An assessment of the alignment of two innovation education programmes with the clinician’s needs for facing the key determinants of innovation in the Irish MedTech industry

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Author(s)	Hardy, Adam
Publication Date	2024-06-01
Publisher	University of Galway

An Assessment of the Alignment of Two Innovation Education Programmes with the Clinician's Needs for Facing the Key Determinants of Innovation in the Irish MedTech Industry

Dr. Adam Hardy

Mb BCh BAO MRCS MBA

A thesis submitted to the University of Galway for an MSc in BioInnovation

14th August 2023

Supervisor: Professor Martin O'Halloran

School of Engineering,

College of Science and Engineering,

University of Galway,

Galway

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Declaration

I declare that I am the sole author of this paper and that the work presented is entirely my own, unless referenced or indicated otherwise. I confirm that the work has not been submitted, in whole or in part, to any other institution as an exercise for a degree or any other qualification.

Signed:  ______________________

Date: 14/8/2023

Chapter 1. A literature review of innovation in healthcare with a highlight on the Irish MedTech industry

1.1. Introduction

In the following chapter, a review of the relevant literature is undertaken. The literature review is divided according to important theories and concepts, and is structured into three sequential building blocks:

- High-level innovation definitions and concepts
- Healthcare innovation
- Irish Medical Technology (MedTech) innovation

The purpose of the first block is to provide common language and a common base of understanding because the term “innovation” has been used as a catch-all term in some industries. Innovation exists on a very broad spectrum, and without clarification the assessment of the research question would be difficult.

The second and third blocks are included so that the reader’s lens may be adjusted to the correct focus. The healthcare industry is a complex industry and has many distinct considerations. The Irish healthcare industry, and more specifically the Irish MedTech Industry, also contain nuances that must be kept at the forefront of the mind before progressing into further chapters.

1.2. Important innovation concepts, innovation in healthcare and innovation in the Irish MedTech sector

1.2.1. Innovation Concepts

Innovation has long been viewed as a means of building a competitive advantage and is the most important method of sustaining a competitive advantage (Bessant, 2003). The importance of innovation must be reflected in an organisation’s strategy, informing strategic direction and decisions made by leadership teams (Baregheh et al., 2009).

In today’s world, innovation is a prerequisite for survival in any industry of today’s world. Market forces are constantly changing, whether it be the needs of customers, or the suite of products and services available from providers. Organisations must constantly be “building for the next round of competition” (Mejtoft et al., 2022).

Recently, innovation topics have enjoyed a boost in popularity in multiple forums. Players in both academic and industrial domains are appreciating the importance of properly teasing out the key components of innovation. Important components include understanding, defining and utilising innovation (Chen, 2017).

This pursuit is made difficult by several factors. Firstly, the term “innovation” is used in different ways by different people. Different people, organisations and industries innovate in different ways. Academic and commercial sources focus on different elements of innovation. Singh and Aggarwal (2022) conducted a qualitative synthesis study and found over 200 discrete terms used in the definition of innovation (see Figure 1 below).

Figure 1. Discrete terms used to define innovation. From Singh and Aggarwal (2022)

Striving for a ubiquitous understanding and definition of innovation is important for multidisciplinary teams working in industry. As vertical silos become a thing of the past, collaboration and innovation require information and knowledge sharing at a rapid and consistent speed (Baregheh et al., 2009).

If a common language and understanding can be obtained, organisations may be able to move back to developing a competitive advantage via superior innovation. The more clarity and coherence provided to innovative practices, the easier it should be to facilitate the implementation of ideas and research into value (Singh and Aggarwal, 2022).

Following the qualitative synthesis study mentioned above, Singh and Aggarwal (2022) developed the following definition of innovation, combining seven broad themes:

"Operationalisation of creative potential with a commercial and or social motive by implementing new adaptive solutions that create value, harness new technology or invention, contribute to competitive advantage and economic growth."

(Singh and Aggarwal, 2022)

1.2.2. Innovation in Healthcare

The healthcare industry is defined by the Cynefin framework as a complex industry (Gray, 2017). This definition is important for focusing on innovation within the healthcare industry context. Snowden and Boone (2007) explain that this industry is unordered, so that the way forward unfolds according to emerging patterns. While a complicated industry may have many different components, they and their relationships are generally well defined and understood. Meanwhile, a *complex* industry is in a state of constant flux, with comprehension of the whole being far more difficult to obtain than comprehension of all of the parts in isolation.

As well as the complexity derived from so many moving parts alone, the problems faced in the healthcare industry are also complex. Chronic illnesses (diabetes, obesity, etc), rising costs and access to healthcare are just some examples of the multifaceted problems requiring innovative solutions in this industry (Roberts et al., 2016).

The structure of most healthcare systems further adds to its complexity. The sheer volume of regulations, rules and the culture of standard operating procedures (SOPs) insist on a certain degree of routine and rigidity in structure (Day-Duro et al., 2020). This makes sense from a patient safety perspective but make it very difficult to innovate to improve patients or clinicians' lives (Mejtoft et al., 2022).

This is amplified by way of diverging priorities; routine service provision versus employee career and skill development, resource investment versus resource saving, etc. Although all relevant stakeholders wish to improve patient care, the scope available and the means by which they try to do so often clash (Day-Duro et al., 2020).

Innovation is required to improve capacity for healthcare organisations. Limited resources, increasing waiting times and physician burnout are all leading to pressures – financial, political, social – and so these needs are diverting innovative minds away from the MedTech industry (Roberts et al., 2016). Of these, physician burnout is one of the major resource concerns. To date, many clinicians find that their involvement in innovative processes is not incentivised and relies on goodwill. In an overwhelmed healthcare industry, this is causing significant pressure and cannot be maintained indefinitely (Day-Duro et al., 2020).

1.2.3. Innovation in the Irish MedTech Sector

The MedTech sector competes with the aforementioned aspects of the healthcare industry for innovation input. This input can be rewarded with improved patient outcomes and system efficiency and can drive economic growth for multiple stakeholders (McCormack et al., 2015). MedTech in Ireland also contributes significantly to Ireland and Europe's economies, due to the fact that one of the European MedTech's most successful clusters is located in Galway, Ireland (McCormack et al., 2015).

There are many challenges to successful innovation in this sector. The journey to market is typically quoted as being a 10+ year journey for most products. Along the way, organisations face many hurdles (Mejtoft et al., 2022). The industry has many universal commercial challenges as well as some unique ones – clinical, regulatory, technical, investment and other challenges must all be overcome in order to successfully implement innovations (Singer et al., 2022).

Fortunately, there are strategies available to MedTech organisations to tackle some of these difficulties. The most important of these is the process of open innovation. Open innovation is built on four pillars – network growth, knowledge exchange, intellectual property (IP) safeguarding and complementary business models (Dahlander and Wallin, 2006). Knowledge sharing helps to strengthen network connections (Chua, 2003). Additionally, it can provide value to multiple players, rather than favouring one over the other (Chin et al., 2008).

