MAY 2018

THE ECONOMIC AND SOCIETAL IMPACT of UNIVERSITY COLLEGE CORK

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

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LIST OF EXHIBITS BY SECTION

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*Key informational exhibit
A – Exhibit is located in the appendix to the report

This report contains multiple case studies which illustrate the depth and breadth of UCC's Economic & Societal Impact.

Case Studies will be referenced by CASE STUDY

“UCC creates more value than it consumes, for the moral, cultural and economic benefit of society.”

Professor Patrick G O’Shea, President of University College Cork

EXECUTIVE SUMMARY

This study provides an in-depth analysis of University College Cork's impact across five key areas, as well as considering the context in which UCC operates. The report examines the following:

1 UCC's **economic impact** at a national and regional level, through the expenditure of UCC itself, the spending of those employed by UCC, those who study there, those who have graduated in the past year, as well as those who visit UCC on an annual basis. The report evaluates the national taxation impact, the employment impact in Cork and the South-West Region, both as a result of direct and indirect jobs, the impact of current and future capital projects, and the impact of visitors and exports. We note that the impact of international students is particularly important from an expenditure and job creation perspective.

2 UCC's **workforce development impact** in the region and beyond, including the ability to graduate high calibre 'world-ready' and 'work-ready' individuals. We look at the investment into, and the output from, a UCC graduate's education, in financial terms. We examine the subsequent effect on the salary of UCC graduates in the first year after graduation vis-a-vis non-graduates, and what this might mean financially over the lifetime of a professional career.

3 UCC has a significant **business impact** and contribution to the wider Irish and international economy. This stems from the University's leading position in relation to research and development activities, its role in attracting foreign direct investment and indigenous investment, as well as UCC's impact on innovation and entrepreneurship. This section concludes by examining UCC's pivotal contribution to local business in Cork and the South-West region.

4 UCC's **impact in relation to creation and discovery**. UCC is clearly driving growth nationally, particularly for the South-West region, through its significant research and development capabilities. It has a crucial role to play in knowledge creation and discovery, technology and knowledge transfer as well as a key role in commercialising that knowledge. Furthermore, UCC's role in creation and discovery has a real impact on society and the community. Work emanating from UCC impacts the lives of millions of people around the globe.

5 UCC's **impact on our society and in our community**. UCC's societal impact is as wide as its financial impact is deep. We examine UCC's impact on social responsibility and the promotion of responsible processes, the physical environment impact, socio-cultural impact and the leading role UCC has taken with regard to widening participation in higher education. We look at the impact of consistent engagement with the community, cultural and sporting impacts, the impact on the health of our citizens and conclude by looking at UCC from an environmental and sustainability impact perspective.

Our study of UCC's impact on the economy and society reveals the following:

The economic impact of UCC is extensive

- Overall, **the total economic impact (Gross Value Added) of UCC is €853m per annum**. That impact means that UCC generates **€2.3m per day for the Irish economy**. The impact generated by **expenditure is €727m** annually and the **fiscal contribution including taxes and social insurance contributions amounts to a further €125m each year**.
- Taking 2016 as a representative year, UCC produced €853m in output for a €151m state investment. That is a return of **€5.68 to the Irish economy for every €1 of state investment** in UCC.

  This compares favourably with the Leading European Research Universities (LERU Group)[1], where their return is estimated at €5 for every €1 invested.
- **UCC's turnover is €350m** per annum, of which 43% (€151m) is invested by the state. UCC secures the remaining 57% of the investment from non-Exchequer sources. In 2016, **for every €1 invested by the state in UCC,** the state directly received **approximately €0.83 cent in return** in the form of VAT and payroll taxes, including employee contributions.
- Furthermore, **UCC supports 14,708 jobs on an annual basis**, which equates to approximately 1 in every 15 jobs in Cork city and county.

In addition, an estimated further **11,482 (Full Time Equivalent) FTE jobs** will be supported over the lifetime of **UCC's €241 million capital development plan (2016-2026)**. The approved development plan alone (which excludes key strategic projects such as the new Cork University Business School), is the largest planned by any organisation in Cork and will **impact positively on the South-West economy to the tune of €446m** including all direct, indirect and induced effects.

UCC graduates play a key role in the development of the Irish workforce

- Graduates of UCC who remain and work in Ireland, **create extra economic value** for the economy of up to **€24.8 million in the first year after graduation** when compared to non-university graduates.
- In 2016, **UCC graduated more undergraduates (4,097) than any other University in Ireland**. Furthermore, and crucially for the economy, UCC is developing graduates in the **sectors that have an economic need** and which are 'hot' in terms of graduate intake. Per 'Grad Ireland' research published in 2017, the greatest availability of jobs was in banking and financial services (32%), accounting related (16%), IT and telecoms (14%). At undergraduate level, UCC leads the way in terms of graduate numbers for business administration and law, science mathematics and computing, addressing this economic need.
- UCC's impressive 1st year retention rate of 93.4% for the academic years 2016/17 to 2017/18 puts it on a par with some of America's elite third level institutions and ahead of prestigious universities such as Boston University, George Washington University and Syracuse University.
- **Employment rates** of UCC graduates (which include those in further study) are at **historic high levels at 94%** for undergraduate level and **95%** at postgraduate level.
- In pure financial terms, **the additional earning potential** (output) from being a graduate of UCC as opposed to being a non-graduate is **10.2 times the cost** (input) to that undergraduate degree.

We have calculated that the UCC graduate premium (UCC graduate versus non-graduate) is circa €10,794 per annum. The input is the cost of the degree (€3,000 annual student contribution plus living costs of €8,018 per annum) which equates to €44,072 and the output is the additional earning potential over the lifetime of a professional career of 40 years, €431,760[2] (€10,794 x 40). Thus the additional benefit is 10.2 times the cost.

[1] Leading European Research Universities (LERU). The Economic Contribution of LERU universities 2016, published December 2017
[2] The Present Value of additional UCC graduate earning potential €431,760 discounted by 3% over a 40 year period is €132,359. This compares favourably to the UK Russell Group average of £88,000 (€101,149 at 0.87 exchange rate) for the 2015/2016 period. – The Economic Impact of the Russell Group Universities. October 2017.

UCC is an innovative university, and contributes significantly to business and industry needs

- UCC acts as an **attractor of foreign direct investment** (FDI) and domestic investment into the South-West Region. The growth of FDI employment in the region is highly correlated with that of UCC. The growing reputation of UCC's creation and discovery environment has helped to facilitate world leading clusters such as pharmaceuticals where **7 of the top 10 pharma companies in the world are located in the environs of UCC**, where there is a highly skilled graduate population readily available.
- UCC's research and development capabilities contribute greatly to the overall impact that the University has on the region. Through proactive collaboration, UCC has forged partnerships with many global names including Dell EMC, Intel, Pfizer, and Lilly; these partnerships have remained strong through various economic climates. **UCC facilitates the industry sector in expanding their R&D capabilities in the region**, with resulting economic impact through enhanced importance, expanded roles, and anchoring employment in Ireland.
- UCC has a huge impact on local business through the expenditure of the University itself, its staff, Irish students, recent graduates, international students and visitors alike. These expenditures impact right across the economy and right throughout the entire region.

  For example **UCC's international students** support total expenditures (direct & indirect and induced) in the Cork region of **€52.5m per annum**. This expenditure supports an estimated **1,421 jobs** in the Irish economy each year.

  Similarly, UCC's **Irish students** have direct expenditure of **€135m** in the local economy and this expenditure supports an estimated **3,675 jobs** in the Irish economy.
- The business innovation impact of UCC is plain to see. UCC has created a bespoke entrepreneurial ecosystem comprising **'Blackstone LaunchPad', 'IGNITE' and 'Gateway' as business incubators, often providing the bridge between education and business**.
- UCC provides world-class training for business people. Business talent is nurtured and developed at UCC and this commitment to the business community is reflected in UCC's plans for **the new Cork University Business School in the centre of the city**.
- The UCC owned **Irish Management Institute (IMI), significantly enhances the University's resources for its delivery of executive education in Ireland**.

UCC is driving the creation and discovery agenda in Ireland

- **UCC's €96m investment (Financial Year end 2016)** in creation and discovery means that it is the leading Irish University with regard to **actively seeking and securing investment** in research and development. Similarly, the **€10m** secured and invested by UCC's industry partners makes it **the leading Irish university by a distance** with regard to research and development investment collaborations with **Industry**.
- UCC hosts several of Ireland's elite research centres including the Alimentary Pharmabiotic Centre (APC) now known as **APC Microbiome Ireland**, recognised as world leaders in the area of food and health. Such centres are home to brilliant scientists and their inter-disciplinary work impacts the lives of millions of people around the globe. Four of UCC's top most cited researchers include Paul Ross in Food and Health Science, Elke Arendt in Food and Nutritional Sciences, John Cryan in Anatomy and Neuroscience, and Catherine Stanton in the area of Food, Health and Nutrition. In relation to **how often APC's ground-breaking work is cited**, APC has a normalised citation score of 1.83 which is **almost twice the world average**.

