a project context, the Minister refers to a new applied research capacity that provides wider competencies of learning bodies. This has been defined throughout the literature review as the need to capture the wider competencies gained through practice oriented learning. Technological Higher Education Authority Quality Framework (THEAQF, 2017) brings full circle the findings from the literature review in relation to the transition within higher education requiring a bottom up approach to meet the broader national strategy. This latest report ensures the project has now covered the project areas from the emergence of RTCs to this latest response in the form of a new quality framework for our emerging higher education system. This culminates with the opportunity to disseminate research findings and contribute to the bottom up approach through a select focus group representing students in direct response to the national strategy.

5.0 Findings

The following is an overview of the research questions and findings.

What is the strategy behind the focus on knowledge creation and innovation within the transitioning higher education system?

- Current strategies for higher education are for innovation and knowledge creation and the capture of broader learning outcomes. This emerged as a reflection of economic strategies.

The findings to date indicate the strategy behind the transitioning Irish Higher education system is to promote knowledge creation as opposed to the traditional knowledge consumption. This is being driven by economic demands in response to the global shift from production based economy to knowledge based economy.

The decade between the early sixties through to early seventies in Ireland saw the vision of T.K. Whitakers free trade and move away from protectionism propel Ireland in a move from agriculture to industry and the creation of modern Ireland. The logistics of creating a technological industrial economy required a skilled labour force that emerged under the advice of Mulcahy and the Steering Committee, in the form of the Regional Technical Colleges throughout Ireland. It is this infrastructure from which the existing Institutes of Technology have emerged and now seek to merge and be delegated as Technological Universities. Education in the higher sector in Ireland is inextricably linked to economic progress. The current strategies are both national and International and strive for innovation through knowledge creation. The IOTs and the University models have developed from divergent cultures but are now converging in these strategic aims. The thesis contributes to the discourse by defining knowledge creation within design education.

How is knowledge created within design education?

- Knowledge creation requires a process of tacit and explicit knowledge exchanges within a shared context

This thesis provides an understanding of knowledge creation as a process of tacit and explicit knowledge exchanges that occur within a shared space or context and the specific activities and interactions within design education which produce tacit and explicit outcomes. The findings show that by taking a theoretical model of how knowledge is created, it was possible to apply and map the theory in practical terms within a design education setting.
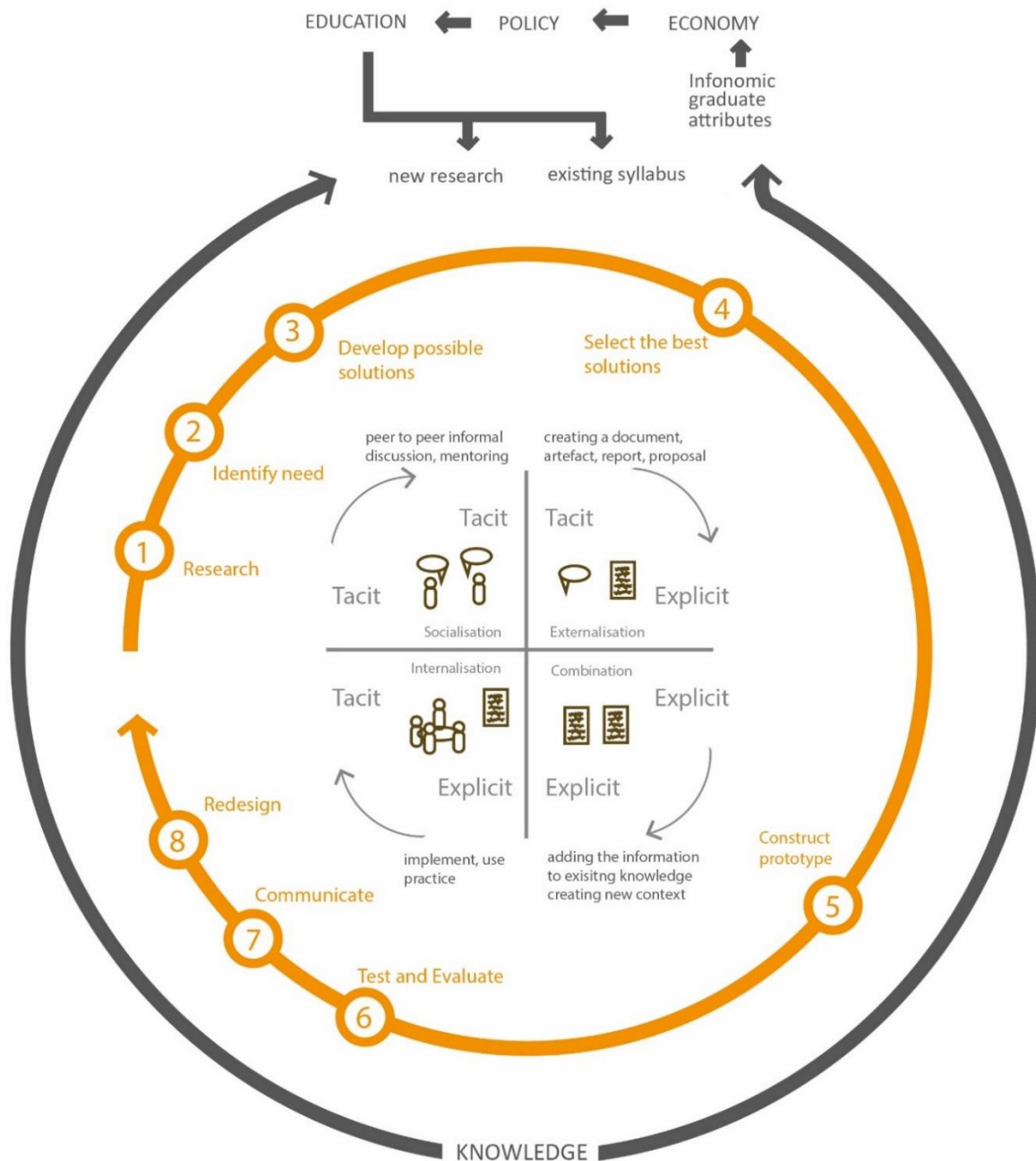
Knowledge creation in design education within the broader knowledge transfer cycle (Author own)

Stages 1-3 of a traditional design process; the research, the informal discussions, the ideation, sit within the tacit to tacit phase. Stage 4 is converting the ideation to concept, taking the tacit ideation and converting it to something explicit, something tangible such as a sketch or report. Stage 5 relates to the constructing of a prototype, sitting firmly in the tacit to tacit phase as extremely tangible and communicable, relatable to other works. Stages 6-8 see the prototype in use and being tested, creating a feedback experience, moving it from explicit back to the less tangible tacit responses.

Beginning with, Socialisation tacit to tacit, informal discussions are enabled by the design studio space as opposed to traditional lecture room facilities. This enables ideas and suggestions to be aired. In a design studio this can be informal or through the teamwork and collaborations which have been supported by continuous engagement between the participants and the place (ba/studio).

Externalisation, tacit to explicit, is the process of capturing these discussions and ideas into a more formal format. In design education this is reflected in students creating sketch models, prototypes, reports from the ideation and concept generation in the studio space environment.

Combination, explicit to explicit, the bringing together of other past and present findings in combination with the new one. This in design terms involves the research from desk or field being used as a reference against the validity of the design.

Internalisation explicit to tacit reflects the design process testing phase, handling using or observing users. This practice, use and testing of findings, informs the iterative process on which design is based. Which brings us back to socialisation and the informal discussions and ideation.

To place this process of knowledge creation back into the context of the emerging TU, the research has mapped the broader knowledge transfer cycle. This cycle follows the newly created knowledge into the economy through graduate attributes. This is where the skills formed in studio based activities such as practice oriented learning hold a value to employers.

This provides an insight into the specific interactions and activities that take place which are of a tacit or explicit nature. The value in doing this is that it emphasises the elements of tacit learning which are otherwise difficult to communicate and therefore easier overlooked. The mapping of this process and identification of both tacit and explicit activities may be of value to other disciplines as a template for assessing their own processes, activities and interactions with the aim of promoting knowledge creation.

What role does practice oriented learning play in achieving knowledge creation?

- The thesis identifies practice oriented learning as providing a pivotal role in promoting and developing tacit knowledge necessary for knowledge creation in design education.

Tacit knowledge relies entirely on experiential learning through practice. Practice oriented learning is also identified as a key contributor to promoting graduate attributes such as critical thinking, team work, leadership and empathy. These attributes are acknowledged within the research from both commercial design practitioners and broader national economic strategies, to be of value to the developing innovative economy.

How can the value of practice oriented learning benefit an emerging TU culture?

- The drivers behind the development of RTCs, IOTs and the emerging TU are clearly set on developing skills and knowledge to contribute to economic progress. As the Irish National Strategy for Higher Education (Hunt, 2011) aspires to achieve knowledge creation in tandem with the development of Technological Universities, practice oriented learning has a distinct and identifiable role in achieving this.

 The research has shown that knowledge creation requires both tacit and explicit knowledge and tacit knowledge has been shown to develop from practice oriented learning. It is clear that the activities of design within the shared context of a studio space provide an environment and a process of innovation. Tacit knowledge gained through practice oriented learning in a design educational context, is an intrinsic component in the creative process.