In open innovation practise, the boundaries between the firm and the external stakeholders are grey. One example of open innovation involved the U.S. response to the spike in traumatic brain injuries (TBIs) caused by the war on terror, which unveiled an endemic of mild traumatic brain injuries (mTBIs) in athletes. The U.S. Department of Defence engaged in open innovation in order to accelerate development of new technologies to aid diagnosis and categorisation of these injuries. Some of the quoted learnings from this endeavour included the benefits of symbiosis and mutual leveraging, the importance of “voice of the customer” (patient +/- clinician) and the utility of a top-down, flexible, innovative mindset (Singer et al., 2022).

Collaborative institutes which specialise in open innovation can help to tackle the many challenges which may otherwise be insurmountable to organisations, from start-ups to multinational corporations (MNCs) (Day-Duro et al., 2020). This is certainly leveraged in Ireland, as an analysis of survey responses showed that open innovation is seen as a key driver of innovation in MedTech in Ireland, particularly Galway (McCormack et al., 2015). Not only can collaboration between partners improve innovation, in some cases it is required for innovation to be possible at all (Bacon et al., 2020).

As well as synergistic relationships that exists between innovative collaborative institutes and industry organisations, a mutually beneficial relationship can also be expanded to include governments. Referred to as a triple helix, the three-way relationship between academic institutes, industry and governments can also drive innovation in the face of many challenges. This is a multi-centred collective in a constant state of flux, with any of the contributors able to take a driving role as needed (Leydesdorff and Ivanova, 2016).

Sweden and Ireland are both recognised as European countries with successful triple helices forming in the ecosystem (Mejtoft et al., 2022). Technology, competencies and learnings can be transferred between parties, which may lead to feedback and feed-forward loops (Leydesdorff and Ivanova, 2016).

However, there may be nuances to be worked out within these relationships. For example, in Ireland there is a healthy focus on both research and development (R&D) investment and open innovation engagement. However, despite this enthusiasm for knowledge sharing, the number of spinouts is low. This suggests ongoing concerns to be addressed, such as with the level of IP safeguarding (McCormack et al., 2015).

1.3. Conclusion

The most pertinent theories and concepts of innovation have now been highlighted. The importance of innovation, as well as the difficulty of defining and understanding innovation have been discussed. A definition has been chosen for the purpose of the following chapters.

The multiple areas in healthcare that require innovation have also been highlighted. Complexity, complex problems, limited resources, burnout and the importance of improving patient care all drive a need for innovation in healthcare.

MedTech has many of the same challenges as the overall healthcare industry, with some more restrictive regulations and additional challenges. Thankfully these can be tackled through the use of open innovation and health relationships with collaborative institutions and governments. This chapter has provided the pedagogical foundation and context upon which the content of the following chapters can be built.

Chapter 2. Identification of drivers, barriers and enablers of innovation in the Irish MedTech start-up ecosystem in 2023 via thematic network analysis

2.1. Introduction

The following chapter attempts to identify important drivers, barriers and enablers of innovation in the Irish MedTech sector by synthesising the results of multiple semi-structured interviews. This chapter first explains the technique of thematic network analysis. Next, the resultant maps of themes that were generated in response to drivers, barriers and enablers of innovation in the sector are presented. Finally, the third section of the chapter discusses these findings, with reference to relevant literature, in order to further build on the context for which the innovation education programmes can be assessed in Chapter 3.

2.2. Thematic network analysis and semi-structured interview methodologies

2.2.1 Thematic network analysis

Semi-structured interviews were conducted with representative stakeholders holding various roles in the Irish MedTech ecosystem. Interviews were conducted in-person or via Zoom video chat and were recorded with interviewees' consent. Transcripts were taken from the recordings of interviews. Thematic network analysis was conducted on these interview transcripts in order to identify the most prominent themes and links between drivers, barriers and enablers.

The interview template created can be seen in Appendix 1. Thematic network analysis provides a robust method of coding data, presenting a summary of ordered themes and generating a qualitative analysis of the data and themes (Attride-Stirling, 2001). By organising the data in a visual, weblike illustration (see Figure 2 below), prominent themes can be unearthed and a structure can be provided with which to discuss them.

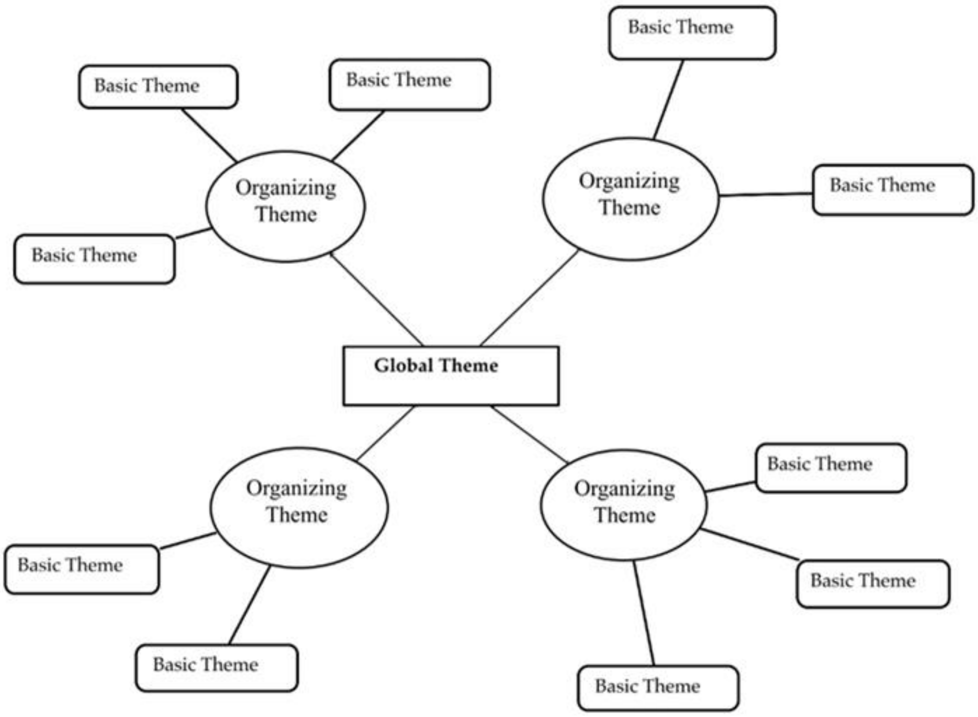

Figure 2. Structure of a thematic network (Attride-Stirling, 2001)

The process of thematic network analysis progresses from basic themes towards global themes. As the data is coded, basic themes become apparent. Once enough of these have become generated, they can be classified according to organising themes. These organising themes tell a story and can be further classified into first, second, and so on, order themes. Ultimately these lead to a handful of global themes that will aid the answering of the research question (Attride-Stirling, 2001).