  APC is ranked number one globally for research in antimicrobials and probiotics (CWTS bibliometric, Leiden)
- **Tyndall National Institute (TNI)** through its **€30m+ turnover** each year, 250 staff and 200+ PhD researchers is the only institute of this scale nationally. It contributes to the impact of the nation at a level which is unmatched in smaller scale research and innovation centres. TNI **represents 30% of UCC's annual investment in creation and discovery**; and its international reputation is renowned. Indeed TNI's investment in research and development each year is **in itself greater than that of two of the seven Irish universities**.
- Beyond science and technology other recent outstanding achievements of scholarship include the production of **Atlas of the Irish Revolution**, published by Cork University Press and edited by John Crowley, Donal Ó Drisceoil, Mike Murphy and John Borgonovo, which was awarded the Irish Book of the Year 2017. Incidentally, **UCC is one of only two** Irish universities with its own publishing house.
- The creative voices of the UCC community are internationally known – Seán Ó Riada, Seán Ó Faolain, Frank O'Connor, Aloys Fleischmann, John Montague, Seán Ó Tuama, amongst others. UCC academics frequently participate in national documentary series, as well as working as consultant academic advisors on major films.

The societal impact of UCC is as wide as the economic impact is deep

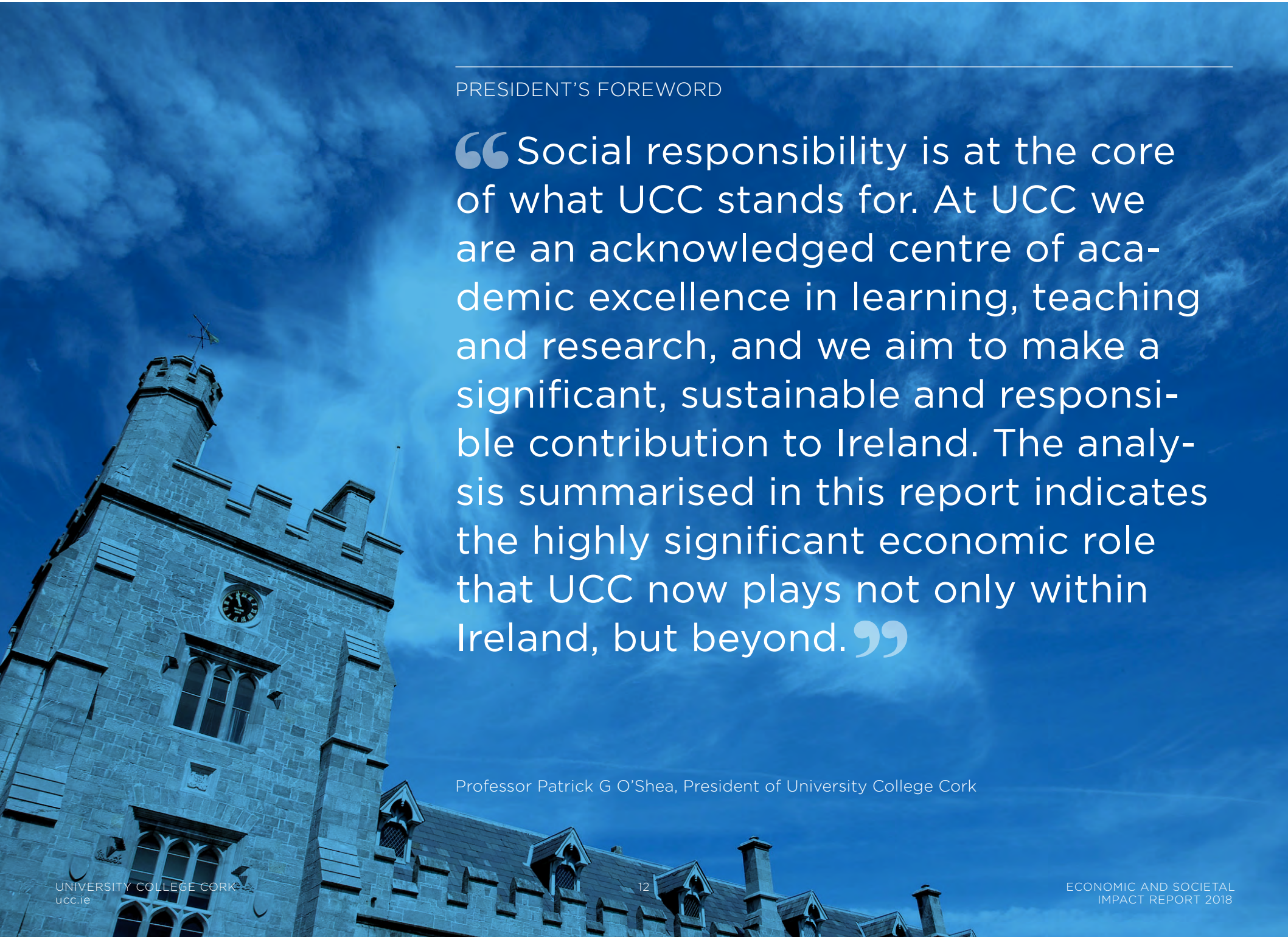
- UCC **shapes and impacts the physical landscape of Cork as much as it's' heritage and culture**. UCC's €241m development plan (2017 to 2022) is the largest planned by any organisation in Cork. Developments such as the new Cork University Business School are a further testament to UCC's commitment to the city and region.
- UCC significantly impacts on our society and in our community. **UCC's impact on social responsibility and the promotion of responsible processes** is noteworthy. UCC helps shape the minds, perspectives and futures of the 25,000 people on a daily basis including students, full-time and part-time staff. This is a population equivalent to the size of Kilkenny City. As influencers, responsible processes garnered on campus by the patrons of UCC, reflecting the ethos of UCC, are promoted locally and globally.
- UCC is **a truly international university**. Circa 17% of the student population and 30% of the staff originate from overseas. This is equally true of UCC's **'Quercus'** talented student programme, which currently has three global teen leaders, two outstanding young people of the world winners, and three of Times Magazine's most influential teenagers in the world.
  UCC invests approximately €600,000 a year on talented students right across the spectrum including sports, citizenship, entrepreneurship, academic and the performing arts.
- UCC has a very proud **sporting tradition** and the first university club founded was the Rugby club back in 1872 with the famous skull and crossbones being introduced in 1880. Today UCC has 58 sports clubs with local, regional, national and international athletes operating from its renowned Mardyke Arena base.

  In addition UCC has 103 different student-led interest societies which run an average of 40 events per week.
- UCC is the primary academic partner supporting nine hospitals in the South South-West Hospital Group. UCC impacts positively on the health of Ireland's citizens. In 2016, **UCC graduated more primary degree health and welfare professionals** (almost 24%), than any other Irish university, a hugely significant contribution to our health service.
- UCC has taken a lead role nationally in relation to **widening participation** and access to third level education for all. **Over 23% of UCC's undergraduate** intake is mature students, students with disabilities or non-traditional college-goers.
- UCC has **a tradition of promoting equality, diversity and inclusion for all**. UCC was a leading Irish university in the admission of female students (1885), the first to appoint female professors (1910); in 2017 it built on this heritage and established an **Equality, Diversity and Inclusion Unit** on campus. Moreover, UCC has become a designated Sanctuary University; 2018 will see UCC awarding seven scholarships to people from the refugee and asylum seeker community.
- UCC considers itself to be **in the community and for the community**. From 'real' research engagement through interdisciplinary projects such as **En-trust**, to UCC's series of public lectures and seminars, **UCC's CARL initiative**, UCC open days, visitor days and the wonderfully successful cultural night, UCC is open to all.

  UCC is the **only Irish university running a junior conferring programme** for primary school students from all over the region. In June 2017 UCC graduated its 70,000th primary school student, a significant milestone for this programme.

  UCC's community outreach was formalised in October 2017 through the publication of **it's first Civic Engagement Plan** for the period 2017 to 2022.