An additional finding can be added to the thesis which does not relate directly to a research question but relates to the methodological approach. In this thesis, the research highlighted the benefits of experiential tacit learning along with the difficulties associated in providing rigour and objectivity to learning that is based on subjective creativity. The same issue applies to this thesis and subsequently an adaptive methodological approach was carried out. This approach was based on a series of peer reviews, publication and conference attendance as a means of member checking findings to assist in the decision making and validation of an interpretative methodology. It is common within design to use a prototype or artefact to test or demonstrate findings. As this project was embedded in the area of education and policy, a prototype or artefact would not be the appropriate means for testing or demonstrating findings.

As a finding in itself, this approach provided the benefit of external feedback throughout the process before information was interpreted to direct the next stage. It also served as a data collection point for national and international context, provided an opportunity to build a research network and acted as a tool to disseminate research nationally and internationally. However, for other researchers considering this approach, potential disadvantages can also be noted. The approach is extremely time consuming and requires a significant amount of planning. There can be extensive lead time to a conference or publication, so it can be difficult to ensure a correct alignment to the work being produced. Another consideration is the standard of writing which is required and that all papers may not be accepted.

6.0 Discussion

The research has identified innovation and knowledge creation as one of the primary goals of Irish educational strategies. Knowledge has been defined and the process of knowledge creation mapped within a design educational context. This has provided clear insight into the role of tacit knowledge, an intrinsic element of the innovation process and knowledge creation.

The World Economic Forum report 'Future of Jobs' released January 2016, states that

> ''with regard to the overall scale of demand for various skills in 2020, more than one third (36%) of all jobs across all industries are expected by our respondents to require complex problem-solving as one of their core skills'' (World Economic Forum, 2016)

This emphasises the economic shift is broader than Ireland's national strategy and reflects a global demand for tacit knowledge skills.

The thesis research considered Irish educational strategy between the periods of 1958-present. The First Programme for Economic Expansion was published in 1958 which saw Ireland move from the era of 'protectionism' as government policy, to a more outwardly view, seeking inclusion in the European Economic Community (EEC). This was identified in the pilot research as a pivotal moment for Irish Higher Education. This was due to the fact that the request for EEC accession was initially rejected due to Ireland's lack of skilled workforce. This required a significant development from the VEC apprentice model offering which ultimately resulted in the establishment of the Regional Technical Colleges in Ireland. This also marks the beginning of Ireland's relationship with the Organisation for Economic Co-operation and Development (OECD) and our alignments to EU targets which continues today. Our most recent educational reports include the 'Action Plan for Education 2017' which strives to align higher education with economic drivers. It is clear that technological education in Ireland is inextricably linked with economy drivers and industry needs. Industry needs have changed however in response to the global shift from production based economy to knowledge based economy. The current economic strategies and subsequent educational policies clearly seek knowledge creation, critical thinkers and innovation.

This first stage of research informed the thesis of the current educational and economic strategies for promoting knowledge creation and innovation. Knowledge creation appeared throughout the government reports for higher education but also within economic reports and national strategic reports. In fact knowledge creation was being mentioned frequently but rarely explained. This was an identified gap in the literature and now became the focus of the thesis. In order to inform methods of achieving the higher educational strategies, knowledge creation would need to be more clearly understood.

The research was now focused on understanding and defining knowledge and knowledge creation. This would then inform the research of where the value might lie in areas such as practice oriented learning in achieving these goals. The research looked to authors such as Polanyi, Kuhn and Schon and more recently, Guillot and Jorgenson. These authors discuss learning through practice and tacit knowledge. As Polanyi writes "I shall reconsider human knowledge by starting from the fact that we know more than we can tell" (1966). Polanyi argues that tacit knowledge gained through experience and practice is a crucial part of scientific knowledge. His work paved the way for the likes of Kuhn and many others. More recently authors such as Guillot have applied this understanding to 'making meaning' of acquired knowledge and what conditions must be present in doing so. In relation to knowledge creation, there is far less literature which mainly becomes saturated with references back to one particular theorist, Ikijuro Nonaka, whose theoretical model is known as the SECI model. It was this model which was therefore selected for use as a framework to assist in viewing knowledge creation within design education.

In aligning a typical design process with the theoretical model of knowledge creation it assists the research in communicating the need for both explicit and tacit knowledge exchanges. It is also highlights the role of the studio environment in providing the means for the exchanges to take place. The explicit knowledge within the design process may be represented in areas such as; the formalisation of findings into design brief, reports and prototypes. The tacit knowledge in design may be represented in areas such as; the studio team work interactions, ideation, observation and testing phases of the process. The activities of design within the shared context of a studio space are therefore demonstrated to require not only explicit knowledge exchanges but also tacit knowledge exchanges.

To place this process of knowledge creation back into the context of the emerging TU, the research has mapped the broader knowledge transfer cycle (Fig 15). This cycle follows the newly created knowledge back into teaching and learning but also into the economy through graduate attributes. This is where the competencies formed in studio based activities such as practice oriented learning hold a value to employers. These are competencies such as team work, leadership, critical thinking, problem solving and empathy within a process of innovation through knowledge creation. The thesis has clearly identified the process and presented this as the 'Knowledge Creation Theory and Practice' graphic (Fig 14). This assists in making the values of the design approach communicable to other disciplines who are seeking routes to develop critical thinkers and knowledge creation.

It is clear that the activities of design within the shared context of a studio space provide an environment and a process of innovation. Tacit knowledge gained through practice oriented learning in a design educational context, is an intrinsic component in the creative process. This approach, used by design may be of value to other disciplines as existing structures transition towards the emerging model of TU with the aim of promoting knowledge creation.

The thesis should therefore inform academic management within Institutes of Technology and Technological Universities as they emerge and also academic policy makers such as HEA. The findings inform academic management of;

- Design pedagogical methods which may be of value to achieving the current strategic aims of a transitioning higher education system. Specifically the need for both explicit and tacit knowledge exchanges in order to achieve knowledge creation.
- The value of interaction spaces such as studio space in order to promote specific graduate attributes such as navigating in a team, leadership, group problem solving, critical thinking and empathy. These are attributes sought after in the workplace and reflective of current work practices.
- Assessment criteria for capturing the broader learning outcomes required for critical thinking needs to be created.

The findings also inform HEA of possible future needs arising from the implementation of current strategies such as resources to promote tacit learning, for example, studio space/interactive spaces and assessment criteria model reviews which may be needed.

7.0 Conclusion

The findings to date indicate the strategy behind the transitioning Irish Higher education system is to promote knowledge creation as opposed to the traditional knowledge consumption. This is being driven by economic demands in response to the global shift from production based economy to knowledge based economy.

The decade between the early sixties through to early seventies in Ireland saw the vision of T.K. Whitakers free trade and move away from protectionism propel Ireland in a move from agriculture to industry and the creation of modern Ireland. The logistics of creating a technological industrial economy required a skilled labour force that emerged under the advice of Mulcahy and the Steering Committee, in the form of the Regional Technical Colleges throughout Ireland. It is this infrastructure from which the existing Institutes of Technology have emerged and now seek to merge and be delegated as Technological Universities.

The IOTs and the University models have developed from divergent cultures but are now converging in strategic aims. There is a risk however of hurtling design into a positivist framework in a bid to excel the intellectual rigour and fortify the university model. This may lead to the erosion of the subjective creativity which provides innovation and knowledge creation. There is also increasing pressure of higher participatory rates and efficiency drives which impact on the provision of design school studio space within the emerging TU model.

Education in the higher sector in Ireland is inextricably linked to economic progress. The current strategies are both national and International and strive for innovation through knowledge creation.

The thesis contributes to the discourse by defining knowledge creation within design education as a specific process of tacit and explicit knowledge exchanges that occur within a shared space or context.

The findings show that tacit knowledge is produced through practice oriented learning approach used in Irish design education. The thesis demonstrates the design process to be a process of knowledge creation.

This approach not only results in innovation through validated ideas but also produces the specific graduate attributes being sought after by industry. Graduate skills such as critical thinking, team work, leadership and empathy are of value to the developing innovative economy.

It is clear that the activities of design within the shared context of a studio space provide an environment and a process of innovation. Tacit knowledge gained through practice oriented learning in a design educational context, is an intrinsic component in the creative process. This approach, used by design may be of value to other disciplines as existing structures transition towards the emerging model of TU with the aim of promoting knowledge creation.

8.0 Future Areas of Research

In building upon this research, future areas of research identified as being of value include;

- Identifying appropriate means of assessment for tacit learning
- The development of studio/interactive spaces for future buildings
- The possibilities for modifying existing classroom spaces to produce interactive spaces where appropriate.

In 2003 Jenniffer Hedlund et. al. (2003) conducted a study to identify and assess tacit knowledge in military leaders. The military value many tacit skills, which may not necessarily be part of formal training and assessment. An example of these skills within the military include leadership, or the ability to think on your feet, or the ability to deliver appropriate responses to a variety of situations. Subsequently the 'Tacit Knowledge for Military Leaders inventory' (Hedlund, 2003) was developed to assess the amount and type of knowledge leaders require for specific rankings. This method was demonstrating the value of tacit knowledge but more importantly, it was establishing the tacit skills in inventory format that were specific to a rank and role.

This approach is of particular interest to the research. Design education is embedded in subjectivity and an interplay of tacit and explicit skills. To devise a method of identifying context specific tacit skills in inventory format would provide a rigorous framework from which assessment methods may be developed.