2.3. Results

2.3.1. Mapping of thematic network

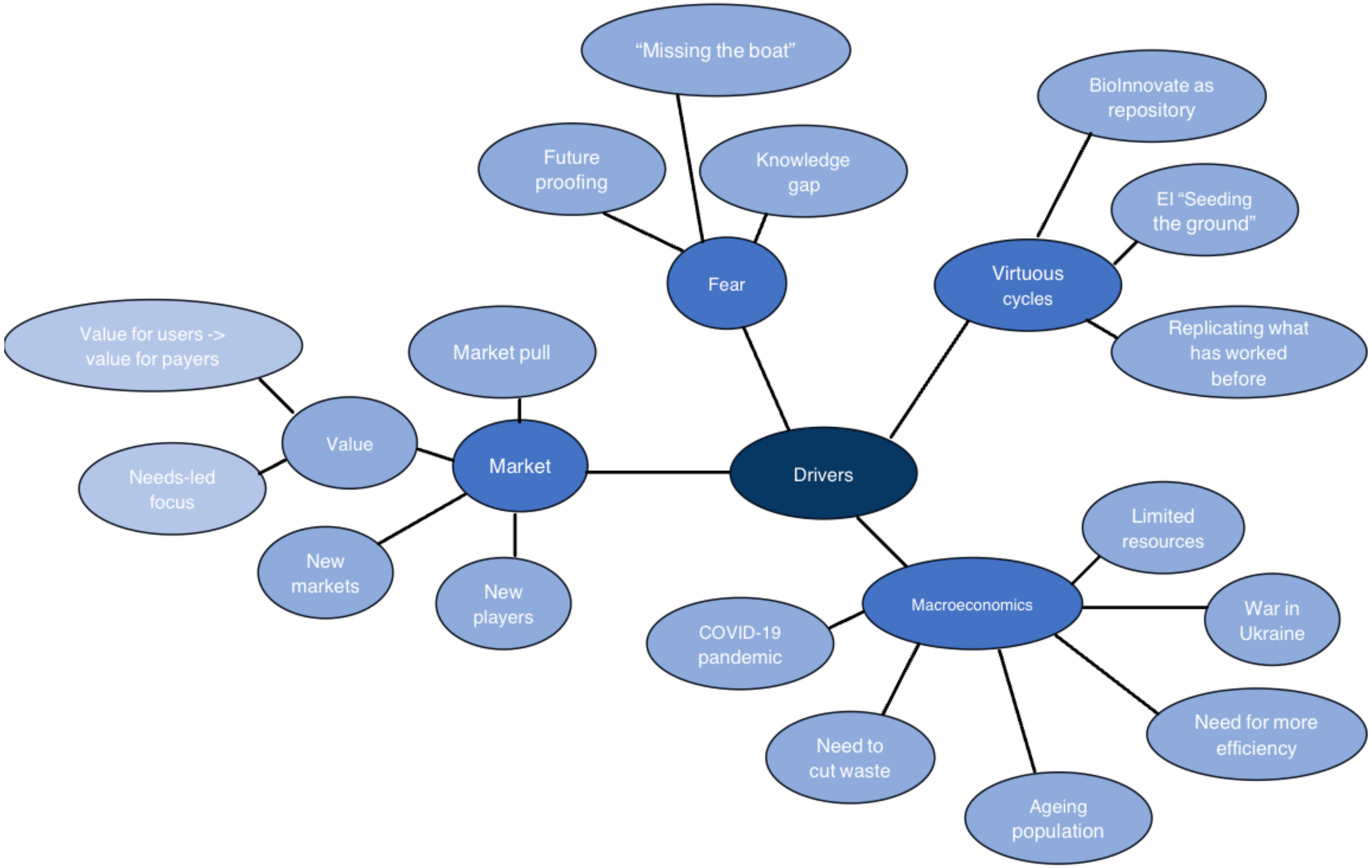

Figure 3. Thematic network of drivers of innovation

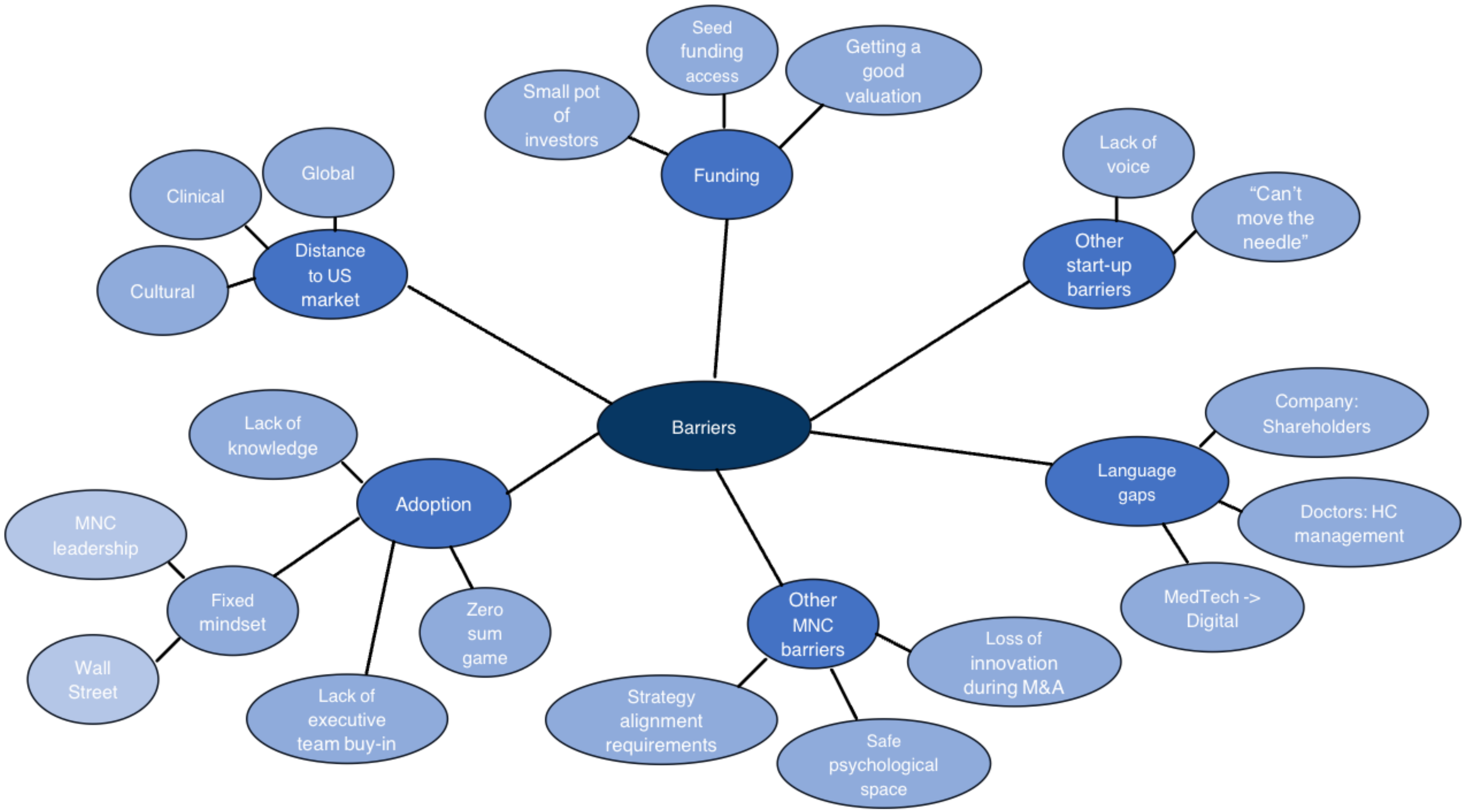

Figure 4. Thematic network of barriers to innovation

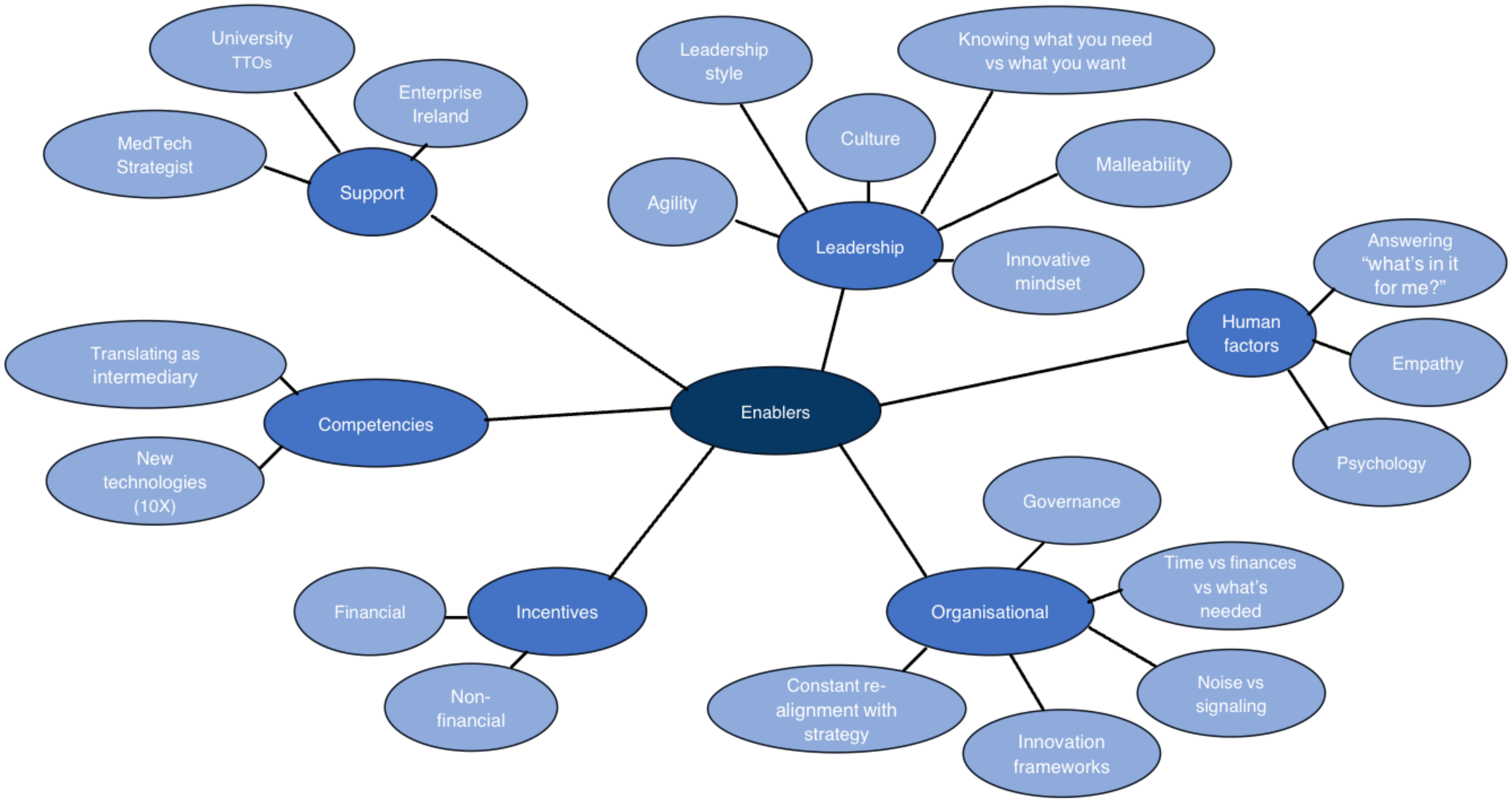

Figure 5. Thematic network of enablers of innovation

2.3.2. Discussion of findings in relation to theory

The findings of the thematic network analysis are displayed above, in section 2.3.1. Basic themes are seen around the periphery, in a light blue colour. These are then grouped into first and second order organising themes in darker blue, before connecting back to the global theme in the centre.

Drivers of Innovation

Various drivers of innovation in the MedTech industry were identified. The diverse spread of driving forces is not surprising, given the complexity of the industry under review (Snowden and Boone, 2007). From a high level view, macroeconomic factors were seen to drive changes in the industry, from global events such as the COVID-19 pandemic and the war on Ukraine to domestic factors, such as the ageing population and a lack of resources and staffing.

Other concerning drivers came indirectly from MNC leadership and investors by way of fear, *"People are paranoid they'll miss the boat. They don't need to panic but they're panicking."* Fear of major changes due to digital technologies, new players, knowledge gaps and a need to future proof were all described as driving behaviours, driving decisions such as a flurry of acquisitions of small digital health companies by MNCs.

These were balanced by positive drivers of innovation. Multiple virtuous cycles were described. Successful models of innovation can generate reinforcing positive feedback loops, which can benefit organisations and help them to build a competitive advantage (Casadesus-Masanell and Ricart, 2011). One virtuous cycle described included Enterprise Ireland's role in *"seeding the ground"* by providing investment and facilitating early stage companies in reducing risk. This provided a potential for Enterprise Ireland to generate returns but also to build skills and competencies in the national MedTech workforce and leadership. This was expected to lead to future start-up creation, which would further aid Enterprise Ireland's investment portfolio and also attract foreign direct investment.