- The University has in its care collections, artefacts and archival material which are of national and international significance, including the Seán O Riada Collection; the George Boole Archive; the Bantry House Archive; a collection of Gaelic manuscripts (including the Torna Collection) and the Great Book of Ireland.
- UCC was the **first university in the world** to be awarded a Green Flag from the Foundation of Environmental Education. Over ten years on, UCC continues to lead the way in relation to impact on the environment and sustainability and through its actions and leading-edge work at the Environmental Research Institute (ERI) and Marine and Renewable Energy Institute (MaREI), UCC continues to champion action in relation to climate change and sustainability.



PRESIDENT'S FOREWORD

"Social responsibility is at the core of what UCC stands for. At UCC we are an acknowledged centre of academic excellence in learning, teaching and research, and we aim to make a significant, sustainable and responsible contribution to Ireland. The analysis summarised in this report indicates the highly significant economic role that UCC now plays not only within Ireland, but beyond."

Professor Patrick G O'Shea, President of University College Cork

PRESIDENT'S FOREWORD

On taking up the post of President of University College Cork (UCC) in 2017, I was impressed by a sense of UCC's key role in the region. Yet, being a scientist, I wanted an evidence base substantiated through analyses. Hence, I commissioned the research assessment that resulted in this report, expertly delivered by Professor Mark Hutchinson and Mr David Hogan of our Department of Accounting, Finance and Information Systems and Cork University Business School.

Our university of ancient heritage is shown through this report to have contemporary impacts of both global and regional range. Our international connections and reputation provide a focal point for activities that are of positive benefit not only to us, but to our extended community and the region.

Often, the debate in relation to third level institutions in Ireland focuses on the cost to the Exchequer and the taxpayer. This report goes some way to balancing that debate by highlighting the significant impact that UCC has, economically and societally. The analyses demonstrate UCC's impressive contribution to the South-West Region, to the Exchequer and to society in Ireland. The economic benefits centre not only on expenditure, jobs and the tax contribution supported by UCC, but also include the impact of our capital projects and the impact of our international students and visitors. Furthermore, the report profiles the undeniable educational, developmental, business, medical, cultural and various societal benefits to having a world-class university in Cork.

Using 2016 as its reference year, the report takes a granular look at the impact of UCC across five key areas as follows:

- Economic Impact
- Workforce Development Impact
- Business Impact
- Creation & Discovery Impact
- Societal Impact

We learn that UCC is generating €2.3 million per day for the Irish economy, while UCC students contribute €187.5 million annually to the Irish economy. Producing far more than we consume, such as the €5.68 return on every €1 invested by the state in 2016, the report underlines the wisdom of investing in third level institutions.

Our greatest asset is undoubtedly our people – our students and our staff. At UCC, we are committed to promoting diversity of thought, perspective, background, ethnicity and to building culturally-inclusive communities within and around the university. This wealth of minds working, learning, researching and thinking at UCC is the foundation for our contribution to the region and the community. The detailed analyses distilled in this report set out how our students and staff connect UCC and its regional community with the globe, via our scholarship, ideas, new ways of thinking, ambitions and dedicated efforts.

I am deeply grateful to the authors for their diligence and rigour in carrying out their analyses, and to the myriad of contributors, both from within UCC and beyond. I am extremely proud of the commendation provided by Professor Sir Anton Muscatelli, Principal and Vice Chancellor of University of Glasgow, Chair of the UK Russell Group of Universities, and himself a world renowned economist, which I share with you here:

> This is an excellent report. The analysis is of very high quality; the authors have been able to calculate both economic and wider social impacts. The report demonstrates that UCC is an engine of growth for the Irish economy.
> Professor Sir Anton Muscatelli 2018

Professor Patrick G. O'Shea
President, University College Cork

INTRODUCTION

An ambitious, agile university with a modern focus and rich historic heritage, UCC sits nestled in the western fringes of Cork City as if it has always been there. Reaching out into the community, both locally and globally, there are undeniable educational, fiscal, developmental, medical, societal and cultural benefits to having a leading-edge world-class university in the city.

In the same way that UCC's role in society and the community has developed extensively over the past 173 years since it was founded in 1845, the University has also become engrained economically in Ireland and the South-West. You will see from our detailed analysis that UCC is now of vital importance to the national and local economies and to the Exchequer.

UCC is one of seven Irish Universities and thirty other higher education institutions which make up the tertiary education sector in Ireland in receipt of government funding. Post economic crisis, higher education funding continues to be cut every year as education resources are targeted toward the primary and secondary sectors. UCC has seen government core grant income (direct state funding calculated on the basis of the number of students) cut by €50m, from €93m in 2008 to €43m in 2016.

The University has faced this new funding reality head on. Approximately 56% of all income (primarily student fee income, research and other income) now comes from sources outside of the Exchequer as UCC continues to adapt and embrace the challenge of reduced government funding. UCC has become leaner as it continues to attract inward investment from a variety of global stakeholders. However, finance continues to be a significant challenge as state funding cuts are coming at a time, and against a backdrop of increasing demand from a growing population. UCC must and will continue to expand and increase capacity to satisfy the increasing demand. Maintaining quality during this expansion requires investment.

The cost-benefit debate of investing in universities such as UCC routinely focuses on the cost to the Exchequer, reflecting a lack of clear understanding of the economic value added by UCC to the Irish economy. This is perhaps because of how little research has been completed in Ireland in relation to the impact of third level institutions. This report aims to fill this vacuum, and in doing so quantify the substantial economic output of UCC in monetary terms as well as addressing the broad and brilliant spectrum of societal impacts that UCC delivers, year in year out. While we can reasonably quantify the economic contribution of UCC in any one year, it must be noted that UCC makes a telling contribution fiscally and societally every year, irrespective of economic conditions and down cycles.

INTRODUCTION

The following areas form the basis of the report:

1 ***UCC in context*** – Sets the scene in terms of demographics, funding levels, as well as the demand and capacity at UCC.

2 ***Economic impact*** – Provides a systematic and granular examination of expenditure, taxation and job impact of UCC, as well as examining the impact of capital projects and future expansion plans. The approach is in line with similar international studies including the economic impact of New Zealand's universities.[3]

3 ***Workforce development impact*** – Examines UCC's impact on the graduate population, their salaries, and highlights the economic benefit of graduating from UCC in the first year following graduation.

4 ***Business development impact*** – Views UCC's impact in terms of business engagement, attracting Foreign Direct Investment, Cork's Technology and Pharmaceutical clusters and UCC's role therein.

5 ***Creation and Discovery impact*** – Analyses UCC's Research and Development capabilities, the transfer of technology and knowledge to the private sector, and the creation and innovation surrounding new companies enabled by UCC's innovation and entrepreneurship platform.

6 ***Societal, Cultural and Community service impact*** – Reviews UCC's world class contributions to society, from chronic and infectious diseases, through food and health, to gender equality and diversity and on to sustainability and climate action impacts. We make various stops along this path to examine UCC's global leaders in more detail.

By adopting this systematic approach, an approach which is in keeping with Biggar Economics report for Oxford University in 2016[4], we aim to deliver a clear understanding of the economic value of UCC, while at the same time proud of the core values which underpin the University's actions and processes.[5] The report shows the positive effects of UCC on the quality of life and economic health of its citizens. It shows that societal impact is as at least as important as the economic impact to Ireland.

This approach allows us to consider the sheer size of the financial and societal void that would exist and would need to be replaced if UCC was not present.

UCC - A PIONEERING UNIVERSITY

UCC GRADUATES THE **MOST UNDERGRADUATES** OF ANY IRISH UNIVERSITY.

UCC SCHOOLS OF NURSING & MIDWIFERY AND PHARMACY ARE IN THE GLOBAL TOP **100** IN THE QS WORLD UNIVERSITY RANKINGS.

UCC GRADUATES MORE HEALTH & WELFARE PROFESSIONALS AT UNDERGRADUATE LEVEL THAN ANY OTHER IRISH UNIVERSITY.

UCC WAS A LEADING IRISH UNIVERSITY IN THE ADMISSION OF FEMALE STUDENTS (1885) AND THE FIRST TO APPOINT FEMALE PROFESSORS (1910).

UCC WAS THE FIRST UNIVERSITY IN THE WORLD TO BE AWARDED GREEN FLAG FROM THE FOUNDATION OF ENVIRONMENTAL EDUCATION.

UCC'S **€96** MILLION INVESTMENT IN CREATION AND DISCOVERY MEANS THAT IT IS THE LEADING IRISH UNIVERSITY WITH REGARD TO ACTIVELY SEEKING AND SECURING INVESTMENT IN RESEARCH AND DEVELOPMENT.

UCC IS THE ONLY IRISH UNIVERSITY RUNNING A JUNIOR CONFERRING PROGRAMME FOR PRIMARY SCHOOL STUDENTS FROM ALL OVER THE REGION.