The TU model is a response to the current post production society which is focussed on the formation of new and innovative knowledge. In the production era, where consuming knowledge was relevant, rows of seats in lecture facilities was appropriate. The thesis highlights the availability of design studio space as providing the conditions for enabling innovation and knowledge creation. The thesis highlights how tacit knowledge is gained through experience, observation and interaction with others. The nature of the design studio provides a shared space that encourages interactions and team work. It also provides space to display work as a whole to give the designer greater insights into the work. The displaying of work also provides the opportunity of gaining alternative insights from other users. However the studio space is probably under the greatest risk as we transition to TU. Higher participatory rates and efficiency drives are also part of the future strategy for higher education. This creates the problem of scalability for studio provision. Studio space and assessment techniques therefore are the two areas for consideration for future research towards the delivery of practice oriented learning within the TU model. Future research in this area would build upon this thesis and assist in informing how the identified strategies may work as a future framework within a scalable model.

9.0 Bibliography

Department of Education & Skills. (2016). *Irelands National Skills Strategy 2025.* Dublin: Departmnet of Education & Skills.

Braga, M. F. (2017). The choice of design . From businessess' conditions to businesses' attitudes. *European Academy of Design.* Rome: EAD.

Breen, M. (2015). *The Death of Irish Trade protectionism.* Retrieved from Dorus.dcu.ie: http://www.dorus.dcu.ie

C&AG . (2010). *Comptroller and Auditor General Special Report fro Department of Education & Skills.* Dublin: Dept. of Education & Skills.

Chambers, A. (2014). *Portrait of a Patriot.* Dublin: Doubleday.

CSO. (2017). *CSO structural business statistics*. Retrieved from Central Statistics office: http:/www.cso.ie/en/releasesandpublications/er/sbs/structuralbusinessstatistics2015/

Designthinking.org. (2016, July 20). *Index*. Retrieved from Design Thinking.org: http://design-thinking.org/en/index.html

Dewey, J. (1916). *Democracy and Education.* New York: Macmillan.

Effectiviology. (2016-2018). *Effectiviology*. Retrieved from Effectiviology: https://effectiviology.com/the-stages-of-learning-how-you-slowly-become-more-competent-at-new-skills/

Enver Tatlisu, &. C. (2017). The Reflection of Experiential Knowledge Into Professional Practice. *European Academy of Design.* Rome: EAD.

Erlhoff M., M. T. (2008). *Design Dictionary Perspectives on Design Terminology.* Berlin: Birkhauser.

EuropeanCommission. (2012). *Post Programme Surveillance.* Retrieved from Europa.eu: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-financial-assistance/which-eu-countries-have-received-assistance/financial-assistance-ireland_en

Frayling, C. (1993). *Research in Art and Design.* London: Royal College of Art.

Gartner. (2018). *IT Glossary.* Retrieved from Gartner IT Glossary: https://www.gartner.com/it-glossary/infonomics

Guilott, M. P. (2012). *A Value Added Decision.* Denver, Colarado: Outskirts Press.

Hedlund, J. e. (2003). Identifying and Assessing tacit knowledge: understanding the practical intelligence of military leaders. *The Leadership Quarterly*, 118.

Howell, W. (1982). *The Empathic Communicator.* Minnesota: Wadsworth Publishing Company.

Hunt, C. (2011). *National Strategy for Higher Education to 2030.* Dublin: Department of Education and Skills.

Irish Dept. of Finance. (1958). *First Programme for Economic Expansion.* Dublin: Irish Dept. of Finance.

ISSE . (2017). *Testing of the Irish Survey of Student Engagement for Postgraduate Research Students.* Dublin: Department of Eduation& Skills.

Joao Bernarda, A. M. (2017). Design as a processtool ofcollaborative multidisciplinary learning in society. *EAD European Academy of Design.* Rome: EAD Proceedings.

Jorgenson, D. P. (2005). *Assessment for Practice Oriented Education.* Queensland: James Goldston Faculty of Engineering & Physical Systems, Central Queensland University.

Krogh, G. e. (2000). *Enabling Knowledge Creation.* Oxford, UK: Oxford University Press.

KTI. (2017). *Knowledge Transfer Ireland.* Retrieved from Knowledge Transfer Ireland: http://www.knowledgetransferireland.ie/Reports-Publications/

Lawson, B. (2005). *How Designers Think.* Oxford: Architectural Press.

Lejk, M. (1996). A survey of Methods of Deriving Individual Grades from Group Assessments. *Assessment & Evaluation in Higher Education Vol 21 No 3*, 267-280.

Lemass, S. (1962). *Statement to Brussels 1962*. Retrieved from CVCE.EU: http://www.cvce.eu/obj/statement_by_sean_lemass_brussels_18_january_1962-en-0187eb1a-39f6-4268-9f0ee527f2e8b088

Lemass, S. (2013). *40th Anniversary of EEC accession.* Retrieved from The Journal .ie: http://www.thejournal.ie/40th-anniverary-eu-accession-956271-Jun2013/

Lesson. (2016). *How to get started on a hill*. Retrieved from Lesson.website: http://lesson.website/how-to-get-started-on-a-hill-when-driving-a-manual-transmission-car/

Lorenz, C. (2006). *Will the Universities survive European Integration.* Amsterdam: Free University Amsterdam, University of Michegan.

Massachsetts, D. o. (2016, July 20). *Strand 4 Technology and Engineering*. Retrieved from Massachusetts Department of Education: http://www.doe.mass.edu/frameworks/scitech/2001/standards/strand4.html

Mathew Bates, D. P. (2017). Learning in Practice [Recorded by I. b. Whelan]. Dublin, Ireland.

Newman, J. H. (1852). *The Idea of a University.* Project Gutenburg Ebook 2008.

Nonaka, I. T. (1995). *The Knowledge Creating Company.* New York: Oxford Press.

O'Connor, M. (2013). *Towards a Performance Evaluation framework: Profiling Irish Higher Education.* Dublin: Higher Edcuaction Authority.

Oireachteas. (2016). *Dail Debates*. Retrieved from Oireachteas.ie: https://beta.oireachteas.ie/en/debates/debate/dail/2016-01-26/27

Paulson F.L., P. P. (1994). Assessing portfolios using constructivist paradigm. New Orleans: American Educational Research Association.

Polanyi, M. (1966). *The Tacit Dimension.* London: The University of Chicago Press Ltd.

Price, B. (2012). Key Principles in assessing student practice based learning. *Nursing Standard*, 1-3.

Sara Colombo, C. C. (2017). New Design thinking Tools for the Next Generation. *European Academy of Design.* Rome: EAD.

Schon, D. (1983). *The Reflecive Practitioner.* New York: Basic Books.

THEAQF. (2017). *Technological Higher Education Quality Framework.* Dublin: Technological Higher Education Association.

Violeta Clemente, k. T. (2017). A Future Scenario for a Methodological Approach applied toPhD design Research. *European Academy of Design.* Rome: EAD.

Vught, F. A. (2012). *Higher Education Dynamics.* Heidleburg, London, New York: Springer Dordrecht.

Wang, T. (2010). A New Paradigm for Design Studio Education. *ijade*, 1.

Wetter-Edman, B. W. (2017). Dealing with wicked problems in messy contexts, through prototyping. *European Academy of Design .* Rome: EAD.

WhelanL. (2018). *LinkenIn.* Retrieved from LinkenIn: https://www.linkedin.com/in/lynne-whelan-a7104019/

World Economic Forum. (2016). *The Future of Jobs.* Geneva: WEF.

10.0 Appendix

Appendix A – Acronyms used in Project

List of acronyms used in the Project :

Acronyms	Full Title
AISHE	All Ireland Society for Higher Education
AIT	Athlone Institute of Technology
C&AG	Comptroller & Auditor General
CE	Campus Engage
CEEN	Campus Entrepreneurship Enterprise Network
CIT	Cork Institute of Technology
DES	Department of Education & Science
DCU	Dublin City University
DIT	Dublin Institute of technology
DKIT	Dundalk Institute of Technology
DJEI	Department of Jobs Enterprise & Innovation
EGFSN	Expert Group on Future SkillsNeeds
ERDF	European Regional Development Fund
ESMU	European Centre for Strategic Management of Universities
FETAC	Further Education & Training Council
GMIT	Galway Mayo institute of technology
HEA	Higher Education Authority
HETAC	Higher Education & Trainign Council
IADT	Institute of Art & Design Technology Dun Laoghaire
ICEP	International Conference on Engaging Pedagogy
ILTA	Irish Learning Technology Association
INEW	Irish Network for Enhancement of Writing
IOT	Institute of Technology
ITB	Institute of Technology Blanchardstown
ITC	Institute of Technology Cork
ITT	Institute of Technology Tallaght
ITS	Institute of Technolgy Sligo
IUA	Irish University Association
IUQB	Iridh Universities Quality Board
LIN	Learning Innovation Network
LIT	Limerick Institute of Technology
LITT	Limerick Institute of Tipperary
LYIT	Letterkenny Institute of Technology
NAIRTL	National Academy for Integration of Research Teaching & learning
NATL	National Academy of Teaching & Learning
NDLR	National Digital Learning Resource

NUIG	National University of Ireland Galway
NUIM	National University of Ireland Maynooth
NQAI	National Qualification Authority of Ireland
OECD	Organisation for Economic Co-operation & development
POL	Practice Oriented Learning
QQI	Quality & Qualifications of Ireland
RAE	Research Assessment Exercise
REF	Research Excellence Framework
SEP	Standard Evaluation Protocol
SIF	Strategic Innovation Fund
SLL	Student Led Learning
TCD	Trinity College Dublin
TOR	Terms Of Reference
TU	Technological University
UCC	University College Cork
UCD	University College Dublin
UL	University of Limerick
UWA	University of Western Australia
UOA	Unit of Assessment
WBL	Work Based Learning
WIT	Waterford Institute of Technology

APPENDIX IV

APPLICATION FOR ETHICAL CLEARANCE FOR A RESEARCH PROJECT
(FORM REC2-L9(R)/ L10)

A.   Applicant Details

A.1   Researcher Details:

Name: __Lynne Whelan_____
Email: __lynne.whelan@itcarlow.ie_____
Telephone: ___085 1194121_____

A.2   Principal Investigator / Research Supervisor(s):

Name: _Carmel Maher_____
Email: _Carmel.Maher@itcarlow.ie_____
Telephone: _____

A.3   Additional Expertise (if applicable)

Name: Colin Deevy_____
Email: Colin.Deevy@itcarlow.ie_____
Telephone: _____

A.4   Does this research form part of a programme of study?   ☒ Yes ☐ No

If yes – please give details

> This research is being conducted as part of a 2year Presidents Research Fellowship Scholarship leading to a Masters degree by research

A.5   I confirm that I have read and understood the following IT Carlow Policies:

Ethics Policy   Yes No ☒   ☐
Ethics Procedures and Guidance notes
On completing this form   Yes No ☒   ☐
Data Protection Policy   Yes No ☒   ☐
Anti-Plagiarism Policy   Yes No ☒   ☐

B.1   Title of the proposed research project

> The Role of Practice Oriented Learning in Design & Creativity in an Irish Technological University

B.2   To what extent has this topic already been researched and written about (e.g. is there a significant body of existing published work)?