Another virtuous cycle was described by the role that collaboration between academic institutes and knowledge-sharing innovation hubs plays (Leydesdorff and Ivanova, 2016). The more these organisations interact with start-ups, the more they can uncover "*patterns of what works and what doesn't work*." These lessons can then be fed back into new partnerships in order to potentially circumvent repetition of the same mistakes.

Market factors were also seen to drive innovation in the industry. Most of the market factors that Porter described in 1979 (see Figure 6 below) were discussed (Porter, 1979). The importance of "customers," whether that refer to clinicians or patients was highlighted multiple times, *"How will that move the dial for patients or clinicians?"* The need to generate value for payers and buyers was discussed. The need for *"ongoing, constant growth"* was discussed in two ways. Firstly, the need to constantly innovate in order to build sustainable competitive advantage and protect against substitutes or new entrants (Rita Gunther, 2013). Secondly, the need to satisfy investors and/or shareholders, *"Wall Street has a fixed mindset around target share price, which requires innovative growth but places restrictions."*

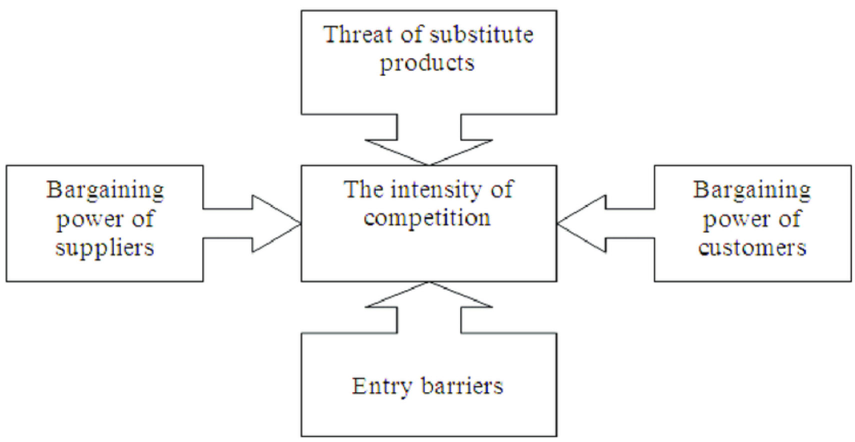

Figure 6. How Competitive Forces Shape Strategy (Porter, 1979)

Barriers to Innovation

Funding was seen to be the main barrier to innovation for start-up organisations. Difficulty with funding included the smaller pool of investors available in Ireland versus the U.S, the critical step of seed funding and the difficulty that these two factors place on negotiating a good valuation for the start-up company. These were further amplified by the macroeconomic factors mentioned earlier. Uncertainty was seen to impact investor appetite for new companies, resulting in a preference for reserving cash to further support those already invested in. Many of these players may not have had a crisis response plan in situ ahead of the COVID-19 pandemic and the could foster a preference for reactivity over proactivity (McKinsey, 2020).

Other start-up barriers included a lack of voice in the target market of the U.S., *"we can move the needle in Ireland but that's not the target market."* In an industry that requires key opinion leaders (KOLs) or champions to drive adoption of a new product/technology, it is a disadvantage being a "*small country on the edge of Europe."* Although *"the world is small and technology makes it smaller,"* Irish organisations looking to innovate and be successful in U.S. markets must be aware of the cultural, administrative, geographic and economic distances to that exist (Ghemawat, 2001).

MNCs were seen to face internal barriers to innovation. Adoption was the largest internal barrier, with sub-themes including lack of pertinent knowledge, a fixed mindset from leaders experienced in older technologies, lack of executive team buy-in and a zero-sum game mindset; a worry of *"robbing from Peter to pay Paul."* Leadership figures were held responsible for many potential barriers to innovation, *"it's a very difficult thing to do internally without an innovation framework and a safe psychological space to work in."*

Other barriers to innovation in MedTech MNCs included the loss of innovation during integration of acquired technologies or companies. Inorganic growth may provide innovative companies but the innovative driving forces can often be lost (Burgelman and McKinney, 2006).

All types of organisations were speculated to have difficulty with language gaps, whether it be between MedTech experts and digital experts, clinicians and hospital management or organisation leadership and owners, *"Have to coach doctors…how to speak the language of the system, as opposed to just the clinical language of their peers."* This barrier is most impactful at the CEO or leadership level, as it may reduce the ability to interact effectively with the constant stream of different stakeholders they meet with (Heifetz and Linsky, 2002).

Enablers of Innovation

As well as causing potential barriers, leadership can enable innovation and was found to be integral to its success by multiple interviewees, *"It's more for leadership understanding…I don't think they'll ever learn the skills…but I think if they understand how to deliver innovation, the key principles involved…innovation will become the norm."* This is fitting, as it is known that leaders play a crucial role in developing an organisation's culture, which drives innovation (Groysberg et al., 2018). As well as understanding, leaders must also possess an innovative mindset to help champion the process, *"…the mindset to be looking for opportunities is needed, otherwise someone else will snap them up."*

The support provided by collaborative partners was also highlighted as a means of reducing risk and thus enabling innovation, *"there's a risk to the person taking it forward, and that can be reduced by support; Enterprise Ireland, technology transfer offices, research centres, technical support from universities, clinical people, etc."* This highlights the importance of open innovation practices and how effectively they are leveraged in the Irish MedTech sector (McCormack et al., 2015).

Human factors elements, or people skills, were also found to be important. There are various ways of measuring the distance, geographic and other, between an Irish MedTech start-up and the U.S. market (Ghemawat, 2001). As such, it is crucial to have champions and advocates to promote your organisation. The small pool of investors in Ireland includes many angel investors, and realising what is driving their decision-making can help ensure a good fit, *"whatever investor you're pitching to, you need to put yourself in their shoes and understand what's driving the investment."* These investors provide not just financial investment but also a voice and credibility, which can help start-up organisations break through to U.S. investors and hopefully U.S. markets.

2.4. Conclusion

In conclusion, positive and negative factors are currently driving innovation practises in the Irish MedTech industry, including the need to drive value, fear of the future and generating virtuous cycles. There are barriers specific to MNCs alone and start-ups alone as well as universal barriers for all types of innovative organisations. These include internal barriers, adoption difficulties, access to funding, favourable valuations and language gaps. Thankfully, enablers exist to overcome some of these barriers, driven primarily by organisational structure, support networks, leadership style and competencies and awareness of human factors, such as having empathy for other stakeholders.

Chapter 3. A comparative analysis of alignment of the Executive MBA and BioInnovate programmes with the clinician's needs for innovation

3.1. Introduction

The final chapter consists of a comparative analysis of the Executive Master in Business Administration (MBA) programme at Smurfit Business School in Dublin, Ireland and the BioInnovate programme at University of Galway, Galway, Ireland. This comparison is done by way of two critical reflections, using Rolfe's reflective model. Relevant theory is first covered, followed by the two reflections and finally the comparative analysis is conducted. The focus will be on assessing how each programme tackles the important themes uncovered in chapters 1 and 2, which are required for a clinician to engage in successful innovation in the MedTech industry.