[3] An analysis of the contribution of New Zealand universities to economic activity, 2016.
[4] Biggar Economics 2017 – The Economic Impact of Oxford University.
[5] Independent Thinking – Shared Ambition. UCC Strategic Plan 2017 to 2022.

AT A GLANCE

€2.3 MILLION GENERATED BY UCC **EVERY DAY** FOR THE ECONOMY.

TOTAL ECONOMIC IMPACT OF UCC
€853 MILLION = €728 MILLION IN EXPENDITURE IMPACT & **€125 MILLION** IN TAX IMPACT (INCL. SOCIAL INSURANCE CONTRIBUTIONS).

UCC IS CHANGING THE PHYSICAL LANDSCAPE OF CORK CITY FOR THE BETTER. **UCC'S €241 MILLION DEVELOPMENT PLAN IS THE LARGEST PLANNED BY ANY ORGANISATION IN CORK.**

UCC HELPS SHAPE THE MINDS, PERSPECTIVES AND FUTURES OF 25,000 PEOPLE ON A DAILY BASIS = STUDENTS, FULL-TIME AND PART-TIME STAFF.

EMPLOYMENT RATES OF UCC GRADUATES ARE AT HISTORIC **HIGH LEVELS AT 94% FOR UNDERGRADUATE LEVEL AND 95% AT POSTGRADUATE LEVEL.**

UCC SUPPORTS 1 IN EVERY 15 JOBS IN CORK CITY & COUNTY.

UCC'S **€96 MILLION INVESTMENT IN CREATION & DISCOVERY** = LEADING IRISH UNIVERSITY WITH REGARD TO ACTIVELY SEEKING AND SECURING INVESTMENT IN RESEARCH AND DEVELOPMENT.

BOOK OF THE YEAR ATLAS OF THE IRISH REVOLUTION PUBLISHED BY UCC PRESS.

23% UCC IS A LEADER IN ACCESS TO THIRD LEVEL EDUCATION. **OVER 23% OF UCC'S UNDERGRADUATE INTAKE ARE MATURE STUDENTS, STUDENTS WITH DISABILITIES OR NON-TRADITIONAL COLLEGE-GOERS.** REFLECTING THE ETHOS OF EQUALITY, DIVERSITY AND INCLUSION FOR ALL.

UCC IS A LEADER IN COLLABORATION WITH INDUSTRY.

€10 MILLION IN R&D SECURED AND INVESTED BY UCC'S INDUSTRY PARTNERS MAKES IT THE LEADING UNIVERSITY BY A DISTANCE WITH REGARD **TO R&D COLLABORATIONS WITH INDUSTRY.**

UCC IS THE PRIMARY ACADEMIC PARTNER SUPPORTING NINE HOSPITALS IN THE SOUTH SOUTH WEST HOSPITAL GROUP. UCC IMPACTS THE PHYSICAL HEALTH OF THE NATION AS MUCH AS IT IMPROVES THE FISCAL HEALTH OF THE CITIZENS.

UCC'S IRISH STUDENTS GENERATE €135 MILLION FOR THE LOCAL ECONOMY THIS EXPENDITURE SUPPORTS **3,675 JOBS** IN THE IRISH ECONOMY.

UCC'S INTERNATIONAL STUDENTS GENERATE €52.5 MILLION FOR THE LOCAL ECONOMY THIS EXPENDITURE SUPPORTS **1,421 JOBS** IN THE IRISH ECONOMY.

€24.8 MILLION IN ADDITIONAL ECONOMIC IMPACT GENERATED IN THE FIRST YEAR AFTER GRADUATION BY UCC GRADUATES.

UCC'S PLAN TO BUILD A **NEW STATE-OF-THE-ART BUSINESS SCHOOL** IN CORK CITY CENTRE IS EVIDENCE OF ITS ON-GOING COMMITMENT TO ENHANCE CORK AS A CITY IN WHICH TO DO BUSINESS.

UCC HAS A PROUD SPORTING TRADITION. THE **FIRST CLUB FOUNDED WAS THE RUGBY CLUB IN 1872** WITH THE **SKULL AND CROSSBONES BEING INTRODUCED IN 1880.** TODAY UCC HAS **58 CLUBS** FOR ITS ATHLETES OPERATING FROM THE RENOWNED **MARDYKE ARENA.** IN ADDITION UCC HAS **103 DIFFERENT STUDENT-LED INTEREST SOCIETIES** RUNNING AN AVERAGE OF **40 EVENTS PER WEEK.**

€30 MILLION ANNUAL INVESTMENT

TYNDALL NATIONAL INSTITUTES €30MILLION ANNUAL INVESTMENT IN CREATION AND DISCOVERY IS IN ITSELF GREATER THAN THAT OF THE ENTIRE R&D INVESTMENT IN 2 OF THE 7 IRISH UNIVERSITIES. **ITS FINANCIAL IMPACT GOES FAR BEYOND THE 250 HIGHLY SKILLED JOBS AND 200 PHD STUDENTS ON ITS CAMPUS.**

€5.68 RETURN FOR EVERY €1 OF STATE INVESTMENT IN UCC.

UNIVERSITY COLLEGE CORK IN **CONTEXT**

SECTION 1:

UNIVERSITY COLLEGE CORK IN CONTEXT

In keeping with the systematic structure of this report, we begin with a top-down approach to the analysis of UCC. It is important to gain a broad appreciation of the tertiary education sector in Ireland, recent developments in its evolution and what the future might look like.

To this end, we have systematically examined population demographics, student demographics, Leaving Certificate trends, UCC enrolments, educational expenditure and the changing face of tertiary education funding.

We conclude with key findings, which help frame the scope of this report and provide the background such that we can understand the current and future demand for UCC as an educational institution, and how UCC will have to continue to grow to increase capacity and meet that demand.

1.1 Population Demographics

To begin, it is necessary to examine the population demographics of the Republic of Ireland. We put particular focus on the population growth in Cork and Kerry, being the immediate catchment area of UCC for undergraduate programmes. Particular attention is also given to those age groups which will be entering the second level education system, given the implications for increase in third level applicants.

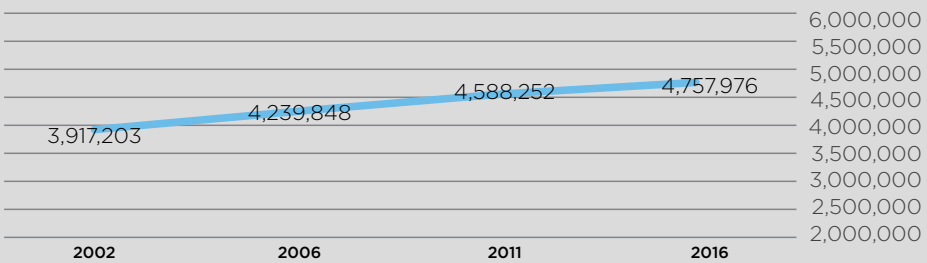
EXHIBIT 1.1: Population demographics of Ireland (in number of people)

Population	2016	2011	2006	2002	Increase
Total population of state	4,757,976	4,588,252	4,239,848	3,917,203	840,773
Population Cork	542,868	519,032	481,295	447,829	95,039
Population Kerry	147,707	145,502	139,835	132,527	15,180
Population Cork & Kerry	690,575	664,534	621,130	580,356	110,219

Source: CSO Census

EXHIBIT 1.1 indicates that the population of the state has increased by 21.4% to over 4.7 million people in fifteen years. This represents an annual average growth rate of 6.28% from 2002 to 2016. The next censuses are scheduled for 2021 and 2026, and assuming this growth rate remains constant, the population of the state will increase to 5.4 million by 2026. The expansion and consolidation of third level facilities to promote regional development is high on the agenda of government, which is reflected in the National Planning Framework 2040, national policy objective 32.[6]

EXHIBIT 1.2: Population growth in Ireland



Source: CSO Census

EXHIBIT 1.2 illustrates the level of population increase to date. Similar increases will put increased pressure on the education system and, as a result, future investment from stakeholders is necessary to keep up with this future demand. Based upon the upward trend in population growth, the current trend of decreased State funding for universities will need to end, and funding will need to be increased to further contribute to existing resources, to develop new and existing programs, and to increase the overall capacity of the University.

Taking a more detailed look at the population by age category in **EXHIBIT 1.3** below, we can see that the 0-14 age group has increased by 21.6% in the period 2002 to 2016. There are also huge gains in the population above the age of 25. 25 to 44 years of age up 19.15%, 45 to 64 years up 36.4%, and the 65+ category up a staggering 46.1%. This highlights the potential that exists for UCC and other Irish Universities across all ages in terms of life-long and life-wide learning.