> The role of practice oriented learning has been researched and written about on an International level over many years by authors such as RM Gagne, DP Ausubel,   JS Bruner, A. Banduras, some specifically within design such as K. Dorst , N. Cross, D. Schon R. Buchanan as example. The technological University in Ireland is a new and emerging entity which has firm strategies in place from a national level such as the Hunt(2011) report .However the implementation, methodologies and interpretation of strategies are equally only emerging and it is within this area the research will address.

B.3   From that, describe how this proposed research is contributing to what is known about the topic

> This proposed research is intended to assist with the development of proposed frameworks within the design education sector for the emerging TU, to ensure maintained/enhance quality within teaching & learning practice in design

B.4   Provide a brief description of research *(not more* than 200 words in any section)*

a) The aims and objectives

> The aim is to reflect the values and competencies gained through practice oriented learning, some of which are perhaps not recognised at assessment level but are proved to be attributes which are highly sought after by today's employers.
>
> The objective is to create, develop and refine frameworks for teaching and learning within Irish higher education that include practice oriented learning and revised methods of assessments rubrics. The overall outcomes may prove to be transferable to many other disciplines that value the benefits of practice oriented learning or learning by doing.

b) The research design

> (Note: This section can include an overview of methodology research design proposals regarding for example, evaluation and data gathering. In describing the research design, applicants are required to explain the reasoning behind their choice of method)

> Stage 1
> Literary review

Research and analyse available data that assists with our understanding of the rationale behind technology education in Ireland. This is to include the emergence of Regional Technical Colleges through to development of Technological Universities. The context to cover policy, social and fiscal influences on an EU and national framework. This will assist our understanding of the strategy for our developing Higher Education. Attendance at relevant conferences.

Stage 2

Literary review

Research and analysis of practice oriented learning. This will involve a review of learning outcomes beginning with a review of the theorists views through to current practices on a national and international level. This will provide a platform of existing knowledge on which to build following primary field research. Attendance at relevant conferences

Stage 3 Primary research Interviews/Observation

This stage is intended to broaden the theoretical knowledge attained through literary reviews to a grounded knowledge based on practice. Interviews with

c) The size and composition of sample

The composition can be divided into six groups, five of which are interview groups, the sixth is an observation group.

Group 1 Higher Education Authority (HEA) strategy member's 1-2 people

Group 2 Small to Medium Enterprise (SME's) owner/managers 1-10

Group 3 Adult Undergrad Institute of Technology students 2nd, 3rd, 4th year students from design sector X 2 Institutes as class groups

Group 4 Adult Erazmus students 1-4

Group 5 Institute of Technology teaching staff 1-4

Group 6 Observation group – 2nd, 3rd, 4th year class groups IT Carlow

d) The method of how participants are expected to be selected, approached and recruited in conducting this proposed research?

(Note: The process of participant selection is required to be outlined clearly. If for example, participants are being contacted through an organisation, e.g. school, an initial step would be to seek permission from the organisation to approach the participants. Any inclusion or exclusion criteria must also be specified.

All engagement will be with voluntary participants over the age of 18 as stated in participant information/consent sheet.

Group 1 HEA members are selected according to their involvement with strategic development of higher education in Ireland eg. Muiris O'Connor Approach will be made by email of introduction to office of work

Group 2 SME's will be selected through criteria of being deemed an SME and operating in South East region. Approach will be made through email of introduction through Local Enterprise Office with request to have an introduced attendance to networking event.

Group 3 Undergrad design students selected by criteria of being over 18 , participating in design study attending an Institute of Technology. The

approach will be through email of introduction to head of design department.

Group 4 Erazmus students selected by criteria of being over 18 and participant of design or similar workshop based learning in an International setting. The interviews will be conducted by Mary Bates at the International Office in it Carlow. I will be in attendance and documenting the interview with prior permission of participant through participant information sheet. Approach has been made in person to Mary Yates to introduce the research.

Group 5 Institute of Technology teaching staff . IT Carlow designcore teaching staff have been selected as the project and myself are already known and require no further introduction. The relevant staff will be verbally approached for voluntary participation Group 6 Observation Group – As per group 3

e) Describe the procedures that will be adopted to maintain the confidentiality of research subject(s).

Participants individual or group and Institutions will be given pseudonyms or numbers, they real names and identifies are only available to the researcher and supervisors . Stored audio , memo, or survey material will use numbers and pseudonyms and be devoid of identifiers. Participant information/consent from will be used to obtain voluntary informed consent

f) Will any member of the intended group of research subjects, to your knowledge, be involved in other research projects or activities? If so, please give details and explain the nature of the engagement with other projects.

N/A

g) Describe how the information is gathered, stored, handled and anonymised.

Informed consent will be obtained from each participant by means of participant information sheet and consent form. Field notes will be devoid of personal identifiers . Participants and Institutes will be given numbers and pseudonyms which only researcher and supervisor have access to real names and identifiers. All data collected will be stored securely in a password protected personal computer and backed up on a password protected hard drive. In keeping with principle 5 of the Data Protection Act 2003, data will be retained for five years after the award of the degree after which time it will be destroyed.

h) Please state the location(s) the proposed research is to be conducted

Participant Groups
Group 1 research will be conducted at HEA offices in Crampton Court, Ballsbridge Dublin 4
Group 2 research will be conducted throughout the South East region of Ireland according to the NUTS 111 level regional categories of Ireland.
Group 3 research will be conducted in IT Carlow & either GMIT or Athlone IT
Group 4 research will be conducted in IT Carlow International Office under supervision of Mary Yates
Group 5 research will take place in IT Carlow Designcore Group
6 as per group 3

i)   The proposed starting date of research/ study

Particpant research proposed to begin March 2016

B.5   Has this research proposal received ethical approval from any other body? – if so please provide details.

No

B.6   Does this proposed research require licensing approval? – if so please provide   details of licenses obtained.

No

B.7   Describe (a) the ethical considerations of this proposal and (b) the steps to be taken to address these.

Ensuring all participants are aware that their participation is voluntary. To address this, the incorporation of a participant information sheet/consent form which states the rationale for the research project, the methodologies of data gathering used, the voluntary nature of participation and the removal of identifiers from their contributions.

Ensuring all data collected is stored in a manner which affords anonymity and security.
Data and study information is stored securely in a password protected personal computer and backed up in a password protected hard drive. Data is retained/destroyed in accordance with Data Protection Act 2003

Ensuring all findings and evaluations, along with field, written and aural notes presentable or publishable works, have no personal identifiers to any participants.
All personal identifiers will be removed and numbers and pseudonyms will be used. The true names and identifiers are to be known only to the researcher and the supervisor

Ensuring the participants fully understand the context of the research and the benefits of potential findings & outcomes.
The use of participant information/consent sheet and email of introduction will explain the context and expected outcomes of the research project.

B.8 Describe the research procedures as they affect the research subject and any other parties involved.

The research in relation to participants involved will include, interviews, group brain storm, and group observation/documentation of groups/individuals.

Group 1 HEA Interviews will be conducted by voluntary contribution in a location agreed by participant and should last approx. 1hr. This should

involve semi-formal interview meetings with open ended questions. This should assist with understanding the background and timeline to current strategies for Higher Education and timeline for implementation stages. Group 2 IT Carlow Design Teaching staff Interviews will be conducted by voluntary contribution in a location agreed by participant and should last approx. 1hr. This should involve semi-formal interview meetings with open ended questions as per group 1. The aim is to garner a deeper insight into teaching roles, restrictions, ambitions and view of emerging strategy for Technological Universities

Group 3 This will involve full class groups in the location of class/studio engaged in a brainstorm/feedback discussion and should last approx. ½ hour

Group 4 Erasmus student interviews to take place in International Office voluntary participation. Interviews conducted by Mary Yates International Coordinator and observed and documented by researcher.

Group 5 as per group 1+2

Group 6 – Observation group will involve the researcher observing and documenting activity within studio/practice based learning environments. The participants will be introduced to the project context and rationale for research. Research activities should not interfere in anyway with scheduled activities.