3.2. Critical reflection theory

Critical reflection is seen as vital to individual learning and to development of a learning culture within an organisation (van Woerkom, 2010). Engaging in reflection periodically can help individuals to better understand their past experiences and develop their knowledge for future endeavours (Loughran, 2002).

By continuously seeking diversity in ways of thinking and trying to view our experiences from other people's perspectives, we can improve in our actions and communication of what leads to successes and what does not (Jacobs, 2016). Reflecting and communicating about those reflections helps us to think critically and to generate new insights (Johnson, 2013).

The optimal method of critical thinking and reflecting involves slowing down thinking and engaging in a systematic way, e.g. by using a reflective model

(Hoffmann, 2018). The method of reflection chosen for the purpose of this paper is a modified version of the Rolfe Reflective Model (Rolfe, 2011). This involves consistently asking questions which are grouped into three broad categories:

- “What?” – describing what happened at a basic level.
- “So what?” – combining the descriptive reflection with existing theories and concepts.
- “Now what?” – focusing on action-oriented reflection.

The reflections on the MBA and BioInnovate programmes are found in the sections that follow. Due to their subsequent use for comparative analysis, each programme has been viewed in isolation for the first two pillars of Rolfe’s model. They are then combined in section 3.5 for the third pillar, as this enables comparison and yields learnings as a result.

3.3. Smurfit Business School MBA Reflection

3.3.1. What is the MBA?

Student cohort

The Executive MBA at Smurfit Business School is a master’s degree, enrolling 40 students per year. Students are required to hold a university degree, have three years of professional experience and score a minimum score on the Graduate Management Admissions Test (GMAT) admissions exam. Following successful application, a number of students are invited to interview. This is usually undertaken one-to-one with the admissions manager.

Students come from a wide pool, in terms of role, industry, country of origin and countries worked in. Students choosing to partake an Executive MBA understand that it is a two-year, part time commitment that will have to fit in around ongoing career commitments. Additionally, there is a considerable five figure fee required to enrol. However, multiple scholarships and financing options exist, to aid with the financial burden.

Teaching methods

The first year of the Executive MBA consists of four core modules per semester, taught across two evenings a week of teaching. Prescriptive reading and preparation work is set in advance. The second year consists of a blend of core modules and multiple elective modules. The final module is the year-long execution of a Capstone project, in which a self-selected team chooses an organisation with a problem, consults with the organisation to scope a solution and then applies the solution with learnings from the programme. Most of the electives modules are delivered by the Smurfit Business School, but due to its Global Network for Advanced Management (GNAM) membership, students are also eligible to undertake a module in an international school.

Most teaching is undertaken by full-time or part-time members of the Smurfit faculty. Lecturers can bring in guest speakers for specific content if desired. Teaching is typically conducted via a blend of didactic lectures and interactive discussions, with source material including textbooks, journal articles and newspaper clippings.

Additional learning resources

The Executive MBA uses additional third party learning sources, such as case-based educational studies via Harvard Business Review and the Harvard School of Business, and online simulations of scenarios such as manufacturing plants, marketing of new products and stock exchanges.

Students are granted access to the UCD college library and all databases with which the library is affiliated. They are also connected to the Smurfit MBA and wider UCD networks of alumni which are a rich source of contacts across all industries and geographies around the globe.

Extracurricular events

The EMBA teaching staff is supported by a careers team and Leadership Development Programme. These ancillary resources work to ensure that students are provided with all the non-educational resources and skills needed to complete ensuing post-programme goals, whether it be progression through an organisation, pivoting careers/industries or embarking on an entrepreneurial programme.

Multiple modules involve visiting other countries to see how business is conducted in a different environment, with meetings to connect students to various organisations or mini consulting projects to provide an opportunity to work closely with a company otherwise unreachable. There are various student-run clubs such as the entrepreneurial club, leadership club, etc., as well as various project, presentation and interview-based competitions.

3.3.2. What is the relevance of the MBA programme to clinician innovation?

Smurfit Business School is a triple-accredited business school, boasting the only global top 100 MBA programme in Ireland. This is advantageous for the programme because it ensures a healthy pool of interested potential candidates, which means that the calibre of those on the programme will be strong. One of the main selling points of an MBA is that students learn as much from each other as from the programme material and thus it is extremely beneficial for a surgeon engaging in a completely new field of study. Exposure to a diversity of background knowledge, experiences and ways of working maximises the learning to be accrued within the two year window.

The GMAT examination performs well in assessing a prospective student's ways of thinking and baseline intelligence, regardless of industry-specific experience. It also assesses a student's ability to perform well under pressure, particularly time pressure. However, the admissions manager interview is the only observed part of the application process. In-person assessments are a core part of the recruitment process in clinical training, with assessment of soft skills ("Human Factors") and technical skills via Objective Structured Clinical Examinations (OSCEs).

Although it has been shown reliably that on average, MBA students typically enjoy a significant increase in salary post-graduation, it still requires a considerable investment of time and money up front. This further ensures a high calibre of students, as only those who truly value the programme should take part. Additionally, due to the fact that some organisations sponsor participants and pay the fees, the potential for variety in student evaluation and participation of the programme is increased.

The careful selection and updating of core modules, as well as the inclusion of elective modules caters to the fact that students have differences in the gaps in their educations and also in their desired focus moving forward. The opportunity to experience other business schools' education systems or other countries' cultures and ways of working mirrors a strong tenet of education in the Irish healthcare sector. Doctors rotate through hospitals every three, six or twelve months and are expected to complete a specialty fellowship abroad. This strengthens a student's education because it allows for them to see multiple approaches and to create their own unique blend based on the perceives strengths of various different inputs.

A medical career is one of lifelong learning and up-skilling. However, once doctors leave medical school, the amount of didactic/traditional teaching drastically reduces. Instead, they learn from other types of teaching, such as bedside tutorials, peer-to-peer learning, journal clubs and grand rounds. As such, there is some overlap with the Executive MBA style, in terms of peer to peer learning. Additionally, the ability to practise developing consulting skills in a safe space is well suited.

Simulation training is an important part of clinical training. The Royal College of Surgeons in Ireland (RCSI) has a wet lab and simulation room for practising surgical techniques and difficult multidisciplinary scenarios. The Executive MBA uses sophisticated software to reflect real world scenarios, for example a dummy stock market that mirrors real stock exchanges. Supplementary reading is a big part of both clinical training and an Executive MBA, so having access to a wide database of journals is crucial.

The careers team and Leadership Development Programme (LDP) are ancillary supports in Smurfit Business School and highlight a significant gap in the professional development given to clinical trainees. There is no valid mentorship programme or career guidance in clinical training. Most of the career is typically spent juggling overwhelming service provision needs with carving out snatches of free time for career development without formal support.