EXHIBIT 1.1: Population demographics of Ireland (in number of people)

Population	2016	2011	2006	2002	Increase
0 -14 years of age	1,006,552	979,590	864,449	827,428	179,124
15-24 years of age	576,452	580,250	632,732	641,522	(65,070)
25-44 years of age	1,406,291	1,405,140	1,345,873	1,180,259	226,032
45-64 years of age	1,135,003	1,042,879	928,868	831,993	303,010
65+	637,567	535,393	467,926	436,001	201,566

Source: CSO Census

Focusing on UCC's immediate catchment area of the South-West Region (Cork and Kerry), we note that there are increases in the 15 to 19 age group and those aged 10 to 14, all of which will be potential applicants to the University within an 8-year time frame.

As of 2016, the population of the 10-14 age group of Cork and Kerry has increased from 43,492 to 45,062. This is reflected in Exhibit 1.4 in the Appendix. An increase of 1,570 since 2011 equates to a percentage increase of 3.61%. This age group is entering the second level cycle and beginning to study for the Junior Certificate program. These students are all potential future applicants to UCC.

The data in **EXHIBIT 1.5** (referenced in the Appendix) represents the upcoming potential student applications for the 15-19 age group. The increase from 2011 to 2016, represents a percentage increase of 8%. It is clearly evident that the number of potential students is increasing.

Between 2011 and 2016, the population of Cork and Kerry increased by 26,041 (see Exhibit 1.1). This figure represents the overall increase but on examination of specific age groups, it will have a more pronounced influence on applicant numbers, especially over the coming 8 years. To meet growing numbers of applicants at undergraduate level while maintaining quality will require significant investment.

1.2 Student Demographics

EXHIBIT 1.6 below represents the number of full time students in each of primary, secondary and tertiary level educational systems in Ireland according to CSO data. In the years 2012 to 2016, primary student numbers increased by 6.7%, secondary by 5% and tertiary by 12.9%.

EXHIBIT 1.6: Ireland's student numbers by educational level (in number of people)

Sector	2016	2015	2014	2013	2012
Primary	557,107	548,542	540,232	531,973	521,677
Secondary	381,615	376,289	371,211	367,372	363,136
Tertiary	188,178	168,640	173,462	168,640	166,574
Total	1,126,900	1,093,471	1,084,905	1,067,985	1,051,387

Source: CSO

It is interesting to note that third level student numbers have seen the greatest increase in percentage terms. However, as we will learn in section 1.5 of this report, the focus for educational investment in the intervening period continues to be both the primary and secondary educational sectors.

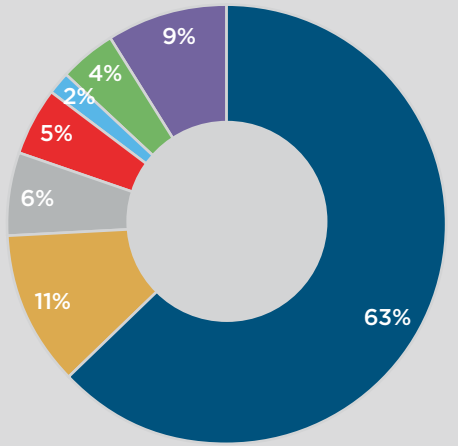
While **EXHIBIT 1.6** above depicts the Irish student population, **EXHIBIT 1.7** below shows UCC's undergraduate intake in September 2016.

EXHIBIT 1.7: UCC's Undergraduate Intake (EU) - September 2016

County	No of Students
Cork	2,347
Kerry	426
Tipperary	223
Limerick	188
Clare	59
Waterford	157
Non Munster	325
Total	**3,725**

Source: UCC Admissions Office

UCC's Undergraduate Intake (EU) by County 2016



On examination of the data, it can be established that 80% of UCC's undergraduate intake is from Cork, Kerry and Tipperary. 8.8% of UCC's undergraduate intake is from outside of Munster. Where there is an alternative university in the Limerick/Clare region (University of Limerick), UCC's intake from these counties is lower.

1.3 Leaving Certificate trends

The Leaving Certificate program provided by the Department of Education is the Irish student's entrance into third level education. Each year, a certain number of places are allocated to each university's suite of undergraduate courses. The academic year 2016/17 has seen a change to the points system. However, for comparative purposes the report continues to use the older system.

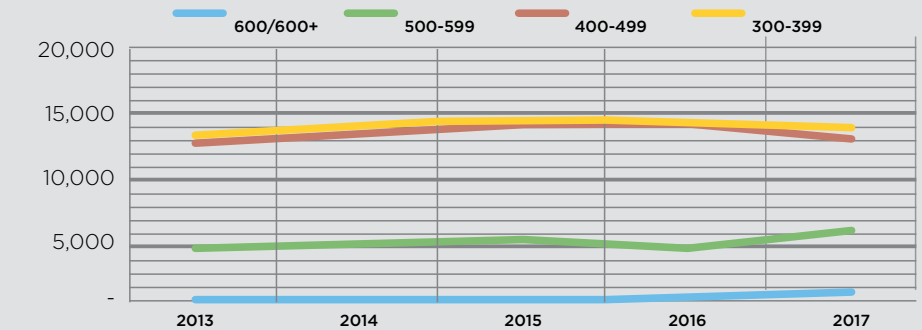
EXHIBIT 1.8: Leaving certificate points statistics (in number of students)

Points attained	2017	2016	2015	2014	2013
600 / 600 +	633	152	215	162	152
500-599	6,162	5,345	5,431	5,088	4,813
400-499	13,394	14,196	14,097	13,447	12,803
300-399	14,201	14,550	14,446	14,047	13,381
200-299	10,964	9,957	9,768	9,584	9,566
100-199	6,656	6,760	6,562	6,926	6,914
< 100	3,760	4,748	4,526	4,771	5,138
Total	55,770	55,708	55,045	54,025	52,767

Source: CAO

EXHIBIT 1.8 illustrates the Leaving Certificate point data for the years 2013 to 2017. Above 300 points, which is minimum entry requirement to UCC, we can see that there is a trend in terms of the increasing points score of students. More students are getting higher grades, accompanied by increased demand elevates entry requirements for undergraduate courses. This data reveals that the point levels are increasing, particularly within the 500-599 points range and that of the 600/600+ categories.

EXHIBIT 1.9: Leavings certificate points trends in Ireland (in number of points)



Source: CAO

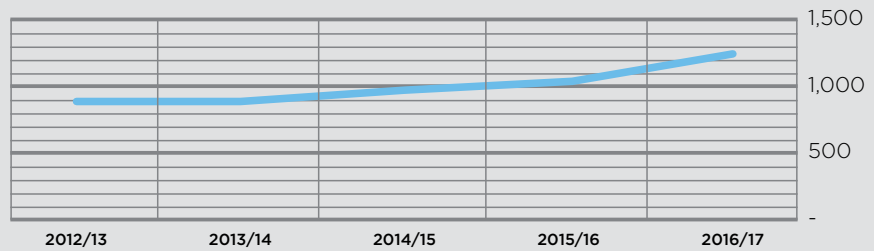
EXHIBIT 1.10 below looks at UCC's undergraduate intake in terms of high achievers. We note that in 2016, 1,264 students scored more than 500 points in the leaving certificate, meaning that one in three of the intake scored more than 500 points, a measure of the quality of students that UCC is attracting.

EXHIBIT 1.10: Number of UCC's 1st year admissions with greater than 500 points (in number of students)

CAO admissions to UCC	2016/17	2015/16	2014/15	2013/14	2012/13
600 / 600 +	1,264	1,049	933	859	856

Source: CAO

EXHIBIT 1.11: UCC CAO 1st year admissions > 500 points



Source: CAO

In February 2016, there were 65,030 level 8 CAO applicants, of which 6,749 (10.3%) chose UCC as their first choice. UCC's subsequent intake was 3,725 in September 2016. The median points scored by UCC's undergraduate intake was 485, which compares favourably with the national median of 355 points, highlighting the calibre of the UCC's undergraduate intake.

In summary, the points attained are increasing, the demand for places is increasing and UCC continues to attract an increasing number of high calibre students.