B.9 Please list the investigators (including assistants) who will conduct the research. Please provide details of their qualifications and experience

N/A

B.10 Are arrangements for the provision of clinical facilities to handle emergencies necessary? If so, briefly describe the arrangements made.

N/A

B.11 Specify whether research subjects include students or others in a dependent relationship.

Research participants are not in a dependent relationship with the researcher

B.12 Specify whether the research will include primary respondents such as children, individuals with mental health issues, individuals deemed to be of diminished responsibility, individuals with a physical or intellectual disability. If so, please explain the rational for accessing these subjects for the proposed research. Please indicate alternative measures investigated to avoid the necessity for direct access to these primary respondents.

It is not foreseen that research will necessitate the inclusion of primary respondents such as children, individuals with mental health issues, individuals deemed to be of diminished responsibility, individuals of intellectual disability.

B.13 Please confirm that no payment will be made to any research subject

I confirm no payment will be made to any research participant

B.14 Describe the procedures to be used in obtaining a valid consent from the subject. Please supply a copy of the information sheet provided to the individual subject(s).

A research participant information sheet will be provided to individual participants who are to engage in the research, this includes a consent request. Copy attached

B.15 Please indicate if there are any cultural, social, gender-based characteristics or sexual orientation, practices or behavior of the subject(s) which have affected the design of the project or which may affect its outcomes.

None

Signed: _____   **Date**:_____

Researcher

Signed: _____   **Date** _____

Principal Investigator

Supervisor)

REVIEWER COMMENT IF APPLICABLE FROM HEAD OF DEPARTMENT/GROUP/ INSTITUTE/CENTRE

Signed: _____   **Date** _____

(Head of Department/Group/CORE/Institute/Centre)

Appendix C – Interview Transcript

Interview with Mathew Bates – Design Partners Commercial Design Practice
Mathew begins by explaining the overall approach to projects which reflects the design approach to having a broad scope but being able to contextualize to provide a holistic response. This includes potential physical prototypes and the opportunity for experiential learning within the workplace

"We do a lot of connected product experiences where you have the physical artifact and digital interface. We're involved in really interesting concepts with users in the field, physical prototypes, involving interviews with technicians, service engineers, projects where we are able to think about the holistic experience"

These are values that Design Partners have held on to amidst rising pressures from international competitors in places like the Far East who strive to make products quickly without much deep thinking or process.

Figure 56 Design Partners value model making

'I think there are certain values that we have from the very start that we haven't lost. I think things like having a physical model as early as possible in the process, there is nothing like a physical model to communicate to a client an experience, product design or prototype. The notion of thinking and doing and getting that balance just right, some agencies focus on strategic thinking a lot and they suffer on the doing."
This is a validation of the findings in relation to the value of tacit knowledge formed through learning by doing as providing meaning and playing an integral role in knowledge creation and the innovation process.

Figure 57 Design partners hold the value of learning by doing within commercial practice

Figure 58 Visual Mapping in design practice at Design Partners

In relation to graduate attributes, it was interesting to uncover if Design partners recognised or or held value of the attributes that are reflective of a tacit understanding.

'' I think what we are looking for is an ability in story-telling, good technical skills, good user experience, general design thinking, they might have had work placement in the field, really well equipped creatively, mature about design."

The general 'design thinking' may be almost overlooked as an aside but when brought to consideration, it covers a host of expected graduate attributes. The term design thinking has a tendency to be over used and used with multiple meanings. In this case Mathew continues to describe this as;

"Creativity is the most important thing that we are looking for coming out of college for students. They need to show an ability to think differently and apply that thinking to design, to an output, they have got to have the 'why?' behind what they are thinking. Core creativity that is the center of everything"

"We have a fundamental message that you always have to be tuned into the audience because different things are relevant to different clients .Having the ability to understand what is relevant so you can almost pitch on the fly, focus on certain areas, emphasize different areas to different clients only comes with experience . If I was trying to explain what it is, I don't think I could",

Again this statement validates the difficulty described in the literature review that practitioners themselves have in communicating these tacit skills, however design partners obviously recognize these skills such as thinking on your feet, experiential learning and creativity as being of intrinsic value to industry and sought after. Mathew goes on to explain however that in Ireland today the creative industries are still not fully recognised and it would appear this also comes down to a lack of understanding these values.

"In Ireland traditional professions seem to get gravity like engineering, lawyers, accountants where, I don't know, there is a perception that that is where the money is and they are more secure. The creative industry is looked upon as diminished, people don't really understand it."

Interview with Educational provider – Exploring the approach of different disciplines to problem solving

Thematic analysis was used with the interview transcripts in identifying key points of project relevance. The following interview transcript demonstrates methodological approach to transcript analysis. By colour coding key themes to extract and consider, it enabled a reflective conclusion to be drawn. The interview was conducted with a marketing lecturer who delivers modules to business/marketing students and also to design students. The aim was to capture new information or re- affirming information and observation/analysis.

Analysis   x xxxxxx – key points of relevance to project (new information)

            – key points of relevance to project (verifying information))

xx xxxx – author thoughts/observations

[**Do you deliver the same module to all disciplines? Any different approach?**]

I take two approaches, basically the content is still the same, for example if its marketing, the marketing plan is still the same, it is what it is, so say in the business school it is very much lecture so the first half of the year you kind of deliver the content through a lecture but you do break up and activities in each lecture. This is very difficult to manage because we have very big numbers, that is one of the big differences (between marketing and design) I suppose compared to design I could have 70 people in a class so I think there's a degree of managing those numbers but I think if you do a task there is a better outcome. So then with design what I see is of big benefit to design is you have your own dedicated room, studio space, you wouldn't have that in a university, you wouldn't have that in a traditional setting and I think that is key to to the success of how design deliver.

Then in design I do still use blackboard and I put up notes and a lot of links to maybe the marketing plan or how to do a competitor analysis plan link, links to how to do academic research and all that but then its much more activity based in the class, we actually do it in the class [do they use the links] the better students do but not all and I see a better outcome from the students that use the links and some of them love templates and they love the structure of the plan and they love to see one of the things I think they love to see and I like to give feedback on is where their marks are from (more used to reflective practice?) so I would definitely use rubrics and they would be quite rigorous the rubrics as to where marks are allocated and where they get the grades from. Again that is different if your problem solving is collaborative it becomes more about the end result as opposed to the process (this is problem with assessment of tacit, in this case collaborative work) I always think the design are so good at the end at the creative, you know the ideas and the branding you know that kind of end bit sometimes I think they fall down in the rigour of the research and citations all that sort of stuff so I would do that with them and when you do that with them in the class they definitely apply the knowledge then. So they are very good at applying knowledge I think.

[**So when you recognise differences in approaches you modify and adapt…**] I do I adapt and each class could be different and each year could be different so I think you have to kind of judge the group dynamic [**You witness the collaborations in design, do you find the same in**

for example the marketing class or is it as easy to observe given the physical environment] we would do a lot of tutorials in business so we would and that really comes in the second half of the year, you might deliver all the content and then they work with live clients and they work with projects and then you set them up in project groups and then we would run tutorials and we would meet each group weekly in a tutorial based but they would be working in the room or in the lab if we were in the lab and that kicks in maybe third or fourth year, first and second year is far more chalk and talk I suppose and exam based. Our 4th year modules are really 100% continuous assessment so it is all collaborative learning and a lot of team work in there we bring them on a journey to get them there right but I know you start on that journey immediately in design. (4.22) **[in relation to that journey and getting to the collaborative and project based learning…]** yes the most difficult thing for us in that, is not having a dedicated (physical) space. I think that is just incredible because you have all the meeting and the you know if you're in a room you're there you're meeting it's all collaborative you're bouncing ideas off different groups and they(marketing/business students) have that whole thing of trying to coordinate a group which can be very difficult and having no space then to meet right.(4.00) I do think that collaborative environment is brilliant, when you're in a lab say and they could be working on a digital marketing campaign for me, they really collaborate and they give each other, they really help each other and it's not just people on their own so I think we miss that a bit by not having the space to do it….we won't get it though.(recognises the value of studio environment)

[Does your current method of assessment or rubrics allow you to capture any of that work/learning outcomes or is based mainly on end result?] No we do we do, we do an awful lot of reflection so we've set up even on blackboard, each group is set up and it's called the journal so you feed into the journal and what you did and how you felt the other groups or team members did so there's a ..it keeps them going and motivates them if they know they have to fill in their reflection each week, how they go about it differently, what they've learned. Then we peer review too, yea we do a lot of peer review now and that is really interesting we've a lot, to be honest we have an awful lot of problems with groups that I don't see in the design class **is that based around student interactions or in managing the groups?]** oh there is war in the groups, who's doing what and who's not doing anything ,leadership, clashes of personality, this year now, its this time of the year all the problems happen so every class you go into there's problems in groups but I don't see that in design to be honest**[it may be they are put in groups often from day one]** it's funny because I have the sports students too and they never come with problems they are out on a pitch working as a team, now there couldn't not be problems in their groups but they never bring it to you and they get there in the end(very interesting difference and aligned with sports who have longer experience of working collaboratively**[it takes that level of practice I suppose}** well that's why they do the reflection and they do the peer evaluate and they peer evaluate other groups and we factor that into grades then**.[do they get the feedback on that and does it impact on them]** For the journals now we make it all open and up front I can see what you were saying and you can see what I was saying, it's you know**[it's transparent]** yes its totally transparent and it cuts out a load of the rubbish. **[it's probably more reflective of a work space today to have to navigate in teams]** yes and that's not what the university sector is about, I think that