3.4. BioInnovate Reflection

3.4.1. What is the BioInnovate Programme?

Student cohort

The BioInnovate programme takes on 12 fellows every year. Prospective students must hold an undergraduate bachelor's degree and work in a career suited to the programme; these are typically divided into Clinical, Engineering, Commercial and Other categories. Following expression of interest, a number of students are invited to an assessment centre. They are taken through a variety of exercises, including a condensed version of the programme, speed dating interviews and roundtable discussion of important topics such as motivation, leadership and teamwork.

Students are selected and placed into three teams, each with a different clinical focus. These teams learn the BioInnovate process together as a group of four for much of the year, before splitting into various pairs or working individually on projects which may become start-up companies.

The majority of students come from clinical, engineering or commercial backgrounds. Occasionally those with a different background, such as lab-based science, data analytics, etc. may also be chosen. Students are selected according to how they are predicted to work in their expected team as much as on the merit of their academic and professional experiences.

The programme is a full time, on-site commitment in Galway, Ireland. Students must leave their existing careers and often relocate for this purpose. Although there are college fees and often relocation costs, student receive a government-funded stipend of approximately €30,000 (varies year-to-year) to facilitate loss of earnings.

Teaching methods

BioInnovate begins with a bootcamp. The programme recently switched from covering all three aspects of its process – identify, invent, implement – to focusing on just the first in this bootcamp. Paramount to this section is a crash course in clinical knowledge because a period of clinical immersion follows immediately after the bootcamp. Due to the relationships BioInnovate builds and maintains with clinical champions, students are granted access to teams in the areas of study that have been chosen for them. Throughout the immersion process and for the duration of the programme, students take part in lectures and guest talks, each with a focus on a different piece of the MedTech start-up journey.

All students take part in the same classes and talks, but there is also potential to avail of additional learning opportunities via the wider University of Galway network. However, these can be difficult to schedule as the BioInnovate timetable is quite full. The small size of the BioInnovate programme lends itself to a flat organisational structure, meaning that students have ready access to directors and the executive director of the programme. This means that there is an increased chance of tailoring the programme to the specific needs of each cohort in response to requests made throughout the ten months.

A minority of teaching is done by faculty of the programme; the majority is done by friends of the programme and past fellows. Goodwill is often described as the currency of the programme (CURAM, 2018). Due to the value that the BioInnovate brand brings to the MedTech ecosystem in Galway, there is no shortfall of available speakers. Due to the variety of speakers, the teaching style also varies significantly from day to day.

Additional learning resources

Students are provided early access to the university anatomy lab. Here, they are provided with lectures and workshops working with prosections of anatomy relevant to their fields of focus. Anatomy lab access can also be organised throughout the year, with staff endeavouring to satisfy specific requests based on active projects.

Students are also granted access to the University of Galway college library and all databases that the library is affiliated with. They are also connected to the BioInnovate and wider University of Galway networks of alumni, which are a rich source of contacts across all industries and geographies around the globe.

BioInnovate is also supported by two external consulting bodies that work closely with the programme. One provides support and human factor skills focused on team dynamics and conflict resolution. It also provides personal development, by teaching students about their dominant action logics. Finally, it provides a safe space for students to talk to someone outside the hierarchy.

The second consulting body focuses on teaching the process of innovation. Featuring professionals that have worked on standardising a framework for approaching innovation, it further bolsters the students' learning of how to be systematic in a new creative space, while always remaining focused on both the patient's need and the need for demonstrating value.

Finally, students are linked with a mentor during the programme. These are often alumni who have passed through the course or may be experts in some particular domain related to MedTech innovation. Students are matched with mentors according to backgrounds, projects and specific requests or needs.

Extracurricular events

BioInnovate sits at the interface of the academic and commercial worlds of healthcare. The programme has a strong commitment to providing students access to many of the most important MedTech events in the Irish calendar. This provides students with a valuable chance to further bolster their network while still in the programme.

There is also the possibility of presenting a business case to the programme director to request funding to travel to medical conferences (both domestic and abroad). This further enables the building of students' networks and provides early feedback from international experts on active projects. This provides students with the potential to get a jump start on contacting international clinicians or key opinion leaders, who may take a more formal or active role in a future start-up.

3.4.2. What is the relevance of the BioInnovate programme to clinician innovation?

Student cohort

The small class size and team size in a BioInnovate programme provides an opportunity for students to work very closely with a small number of people. This trades an ability to deeply learn from some peers in exchange for reducing the total number of peers available to learn from. This is further impacted by the intentional selection of students with specific backgrounds and ways of working.

The careful selection of graduates also increases the chances of successful programme delivery in two ways. Firstly, each team is unlikely to have any insurmountable knowledge gaps, as they are created with the members' combined experience and backgrounds in mind. Secondly, the programme team puts a high priority on understanding personalities, ways of thinking, ways of working, reactions to stress, etc. These factors are arguably more important than experience when forming teams and therefore maximises the chance of a good fit throughout a potentially stressful ten month period.

The programme team also places an emphasis throughout the year on all 12 fellows also seeing themselves as a large team in which to share ideas and learn collectively. However, this is impractical in reality, as the three teams move at different speeds, focus on different clinical areas and tend to prefer to work separately from other teams.

Teaching methods

One of the early hallmarks of the BioInnovate programme is the clinical immersion granted to fellows. Access to clinical teams, clinics, theatre and wards provides an eye-opening experience for many of the students. During this period, the clinical team member is leaned on to help translate medical language, explain how hospitals work, make introductions, etc. While this is beneficial to the other team members, it tends to limit how the clinical person can choose to organise their time in clinical immersion, as they are often needed by others. There is no equivalent period for fellows with other backgrounds; at no time is there an immersion in engineering, commercial or other practices. This means that the potential for real world learning is most limited for the clinical fellows.

The frequent use of guest speakers comes with pros and cons. Students gain the benefit of meeting influential, knowledgeable speakers (often in person) and have a chance to speak with them before and after lectures. The wide pool of speakers ensures that fellows receive many different views on how to approach innovation. However, the lack of consistency means that sometimes speakers do not pitch at the right level, they may over or under scope a topic and scheduling can be difficult. Each of these can have negative impacts on fellows which must be overcome.

The tools used for learning are primarily classroom based. Although students routinely pitch ideas to a mock panel, the weekly nature of these pitches and the limited number of panel members means that they can become stale. The lack of simulations or case studies limits the potential for fellows to figure out what they would do in likely future situations, which may be a potential area for investigation by the programme in the future.

Additional learning resources

The University of Galway library and networks of alumni provide a large pool of information that can facilitate learning for fellows of the programme. These two sources are complementary; many of the alumni have access to commercial reports and up to date investment information while the college database provides access to academic journals and articles.