1.3 Leaving Certificate trends

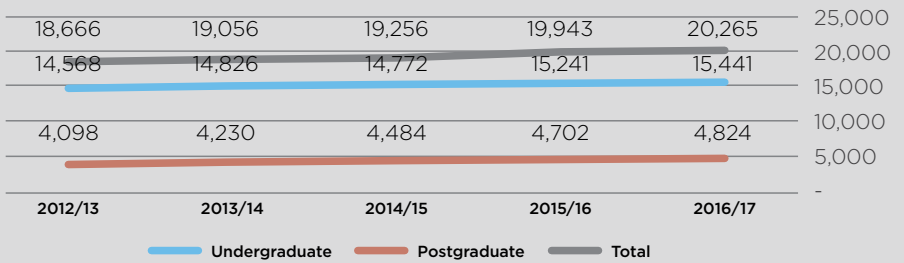
EXHIBIT 1.12: Enrolments at UCC for academic years (in number of students)

Level	2016/17	2015/16	2014/15	2013/14	2012/13
Undergraduate	15,441	15,241	14,772	14,826	14,568
Postgraduate	4,824	4,702	4,484	4,230	4,098
Total	20,265	19,943	19,256	19,056	18,666

Source: HEA
Note: student numbers for HEA reporting exclude Adult Continuing Education (ACE) and online students.

EXHIBIT 1.12 illustrates that the student population of UCC is increasing. From this data, the average annual growth rate is over 2% and, if the current trend continues, the student population of UCC for the academic year 2018/2019 will be 21,085.

EXHIBIT 1.12: Total student population growth at UCC



Source: HEA

1.4 UCC student enrolment

There has been an increase for both the undergraduate and postgraduate cohorts. The undergraduate population has increased by 5.6% since the academic year 2012/13 while the post graduate population has increased by 17.7% in the same period. Assuming the growth rate continues, the key challenge is for UCC to expand to take the additional demand without any reduction in quality. This will require investment.

The other notable trend is that postgraduate numbers are increasing at a faster rate than that of the undergraduate group. Thus, over the coming years it is forecast that, while overall student numbers will continue to increase, at the same time, the gap in student numbers between those taking undergraduate and postgraduate courses will continue to close.

UCC has worked proactively in tandem with the Higher Education Authority (HEA) through the HEA strategic dialogue process to develop improved opportunities for lifelong learning including CPD, executive education (IMI) and with partners nationally such as CORU (regulator for health professionals in Ireland) and internationally.

1.5 Expenditure on education

Government funding has been decreasing for tertiary level education due to the prevailing economic conditions. It is important to look at Ireland in the context of overall educational spending.

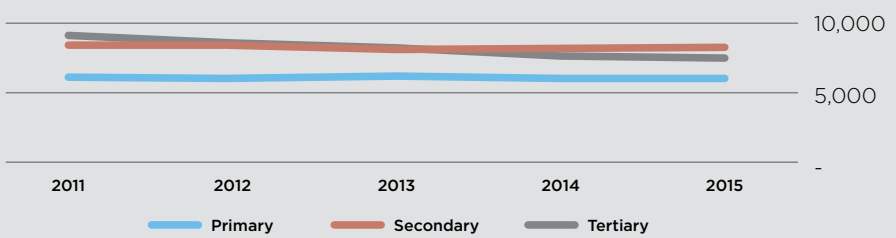
We can see from **EXHIBIT 1.13** below that expenditure per student for the primary sector is now almost back at 2011 levels of €6,258 per student. Secondary education expenditure per student has been more or less constant for the past three years with modest increases in 2014 and 2015.

However, expenditure per student for third level education has continued to decrease every year since 2011 (and further back since 2008). It has seen the most pronounced reduction in spending per student at -16.4% compared with 2011 levels. This is a reduction in per student expenditure in the amount of €1,473 per annum.

EXHIBIT 1.13: Expenditure per student by educational level (in EUR)

Sector	2015	2014	2013	2012	2011
Primary	6,248	6,055	6,172	6,080	6,258
Secondary	8,195	8,183	8,117	8,469	8,639
Tertiary	7,520	7,655	7,994	8,263	8,993

Expenditure per Student (in Euro) by Educational level



Source: CSO

The data in **EXHIBIT 1.14** is taken from the OECD, a sample of nine countries, including Ireland, were selected.

EXHIBIT 1.14: Tertiary Education spending as a % of GDP 2010 to 2014

Country	2014	2013	2012	2011	2010
Ireland	1.14	1.19	1.37	1.39	1.50
UK	1.81	1.83	1.78	1.75	1.71
Denmark	1.70	1.71	2.19	1.85	1.83
Netherlands	1.73	1.71	1.69	1.65	1.62
New Zealand	1.78	1.75	1.83	1.82	1.80
France	1.48	1.47	1.44	1.45	1.47
Germany	1.23	1.22	1.22	1.21	1.20
Spain	1.26	1.29	1.26	1.29	1.31
Belgium	1.43	1.41	1.35	1.34	1.34

Source: OECD[7]

From the data collected, Ireland has a declining investment into tertiary education. The investment as a percentage of GDP of the remaining countries either remained unchanged or is gaining in terms of % investment. While this provides us with a percentage of GDP decrease, it is worth analysing what that translates to in monetary terms. This is achieved by examining the government spending per student.

EXHIBIT 1.15: Government spending per tertiary student (in USD)

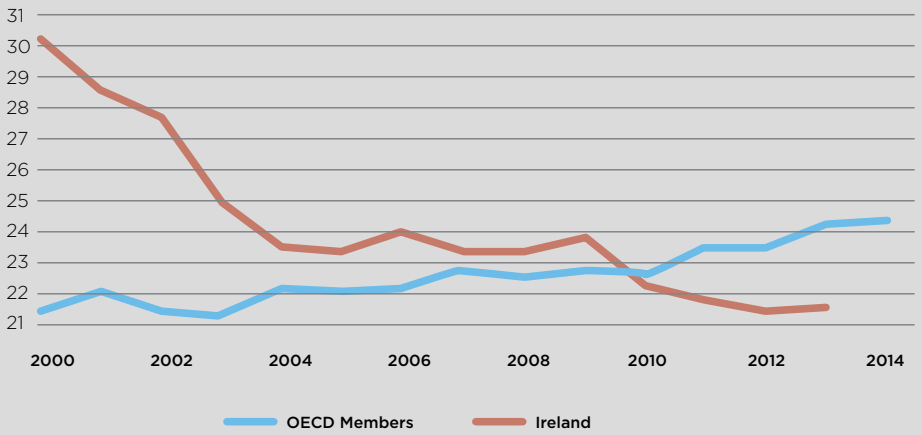
Country	2014	2013	2012	Change, 2012 to 2013
Ireland	14,131	13,381	14,228	(847)
UK	24,542	25,744	24,313	1,431
Denmark	16,102	16,609	13,718	2,891
Netherlands	19,159	19,173	19,413	(240)
New Zealand	15,088	14,234	13,603	631
France	16,422	16,194	15,371	823
Germany	17,180	16,895	17,157	(262)
Spain	12,489	12,604	12,298	306
Belgium	16,599	15,911	15,217	694

Source: OECD[8]

EXHIBIT 1.15 provides information on the investment per student in USD. It is worth noting that Ireland's expenditure per student in 2014 was 58% that of the United Kingdom. Ireland experienced a decrease from 2012 to 2013 of $847. This represents a 5.95% decrease in per student investment. In the most recent OECD data available which is for 2014 Ireland is the weakest of the selected countries with the exception of Spain in terms of actual spend per tertiary student.

[7] OECD: https://data.oecd.org/eduresource/education-spending.htm#indicator-chart/
[8] OECD: Education spending https://data.oecd.org/eduresource/education-spending.htm

EXHIBIT 1.16: Expenditure on tertiary education Ireland v OECD countries as % of educational spending



Source: OECD

EXHIBIT 1.17: Analysis of UCC income 2012 to 2016 (in €000's)

Income item	2016 D	2015 A	2014 A	2013 A	2012 A
State grants	43,282	44,327	47,032	53,633	58,735
Academic fees	133,976	125,125	120,193	116,321	116,268
Research grants & contracts	94,525	88,685	79,417	78,440	79,916
Amortisation state capital grants	9,245	8,570	10,672	12,735	14,708
Other operating income	34,492	31,197	27,667	28,362	29,070
Interest income	156	218	392	1,107	1,704
Investment income	249	-	-	-	-
Net return on pensions	335	302	-	-	-
Deferred funding for pensions	29,008	30,232	55,200	50,425	41,658
	345,268	328,656	340,573	341,023	342,059