is one of the USP's of the IT sectors really [**what is your view of the emerging TU culture and the difference from your own experience of IT culture**] the usp's of the IOTs and all the student surveys say it and all the feedback from graduates, is accessibility of lecturers applied education , I firmly believe that if you did marketing here you are coming out with much more transferable skills for industry than if you had done it in a university and I'm not knocking universities because it's a different type of learning we do have different students too   [**education for education sake or education for vocation**] yes if you've come out of university

 from the classics and you've done pure English(9.07) and you've had 600 points to get in there it's more about education for educations sake, broadening your mind, whereas you(design) are ready to go into any industry maybe business graduates are only a two steps ahead of you in terms of a business role, like I do think it's a different type of person whereas I think that is the key thing for the IT sector, you are fit for purpose immediately and you're ready for industry and you really see people shine, that mightn't have shone in traditional education [**where do you see the benefits lie in the transition to TU** ?] pause, eh, suppose it will attract more students…wont it?, I suppose funding and numbers to the region and its eh…(shrugs)design has fought for their spaces for studio base , but even if you look at the new buildings and the new everything, like its amazing and we are moving towards a technological university definitely in that respect but it doesn't really lend itself to collaborative learning as in you know I'm in the huge L theatre and you're like oh my God, I feel as if I'm like I'm in I don't know where but they can put huge groups in there.[**Do you think that's what's envisaged for the TU in general?**] like we've asked for a few things small things like not fixed seating so that we can, there can be more collaboration in the rooms, I suppose though its funding and numbers but even there's no…when they designed that building its amazing the Haughton building but, there's few rooms upstairs but there's no left handed seats little things like that they should talk to people you know, it's funny that it's all just right handed you see we have a few left handed people and they have to go like this(indicates crossing over arms to try and write), I know that might be small (student centred approach?) The service space is state of the art I mean our Erasmus students come in and they go this is amazing and any guest speakers you bring in they go they never thought Carlow would be like this so we are up a level definitely, but in terms then of collaborative learning it's very difficult. [**From a business course perspective as well as design, the strategy for transitioning higher education is to create critical thinkers and innovators, and for problem solving/ project based learning approach, have you witnessed your course adapting to this approach could you tell me about that**] across the business school a couple of courses really have embraced that problem solving and critical thinking and we've gone towards that 100% and it is all..you know live projects with clients, team work, mixed team, individually, we can really oh my the benfit of that has really improved the course, the masters in digital marketing is all collaborative and it's all you know problem solving, even we have scaled down the contact hours so its much more like the design model I suppose. I see though, I have the 3rd year design this year and it's a very big class and I find it can be difficult to manage them…. People can hide, there's a few people there now and I've had them for 2 years as we've changed and I really know the really good students , it seems to be a really good course and its lucky there is such really high achievers in there but I do see a few and Im like oh yea I wonder what their

name is and id normally know everybody well you know there's room to hide in that environment..(Scalability is a problem for studio based earning) there is two very good leaders and they bring the whole class on, you need leaders (14.05)(few mins off topic recommending Irene Mc Cormack as someone else to talk to)

But yes I have changed my style totally, Im going ok this is design now, and then I go in and they're surprised to see me, and like they're sitting waiting for you in business, it's a totally different approach,**[how do find the design student delivery of projects when they comeback with work],** totally different ,totally different, they can be random, totally(laughs) but never boring as in they are excellent presenters , they have confidence but sometimes they are very in to the output at the end, the creative end of it but you do need the rigour that goes behind that, sometimes I can see they really approach their research very hap hazardly and I kinda go like who did you sample, what technique did you use there and I'd have done it all with them, ah we just did… but their outcome is really good but Im going that would not work in the real world, your product will fail, you need to listen to your customer, you need to listen to the research, so sometimes..eh…but they deliver, they never miss a deadline, they are very mature in their approach, you know if they needed an extension, loads of things like that they're very very mature in the way that they approach it, never ever I don't think I've ever had a team miss a deadline which would be very unusual, **[do you you're your experience, think they enjoy the subject, do they engage with it]** they always have had positive eh, like that's why they kept it, and I love them, when I meet them I have to say I always love them, I'd have kept in touch with past students, I'd always come back to the office and say, they are such nice students. I sat beside designers when I was in industry, we are mutually dependent on each other, you can have the best product in the world but if nobody knows about it, its communication. This year it is a bit more challenging because say I've had them last year and we , its all a bit of a learning process, everybody is working on the same project all the time, you know so they're like we love to do a different project with marketing to go off and do something else, and I've to go we can't really we have to stick with the outcomes like. But I think they see the value of it definitely **[from a future work perspective or academic]** . I think they just know that long term we need this and definitely, if I look at the alumni that we've kept in touch with, some of them are incredible marketeers , I think it's when you get out into industry you'll really see the value of it and I think it was one of the unique things about Carlow that they brought in the business stream, a lot of them are very engineering, in product design **[yes , I think in general there are more collaborations in general which is a good thing]** yes in science now I was involved in the brewing and distilling course. I went to that validation panel and I just though this is the most interesting, I should have done science(laughs) but not but you know it was just so interesting to see another discipline and see it from another perspective….but that's industry that's the world. I think the way they(design) learn is fabulous because the outcome is really fabulous at the end, they really deliver, they wow you , their presentations do wow me always and its more the content. **[what do you make of your observations of their process, they go through a certain creative process which to some may seem 'messy']** they don't know what they're doing and I can see their frustration, I can kind of see at the beginning, they don't see…eh there's no joined up thinking to see where it's all fitting in and it's a process(there may be a

consideration here in relation to someone from another discipline not recognising the design process and how iterative it is , this seems to be ongoing that other disciplines observe iteration as 'mindchanging' or indecisiveness as opposed to ensuring depth and being part of the process.) but they definitely get there in the end but you bring them on that journey, I think really the role in design is you're a facilitator as opposed to delivering lectures)**[do you think that enables broader learning outcomes]** yes it is definitely **[which is where possible the Tu is shaping itself around}** yes I think education is going that way, even in the schools and younger levels, even in primary schools [**so its how to capture what this will mean to people like yourself on the ground working within the system and possibly facing the difficulties}** you have to change your technique, and how you eh …it's not that rote learning and then a test at the end of it, so that your just testing a memory, it is , it's how you've applied, how you've reflected, how you've learned how you'd approach it again and peer evaluation **[do you measure all of that or is it mainly the outcome]** we are great at measuring and rubrics in the business school so we do , we are quite rigorous in that… pauses **{ so it's the entire process you aim to capture?]** yes being totally honest you find they actually do better on (by being assessed on entire process) because sometimes I say, this rubric has given me ..you know the way you can read something and go that's worth a 50 or a 60 that's a first class honour and next thing you go Jesus they're actually after doing better but that's great because they deserve that for how they managed the team or how they did you know were not just grading that end piece result which can be unfair because there is a big process that went beyond it**[do you find that easier or harder to capture with design students or business student do you do the same for both]** eh ….kinda do it in the same way really but then there can be a lot of upset, the feedback is difficult, not from design students, in fairness , they'll take critique no problem, that's a really interesting one actually I'm only thinking that now , they definitely take critique and they don't take it personally and they don't get all upset about it, whereas you could dread going in to some classes going oh my God like how am I going to give this feedback **{ because it is an important part of the learning process]** exactly it's like Im not…I want you to get better at this, it's not that Im saying you know but yes they actually do take critique really well and they're not childish about reflection actually I must do a bit on the reflection, I did a little bit with design but I must, you can see as you do more reflection with the group that they're not childish about reflection or grading themselves really high you know ridiculous evaluations or peer evaluations, you can see that they actually do it properly.

Appendix D – Reflection on key conference attended - European Academy of Design (EAD) 2017, Rome,Italy

Presented Full Paper
The European Academy of Design conference was selected to submit a paper to as it provided an international platform relating to design and specifically dealt with a track on 'Design For Next – Education'. Abstracts and full papers receive peer review and attendance would provide access to other researchers for feedback and also for data collection on contextual areas to this research project. The conference was held in Sapienza University in Rome and ran for three days

An abstract was prepared and submitted which was subject to double blind peer review prior to full paper acceptance. The abstract was accepted and the peer review was considered in preparation of full paper content and approach.

Title: Towards a University Design School - Restoring the Value of Tacit Knowledge through Assessment

Peer Reviews of Abstract
Review 1

Comments for the Authors

This paper is focussing on the one of the most crucial challenges of design education and its role in academia between the sciences and art. I am not sure what kind of assessment the authors are proposing, but I am looking forward to learn more about it

Review 2

Comments for the Authors

The abstract content, method and content are not so clear.
In particular, the concept of "tacit and explicit knowledge" have to be better explained, as well as the declaration that "traditionally the University model of education has been far removed from the design school principle", or "design has been traditionally marginalized by the university structure."
A wide and deep analysis and comparison with educational paths in the world (in University and other schools) could be useful; some case studies should be provided to demonstrate the thesis.

Reflection on abstract peer reviews

The abstract peer review 1 highlights firstly that' the area of research is noted as focussing on one of the most critical challenges of design education and its role in academia between the sciences and art'. This validates the current direction of the research and the context in which it sits.

The abstract peer review 2 refers to method and content not being so clear in relation to the concept of tacit and explicit knowledge. This was considered and specific focus was given in the full paper to defining knowledge, knowledge creation and the role of tacit and explicit knowledge. The full paper was submitted and an additional peer review was given as follows.