Due to the complexity of the many components of innovation, particularly in the MedTech sector, it is a challenging field to educate students in. The process of innovation and underlying principles can be taught but specifics cannot. Therefore, the smaller intake of students is beneficial. Each team has different needs and so the approach can be tailored to be fit for purpose. This would require significantly more resources in a larger class.

The mentorship linking is done in the second half of the programme. The mentors are often busy professionals with limited free time, so the university is limited in access to them. This leads to a difficulty for the programme in balancing the student's needs with the mentor's availability. Again, this feeds into the programme's reliance on goodwill and is something that must be actively managed.

Extracurricular events

The number of events that students are granted access to in a ten month period is impressive. Students can witness fellow entrepreneurs at various stages of the start-up process or learn about innovation in MNCs. This can provide a useful insight into what future careers may look like – a crucial consideration for people who have typically left their existing jobs for this programme and are likely looking for a new career.

The extracurricular events also help them to accelerate the growth of their network, by meeting people under the auspices of a well-recognised and respected programme. This further helps students to personally de-risk a potential career innovating in a start-up in the MedTech industry.

3.5. A comparative analysis of the MBA and BioInnovate programmes

Student cohort

Diversity of thinking is beneficial to developing an innovative mindset. By design, the BioInnovate programme limits potential applicants to specific archetypes. While this helps ensure that the teams created have the prerequisite knowledge/skills between them, it potentially limits the total breadth of experience that students can pull from more than the pool of the MBA class.

The BioInnovate programme tackles this problem in two ways – consistently driving awareness of the biases that all people possess and structuring the guest lecture programming to provide access to diverse thinking. Also worth consideration is the fact that BioInnovate caters towards innovating specifically within the MedTech industry; a highly specialised and complex industry. Therefore, the reduced diversity is a requisite trade-off in favour of ensuring the minimum required experience is available.

Potential innovators often take on considerable personal risk when pursuing projects, roles or careers that focus on innovative projects. For applicants considering an MBA, there is a significant financial risk, due to large student fees across two years. In comparison, the BioInnovate programme reduces this risk by way of a stipend from Enterprise Ireland.

Similarly, students are closely linked with representatives of Enterprise Ireland later in the programme, so they can troubleshoot their project pitches in a safe environment prior to application for a commercialisation fund. The MBA programme typically makes up for this upfront cost by increasing earning potential significantly; an MBA can provide up to $20,000 additional salary immediately after graduation (Kowarski 2023).

Teaching methods

The MBA and BioInnovate programmes each cover two of the three main pillars of clinical training; theoretical knowledge, technical skills and human factors. Each of these competencies are also needed in some form for the successful application of innovation. The MBA programme provides a blend of theoretical learning with many different forms of practising skills; presentations, projects, case studies and simulations. Students have the potential to experience being in the decision maker's shoes and learning from their own mistakes in a safe environment. One area that is not addressed as thoroughly is the human factors collection of soft skills. While certain subjects, such as organisational behaviour or human resources management touch on some of these, they are not prioritised the same as the other skills.

The BioInnovate programme focuses primarily on providing theoretical knowledge and principles of innovation. To a lesser degree, there is a focus on human factors within teams, facilitated by external consultancy resources. There is also a limited potential for simulating pitch meetings, as teams pitch ideas to a mock panel every Monday. While all teams also undergo clinical immersion and are granted a chance to experience the clinical world in a way that many other programmes cannot facilitate, there is no similar experience for clinical staff to experience the other aspects of an innovative organisation.

The MBA programme provides an opportunity to avail of coaching, whereas the BioInnovate programme provides access to a carefully matched mentor, according to a participant's background, goals and needs. In the context of innovation, the mentorship programme is likely more beneficial, as students may not have sufficient background experience or time to be able to glean as much value from facilitated discovery as from the mentorship style of instruction. Clinical learning is classically described as "see one, do one, teach one," which describes the hands on approach of learning. It also touches on the fact that they learn from their peers or those around them – as training progresses, clinicians pick up on the small idiosyncrasies, quirks, advantages and disadvantages of each teacher's style.

Continuing to focus on this way of learning, clinicians rotate throughout teams and hospitals regularly for the duration of their training programmes. This does away with the old apprenticeship model of linking with one consultant doctor for the majority of training. It is thought that having a broad range of teachers and approaches will allow trainee clinicians to compare, contrast and select the best combination of techniques throughout their career. The MBA mirrors this to some extent, with students rotating through teams in different subjects and even mingling with other MBA programmes. By comparison, the BioInnovate programme limits students to teams of four, before further reducing into pairs or working alone on projects. This potentially limits the opportunity to work closely with the full mix of students in the course and learn in the same way.

Implementation is a major part of successful innovation. To innovate in a technical industry, commercialisation is as crucial as invention (Mejtoft et al., 2022). The MBA programme focuses more on some of the skills needed to drive implementation more than the BioInnovate programme. With subjects such as Executive Decision Making, Strategy Execution, Organisational Behaviour and Human Behavioural Psychology, the MBA programme prepares students for how to turn well laid plans into real change. The BioInnovate programme focuses less on these skills, leaving them to be learned elsewhere, in the workplace. This may be due to the fact that the BioInnovate programme positions itself to prepare students for translating a project to a start-up in the MedTech sector, in which years may pass before these skills are truly needed. By comparison, the MBA must prepare experienced students for the option of transitioning into senior decision making roles in established organisations soon after graduation.

3.6. Conclusion

In conclusion, each programme provides many of the skills and experiences necessary to a clinician embarking on a career innovating in the MedTech industry. The MBA programme is more useful in preparing students for executive level strategy, decision-making and change management. The BioInnovate programme is more useful to students pursuing a more entrepreneurial role, with room to learn via a hands-on approach later. Each programme provides access to a diverse range of individuals, whether it be students, lecturers, alumni or part of the wider networks. The MBA programme likely does not provide enough deep level knowledge of how to innovate in a heavily regulated and complex industry, while the BioInnovate programme could benefit from a stronger focus on the implementation aspects of innovation. Ultimately, a blend of the two programmes provides a complimentary set of skills, experiences and networks for clinicians wishing to pursue innovation in this industry.

Appendix

Introduction
- Thank you.
- Purpose of research.
- Explain interview.
- Request re: recording and note-taking.

Background
- Introduction.
- MedTech experience.
- How do you define innovation?

Drivers of Innovation
- Primary drivers of innovation?
- Prompts: Marketplace, Patient need, Competition, MNC strategy, Other?

Barriers to Innovation
- Most significant barriers or challenges facing Irish MedTech companies?
- Prompts: Technological, Regulatory, Financial, Cultural?

Enablers of Innovation
- Most vital factor for success?
- Key competencies?
- Any examples of successful innovation?

Close
- Any other thoughts regarding innovation in MedTech in Ireland?
- Thank you.

Appendix 1: Semi-structured interview template

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