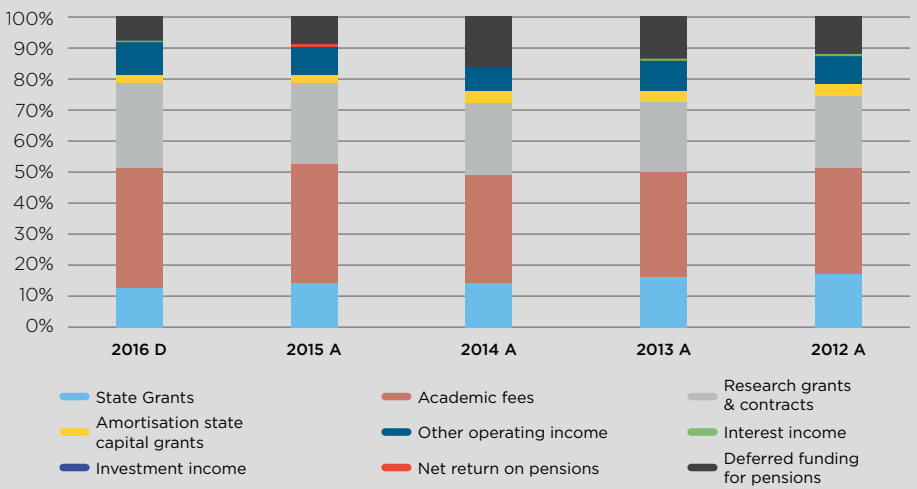
Interestingly, The European University Association (EUA) Public Funding Observatory evaluated 34 higher education systems across Europe and found that just 14 had higher funding in 2016 than in 2008, including Luxembourg, Austria, Germany and Switzerland.[9]

1.6 The changing face of UCC's funding

In the UCC context, as evidenced below in Exhibit 1.17, it is apparent that core funding from the government in the form of the state grant has declined rapidly over the past 5 years, continuing the trend since 2008. It has a seen a 26.3% decrease in that period and a huge 53.7% decrease since 2008.

Where overall income has stayed largely static at 2012 levels (€345m now compared to €342m in 2012) academic fees (+€17m), research investment (+€14m) and other operating income (+€5m) have seen incremental increases to cover the reduction in the core state grant.

UCC Income Analysis 2012 - 2016 (in €000's)



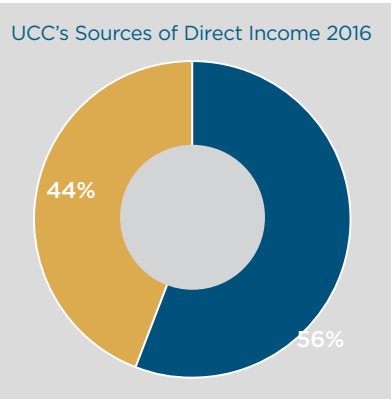
Source: UCC Audited Financial Statements & Draft Financial Statements 2016

[9] The European University Association (EUA) https://thepienews.com/news/research/european-university-association-hei-funding/

Significantly 43.9% of UCC's income in 2016 came from Exchequer sources, meaning that 56.1% came from non-Exchequer sources. UCC has adapted to maintain and grow its output, with non-Exchequer income becoming the mainstay to funding that output.

In the context of the Exchequer / Non-Exchequer 44% / 56% split in relation to UCC's income, it is important to point out that the €151,800 in 2016 includes direct sources of income from the state in the form of:

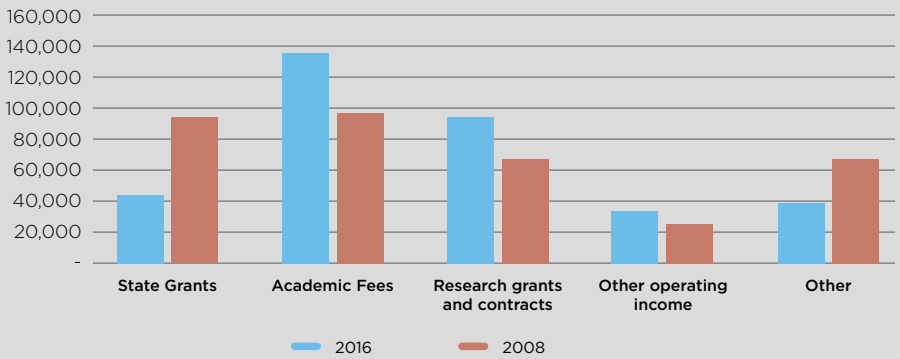
1. state grants, i.e.: the direct state funding calculated on the basis of the number of students,
2. direct academic fees paid to UCC by the Higher Education Authority (HEA), and
3. state research contracts and grants directly awarded to and won by UCC.



It is important to point out that there is also indirect income from the state in the form of deferred funding for pensions and that in 2016 this amounted to €29m. However, for the purposes of the Exchequer/Non-Exchequer split, we have concentrated on the direct sources of government income only.

Similarly, in the case of the annual student contribution for undergraduates of €3,000 and up to a €7,000 postgraduate fee, which are subject to tax relief, one could argue that these are a public contribution to universities. In effect, these are a subsidy to Higher Education funded by the Exchequer. As robust data is not available in relation to the amount of tax relief claimed, we have again omitted this indirect contribution from the public purse.

EXHIBIT 1.19: UCC Income 2008 and 2016 (in €000's) – A comparative analysis



Source: UCC Audited Financial Statements & Draft Financial Statements 2016

The importance of Exchequer funding cannot be understated; as such, it is crucial that UCC can deliver on its ambitious strategic plan. That said, UCC has increasingly looked outwardly and broadened its stakeholder base. Critically, UCC has been proactive in relation to income generation, and the Income Generation Oversight Group at UCC (IGOG) has led the University strategically, focusing on postgraduates, philanthropy, international students, CPD and online, in particular. This is also directly in line with leading action one in Sustaining Excellence,[10] UCC's strategic plan for 2013 to 2017, and reflects a coherent and concentrated approach in this regard. However, the current model of funding is not sustainable and with increasing demand, increased inward investment from both Exchequer and non-Exchequer sources is of paramount importance.

Heretofore in the report we have concentrated on one side of the Exchequer funding debate, notably what is being invested by the state in UCC on an annual basis. UCC is in continuous contact with the HEA through the HEA strategic dialogue process, working in line with the HEA Strategy for Higher Education 2030. The next section of the report will highlight how UCC improves the fiscal health of its community.

[10] Sustaining Excellence: UCC Strategic Plan 2013 to 2017

1.7 Key findings

Demographics

- The population of the state has increased by 21% in the period 2002 to 2016. The population of Cork and Kerry combined, UCC's immediate catchment area, increased by 19%. Both Cork and Kerry have seen increases in the population of 10-14 and 15-19 age groups.
- There are also increases in the population above age 25, with the 25 to 44 range increasing by 19.15%, 45 to 64 years increasing by 36.4%, and the 65+ category increasing by 46.1%. This highlights the potential that exists for UCC and other Irish Universities across all ages in terms of life-long and life-wide learning.

Student Numbers

- In the years 2012 to 2016, primary student numbers have increased by 6.7%, secondary by 5% and tertiary by 12.9% to over 188,000 in 2016.
- 80% of UCC's undergraduate intake is from Cork, Kerry and Tipperary. 8.8% of UCC's undergraduate intake is from outside of Munster. Where there is an alternative university, such as in the Limerick/Clare region, UCC's intake from these counties is lower.

Competition for third level places

- At UCC, the leaving certificate point levels are increasing, particularly attracting students within the 500-599 points range and that of the 600+ categories.

Enrolments at UCC/ Student Demand

- The undergraduate population has increased by 5.6% since the academic year 2012/13 while the post graduate population is up 17.7% in the same period. This general trend is mirrored in other Irish universities.

Expenditure on Education

- Expenditure per student for third level education has continued to decrease every year since 2011. It has seen the most pronounced reduction in spending per student, down 16.4% on 2011 levels. This equates to a reduction in per student expenditure of €1,473 per annum.
- In Ireland, expenditure on tertiary education has fallen dramatically since 2000 when tertiary education was over 30% of the overall education spending. At 21%, Ireland is currently well below the OECD member's average of circa 24%.

UCC Income

- Academic fees account for almost 39.7% of overall income, research income accounts for 27.3% and other operating income including student accommodation and the Mardyke Sports Arena account for almost 10% of all income.

43.9% (€151.8m) of UCC's income in 2016 came from direct Exchequer sources, while 56.1% or €193.4m came from non-Exchequer sources. Direct Exchequer sources include state grants, direct academic fees paid to UCC by the Higher Education Authority and state research contracts and grants directly awarded to and won by UCC.

ECONOMIC IMPACT

€2.3 MILLION
GENERATED BY UCC EVERY DAY FOR THE ECONOMY.

TOTAL ECONOMIC IMPACT OF UCC €853 MILLION = €728 MILLION IN EXPENDITURE IMPACT & **€125 MILLION** IN TAX IMPACT (INCL. SOCIAL INSURANCE CONTRIBUTIONS).