Peer review of full paper

Regarding the contents, the Review Committee would like to give you the following feedback:
The paper reports an interesting research that points out the value of tacit knowledge in the design educational context as an intrinsic component in the creative process.
The cultural assumption is inspiring and the approach demonstrates some valid outlines. The structure and theoretical basis are clear, well-built and clearly documented with an appropriate bibliography.

Reflection on full paper peer review

The final peer review of full paper acknowledges that the research has captured and communicated the value of tacit knowledge as an intrinsic component to the creative

process. This is exceptionally positive feedback at this point in the research as this demonstrates the thesis answering of the original research question.

Attendance and presentation at European Academy of Design

Opening address

''Internationalisation is the key word for any institution, this means more than international students, this is an opening of minds and welcoming of new disciplines and cultures. There is a strong need to reach out to industry and to partner with industry. Creativity is a defacto of innovation. This is new from an economic point of view, we must meet the challenge as there is such strong links between creativity, people and innovation in economy.'' Stefano Fontacne, Lazio Innova**.**

Figure 59 Opening address at EAD conference (authors own 2017)

This opening address refers specifically to links between creativity and innovation and the need to meet the challenges of the changing economy which aligns with research findings to date. This extends validation of the research findings also to an International perspective.

Presentations of relevance and interest to the project

There were eighteen breakout rooms each facilitating 12-13 presentations everyday .This required some time to review and plan the tracks to attend that were most relevant. This included not only educational speaker but speakers on design methodology, industry, technology and social innovation. This ensures the broadest reflection of the research work against these various contexts. The research had already highlighted the need for graduate attributes to be aligned with today's workplace demands, therefore information on the industry of design and designs impact on industry was of value. Social values and responsibilities have also been highlighted within the research as reflective of how education is perceived and valued, so social innovation and societal needs was important to capture.

Finally as design methodology is an integral part of this thesis, it was of great interest to gain insight on international understanding and methodological approaches to research.
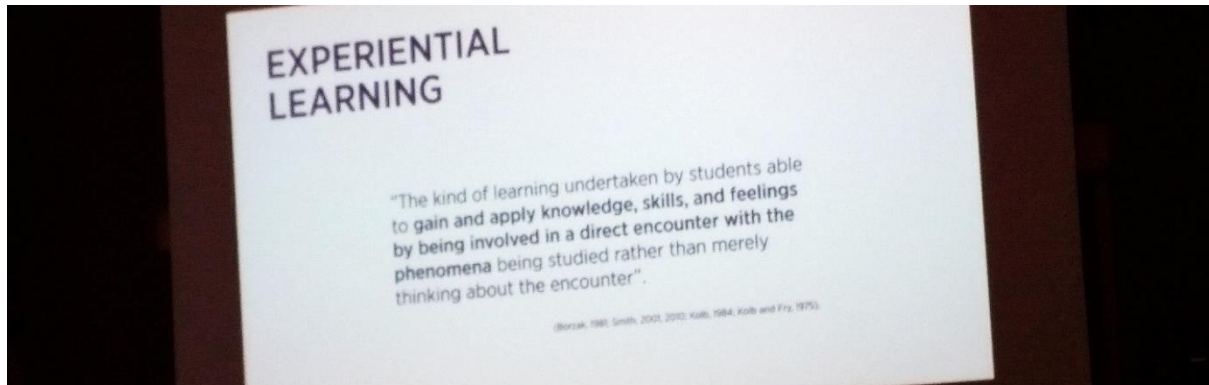
Overview of selected presentations

Figure 60 Experiential learning providing deeper insights to a study (Joao Bernarda, 2017)

A presentations was made by Joao Gago Bernarda (2017) in relation to experiential learning. Barnarda focussed on collaborative learning and design as a process tool for multidisciplinary learning. It was interesting as the context was based around knowledge skills and competencies similar to this research.

A presentation by Viola Clemente ' A Future Scenario for a Methodological Approach applied to PhD Design Research', focussed on methodological approaches. Clemente has developed a design research canvas. This was very interesting as Clemente also recognised the need for design to develop methodological approaches that capture the tacit nature of design "the need to translate the tacit knowledge embodied in the project output, into explicit verbal communication as a written thesis, is not always well accepted." (2017)

Clemente refers to the work of Frayling (1993)and the understanding of research *into,for* and *through* design but went an step further by suggesting there may be an additional category of *from* design. The' research from design' refers to the new understandings which form following tacit knowledge made explicit through reflective practice.

"research *from* design arises from tacit knowledge made explicit and communicable, moving from a succession of unique cases to broad explanatory principles through an author's reflection and analysis" (2017)
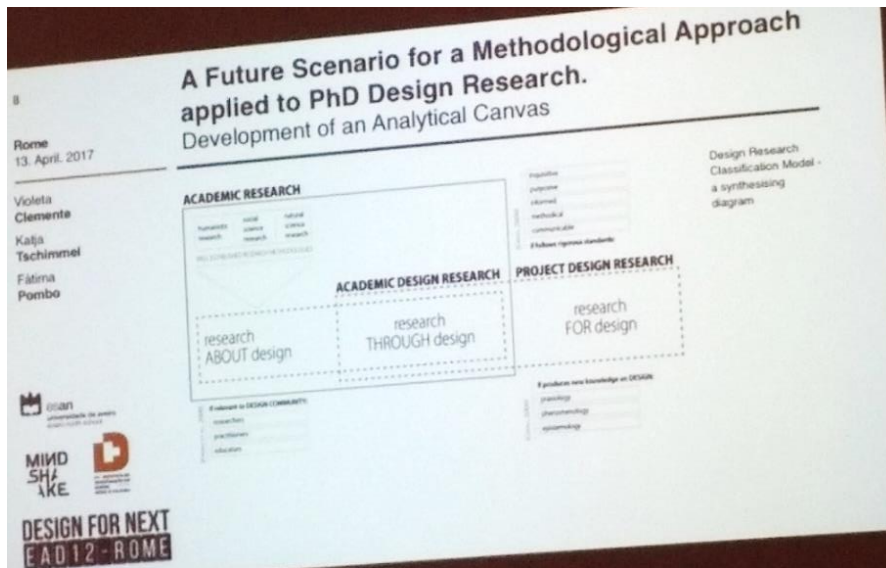
Figure 61 Clementes research chart referring to Fraylings paradigms of design research
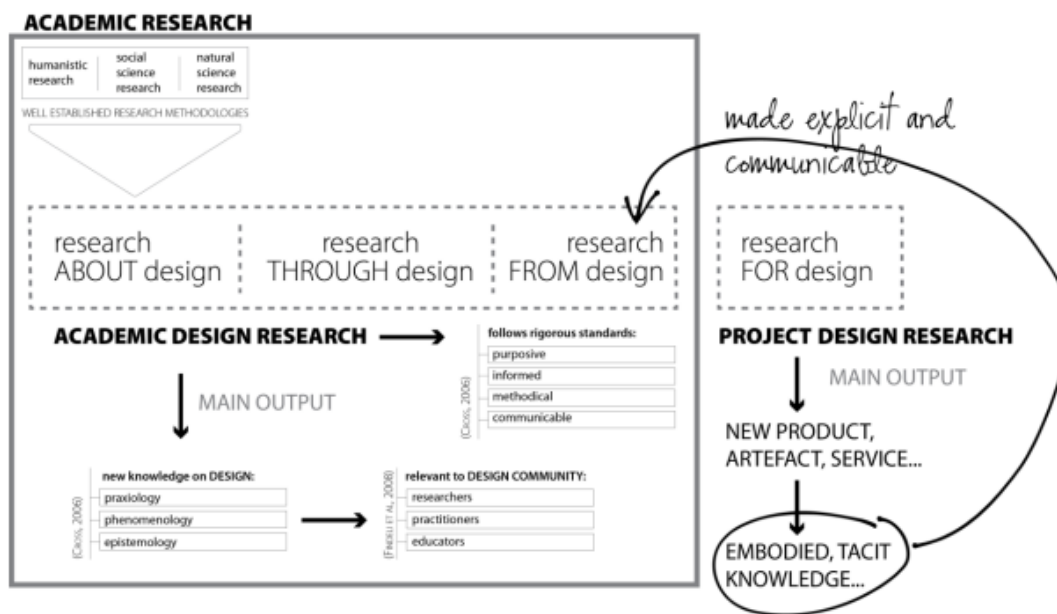

Figure 62 Clemente introducing a proposed category of research as 'research from design' (Violeta Clemente, 2017)

In relation to industry, a presentation was given by Mariana Fonseca Braga 'The choice of design. From businesses' conditions to businesses' attitudes' (Braga, 2017)
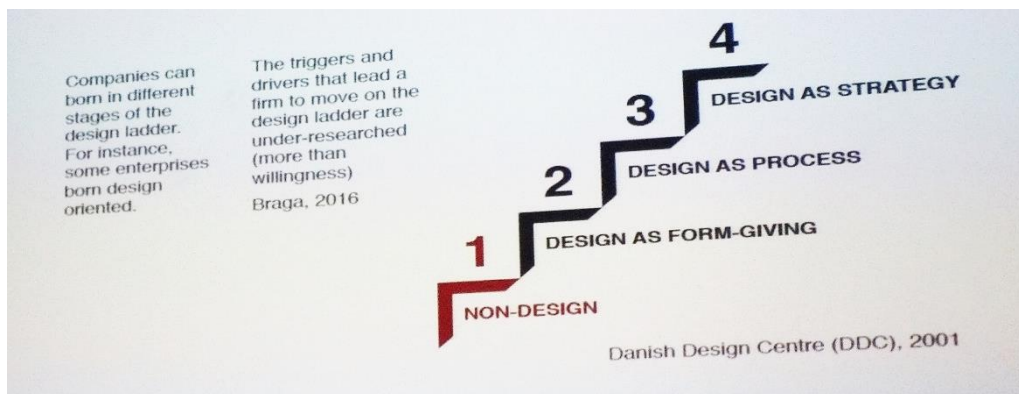

Figure 63 Steps to introducing the design approach to business

Braga refers to an organisational position on the steps of absorbing a design culture and the discussion of what triggers a company to move on the design ladder. The interesting element of this to the research project was the underpinning rationale for why a company should consider the design approach. This was based on the link between creativity and innovation.

"creativity is the main basis of the design process. Studies have not considered a psychological approach to creativity in order to analyse the role of firms' conditions and attitude during the integration of design into their (not design-oriented) small businesses" (Braga, 2017))

Keeping to the business theme, Sara Colombo (2017) discussed 'New Design Thinking Tools for the Next Generation of Designer-Entrepreneurs'

This speaker addresses the idea that not only are graduates with design attributes useful to multidisciplinary industries but also in apply them to designing their own start up. The design approach is compared in start-up with high tech start-ups.

Bo Westerlund & Katarina Wetter-Edman (2017) discuss dealing with wicked problems, in messy contexts, through prototyping

This was interesting as Westerlund refers to the next phase of design education whereby students will need to experience knowledge as situated and particular, which is reflective of knowledge as defined within this project, knowledge as contextual. Westerlund refers to John Law and continues to say that this understanding of knowledge as contextual realise that this renders things present, absent and othered. 'Othering' is referred to as an absence which is not acknowledged. Tacit knowledge could be said to be classed as 'othering' in much of the assessment criteria that exists in many disciplines which use experiential learning such as design.

A final presentation of interest was given by Enver Tatlisu (2017) in relation to 'The Reflection of Experiential Knowledge into Professional Practice'. This study highlights the

interdisciplinary nature of design graduate skills due to the experiential nature of the design process. Tatlisu examines the theories of experiential and implicit knowledge within design education and concludes that "a designer holds skills such as reconciliation with the clients, problem solving, interpersonal skills, project management etc." (Enver Tatlisu, 2017)These are tacit knowledge skills acquired through the practice of the design process.

"eventually students are able to develop a unique idiosyncratic cognitive ability" ((Enver Tatlisu, 2017)

Tatlisu describes this cognitive ability within practitioners of design and how it forms their unique internal knowledge sets and how these knowledge sets lead to create a strong tacit knowledge for practitioners. This enables practitioners to reflect-in-action and deal with complex problems in this unique way. The aim of the study is to investigate how practitioners from industrial design use knowledge while performing outside of the traditional design fields. This provides us with an insight into how transferable design process is to other disciplines as an approach.

This reflects the findings throughout the research that the design process is in itself a form of knowledge creation and through practice builds a tacit understanding essential to dealing with complexity and problem solving, providing attributes and skills that may be of value to other disciplines. The fact that design graduate skills are becoming more desirable to other disciplines is also reflective of the changing economic demands for knowledge creation.

Reflection /summary of EAD Confernce

This was the most important confernce attended throughout the research project. It provided an up to date insight on all contextual areas to the project from an international perspective. The discussions with peers was timely as the main body of research was completed, analysed and could be openly discussed debated and reflected upon.

The key findings from the conference highlighted the International research which acknowledges design as an approach to complex problem solving within industry policy and society and as such is a transferable and contextual skill. Europe recognises the need to create an innovative society to have a strong economy and that creativity is a defacto of innovation.

Full versions of publications available in thesis hard copy in IT Carlow library

13. Whelan, L., Maher, C., Deevy, C., (2016) **"The Role of Practice Oriented Learning in Design and Creativity in an Irish Technological University"** in: Proceedings of Ireland International Conference on Education (IICE-2016), Dublin, April, 2016

14. Whelan, L., Maher, C., Deevy, C., (2018) **''Timeline – The foundations of Regional Technical Colleges in Ireland to the Emergence of Technological Universities''** International Journal for Cross Disciplinary Subjects in Education (IJCDE) Vol 9, Issue 1 ISSN 2042 6364

15. Whelan, L., Maher, C., Deevy, C., (2016) **"Learning in practice"** in Madden, G.ed. ITERATIONS Design Research & Practice Review, Issue 3, pp 70-75

16. Whelan,L., Maher, C., Deevy, C., (2017) **'Towards a University Design School - Restoring the Value of Tacit Knowledge through Assessment'** in proceedings of European Academy of Design 'Design for Next', 12th EAD Conference in Sapienza University of Rome, 12-14 April 2017www.designfornext.org

17. Whelan L., Maher, C., Deevy, C., (2017) **"Towards a University Design School. Restoring the value of tacit knowledge through assessment"** The Design Journal Volume 20, 2017 – Issue Sup1: Design for Next: Proceedings of the 12th European Academy of Design Conference, Sapienza University of Rome, 12-14 April 2017

18. Whelan ,L., Maher ,C., Deevy, C., (2017) **"The Role of Tacit Knowledge in Merging Educational Cultures – Towards a University School of Design"** International Journal for Infonomics(IJI) Volume 10, Issue 4, ISSN: 1742-4712(Online)

TUI press statement 11/1/16

Technological Universities Bill must be amended to protect sector

The Teachers' Union of Ireland (TUI) has warned that if enacted in its current form, the Technological Universities Bill would wreak considerable damage on the Institute of Technology sector.

Among the union's key concerns are the undertaking of huge change without appropriate funding, the potential damage posed to individual institutes by the requirement to merge and dangers posed to the vital regional mission of the sector.

The union is lobbying public representatives to seek changes to the Bill ahead of its enactment.

TUI represents 4,000 lecturers and researchers in Institutes of Technology.

Speaking today, **TUI President Gerry Quinn** said:

'TUI has always stated that it is not opposed to the concept of Technological Universities. However, if enacted in its current form, the Bill has the potential to wreak considerable damage on a sector already steeped in a crisis situation as a result of brutal austerity cutbacks.'

Seismic change in an era of cutbacks

'We remain gravely concerned about the potential consequences of this Bill given the current crisis of underfunding, understaffing and precarious employment in the institutes.'

'Between 2008 and 2015, funding for the sector was cut by a massive 35%, or €190m. Over the same time period, lecturer numbers fell by 9.5% (535) while student numbers rose by a staggering 32% (21,411).'

'As a result, many institutes are struggling to tread water. The intention to effect such huge additional change without appropriate resourcing in an era of hugely damaging cutbacks to the sector is, at best, ill-advised.'

Requirement to merge

'We believe that the requirement that Institutes of Technology must merge before they can apply for Technological University status is more related to rationalisation of the institutes within the sector than to any academic considerations based on the particular missions, values and ethos of particular institutes. The exact rationale for this requirement has never been clearly established and it must be removed from the Bill.'

'Those mergers which are envisaged must be appropriately funded and the regional mission including multiple programmes which is central to the institute of technology ethos must be retained.'

Protection of mission and preventing geographic inequity

'Institutes have a proven track record of excellence in programme development and content as well as a significant commitment to regional equality and equity of access. They provide multiple programmes from National Framework of Qualifications Level 6 (Apprenticeship) to Level 10 (Doctorates/PhDs). The mission of the sector is distinct, with a strong focus on meeting local and regional needs.'

'A rationalisation agenda will lead to a dramatic reduction in regional provision of programmes and a corresponding geographic inequity in respect of access to higher education.'

'Towns and communities with an existing institute that is being coerced by the requirement to merge have real cause to worry. As matters stand, an invaluable local resource may effectively be down-graded or asset-stripped.'

Additional concerns

'Throughout this whole process, there has, in some institutes, been a consistent failure to consult properly with the real experts - the academic staff.'

'The Bill is excessively focused on the concerns of business and enterprise. It would be a grave mistake to prioritise the short-term needs of employers over the long-term needs of students and society. An appropriate balance is required.'

'We are also gravely concerned about the threats posed by the Bill to national collective bargaining and the terms and conditions of our members.'

'Other concerns within the Bill include the weakening of staff and local representation on Governing Bodies and the weakening of the academic voice.'

Changes to the Bill a necessity

'Amendments to the Bill to take account of these valid concerns are a necessity in the interests of maintaining and enhancing quality of educational provision by the institutes and of protecting the educational, economic, cultural and social infrastructure in the regions that they serve.'

'TUI is currently lobbying public representatives to seek the required changes to the Bill.'

An Roinn Oideachais
agus Scileanna
Department of
Education and Skills

DES Press Statement 9ᵗʰ March 2018

09 March, 2018 – Minister Mitchell O'Connor successfully steers the Technological Universities Bill through the Seanad

The Technological Universities Bill has now completed all stages, in both houses of the Oireachtas and will soon be signed into law.

Minister Mitchell O'Connor said, "This is a transformative piece of legislation and I am delighted that we have got it over the line. The Technological Universities Bill is a high priority for Government and will radically change the higher education landscape.

"The legislation when enacted will underpin the development of a new type of higher education institution, building on the strengths and mission of institutes of technology to develop world class technological universities."

She went on to say "The creation of technological universities provides the opportunity to drive regional development and provide more opportunities for individuals, enterprise and the community. These institutions will have significant impact and influence regionally, nationally and internationally.

"I am excited about the prospects for all regional clusters with a Technological University. It will have a transformative effect on communities. Enhanced higher education institutions will deliver the skilled and talented people that sustain enterprise and new investments. Ultimately it will make these areas more attractive places to live, raise a family in and work."

Ends