UCC SUPPORTS 1 IN EVERY 15 JOBS IN CORK CITY & COUNTY.

SECTION 2:

THE ECONOMIC IMPACT OF UCC

When one considers the economic impact of the University, the first contribution is on the fiscal and economic impact on Cork City and the wider South-West Region. The University has become engrained fiscally and economically in Cork City and the South-West Region. Broadly speaking, its fiscal and economic importance relates to expenditure, taxation (including social insurance contributions) and jobs. These serve to enable, finance and employ Cork and the South-West Region.

From the annual expenditure of the University itself, the spending of staff, students, graduates (incremental expenditure above non-graduates) and visitors, to the payroll taxes, social insurance contributions and VAT paid by the University, its staff, students, graduates and visitors and finally onto the employment it creates both directly and indirectly, the economic and fiscal impact of University College Cork is deep and wide.

The following is a snapshot of the key findings of the fiscal and economic impact:

Enabling the South-West	Financing the South-West	Employing the South-West
€727m in annual expenditure	€125m in annual taxes	14,708 FTE jobs supported yearly

This section of the report takes a systematic approach to examining the expenditure, taxation, employment, capital projects, visitor and export impact of UCC to Cork City and the South-West Region. Thus, we can reasonably quantify the economic and fiscal contribution of the University in any one year. The approach taken allows consideration of the sheer size of the fiscal and economic hole that would exist in the region and beyond if UCC did not exist.

2.1 Expenditure impact

In financial terms, expenditure relates to spending. This includes the expenditure of the University's annual budget itself, the spending of those employed directly by UCC, those who study at UCC, the incremental expenditure of recent graduates of UCC above non-graduates, as well as those who visit UCC on an annual basis. The combined expenditure is considerable, taking 2016 as a representative year, up to €727m million annually.

Methodology

The methodology is based on the input-output model originally outlined by Leontief (1936). The output multiplier refers to the change in total output for the economy as a whole resulting from a unit change in the final demand (Hermannsson et al 2014).[11]

The Type I multiplier for a particular industry is defined to be the total of all outputs from each domestic industry required in order to produce one additional unit of output while the Type II multiplier incorporates not only the increase in demand but also the induced household consumption effects (Hermannsson et al 2014).

In other words, Type I = direct + indirect effects and Type II is defined as direct + indirect + induced effects. This is the approach taken by most international studies, including that of the University of Glasgow in 2015.[12]

2.1.1 University expenditure

The University has expenditure of €345m, €336m and €345m respectively in each of its last financial years (FY), September 2016, 2015 and 2014, a combined €1.026bn. However, adjusting for FRS impact, interest paid and depreciation, a more conservative estimate of expenditure is €293m, €284m, €269m respectively, as illustrated below in **EXHIBIT 2.1**.

This is significant direct expenditure in the local economy. Taking 2016 as a representative year, circa 70% or €243 million of the expenditure relates to staff costs (including pensions) which leads to knock on expenditure indirectly for the suppliers of UCC and their businesses and also induces further knock on effects in terms of UCC staff spending in the economy.

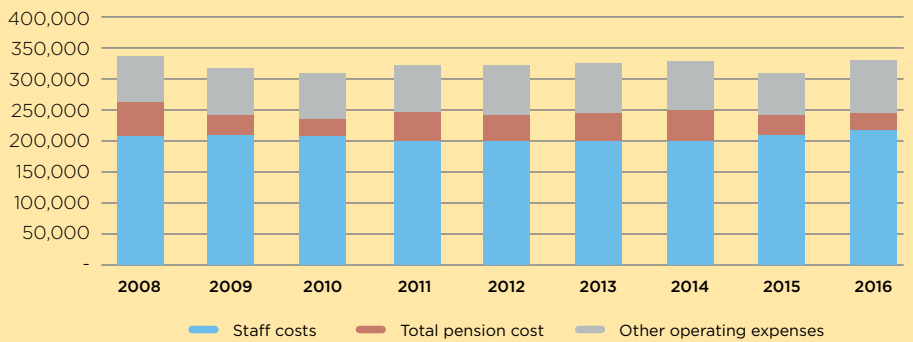
EXHIBIT 2.1: Analysis of UCC expenditure (in €'000s)

Expenditure item	2016	2015	2014	2013	2012
Staff costs	214,063	206,465	197,831	198,755	198,139
Total pension cost	29,343	30,534	55,200	50,425	41,658
Other operating expenses	79,114	77,693	72,066	73,554	76,417
Interest payable	2,119	1,302	1,251	858	1,247
Depreciation	21,041	20,044	19,180	21,832	23,744
Total	345,680	336,038	345,528	345,424	341,205

Audited Financial Statements

[11] Hermannsson, K, K Lisenkova, P G McGregor, and J K Swales, 2014, The expenditure impacts of London's higher education institutions: the role of the diverse income sources. Studies in Higher Education.
[12] University of Glasgow – Inspiring Economic Impact. 2015

EXHIBIT 2.2: Analysis of UCC expenditure by cost item



Source: Audited Financial Statements & Draft Financial Statements 2016

Very importantly, approximately €79m was directly spent by the University alone in all sectors of the economy on everything from light and heat providers, IT, and consumable food and beverages.

The economic impact of the €293m expenditure is considerable when we adopt a multiplier of 1.35 for university expenditure, as has been used in the recent country-wide Irish Third Level Institution Economic Impact Report, as published by Trinity College Dublin.[13] Consequently, the overall impact is an additional €102m, making a total output of €395m for the University itself.

2.1.2 Staff expenditure

By taking the annual staff costs of the University and adjusting these downwards for pension contributions, taxation and social welfare costs then this leaves €96.485m that can potentially be spent by UCC staff in the local economy for 2016, which is up on 2015 and 2014, respectively.

EXHIBIT 2.3: Total available for staff spending in South-West economy (in €)

	2016	2015	2014	2013
Total available for staff spending in the South-West economy	96,485,268	88,034,121	83,848,098	86,726,299

Source: Audited Financial Statements / IAPF survey on pension contributions / national savings rates

We assume that staff spend in relation to debt servicing is counted as expenditure in the economy and, similarly, expenditure by staff does not include what is spent by other persons in the staff member's household.

2.1.3 Graduate expenditure

By obtaining the median salary of UCC graduates, which was €28,591 in 2016 (for the first 12 months after graduation), and applying the same methodology as outlined for the staff above, it can be established that the average net income after tax and IAPF average pension contributions amounts to €22,620 per annum. Again, applying the appropriate national savings rates, the total available for spending in the economy is €20,629. If this figure is multiplied by the number of graduates remaining and working in Ireland, then we can establish that UCC graduates in their first year can potentially spend up to €47.5m million in the Irish economy. This is set out in detail in **EXHIBIT 2.4** below.

EXHIBIT 2.4: Potential for UCC graduate spending in the Irish economy (in €)

Potential for graduate spending in the Irish economy	2016	2015	2014	2013
Average salary of UCC graduate (first 12 months after graduation)	28,591	26,297	26,178	26,310
Total tax (& contribution) take per graduate	4,428	3,751	3,716	3,623
Pension contribution	1,544	1,499	1,492	1,500
Average net income	22,620	21,048	20,970	21,187
Average national savings rates	0.088	0.101	0.116	0.092
Income saved based on national savings rates	1,991	2,126	2,433	1,949
Total available for spending	20,629	18,922	18,538	19,238
Total no. of graduates remaining in Ireland	2,305	1,992	1,908	1,875
Total potential UCC graduate spending in the Irish economy	47,550,631	37,692,064	35,369,991	36,071,497

Source: Careers office / revenue.ie / taxcalc.ie / IAPF survey

[13] The Economic Impact of Higher Education Institutions in Ireland. Trinity College Dublin, February 2015.

In 2016, a non-graduate on the minimum wage would have earned €17,797. After tax and social insurance contributions this would amount to €17,244. Applying the same methodology in relation to pension contributions and national savings rates, it means that a non-graduate would have €14,796 available for spending in the economy on an annual basis. Thus, the incremental expenditure of a UCC graduate over a non-graduate is €20,629 minus €14,796 or €5,833 per annum. When this is multiplied by the total number of graduates remaining and working in Ireland this amounts to €13.445m each year for one set of graduates.

In the context of a three-year time period post-graduation (i.e. the economic value added by graduating from UCC is confined to 3 years: In 2016 you would have the classes of 2016, 2015 and 2014 contributing in line with typical graduate programmes), then the total impact of graduate expenditure amounts to €40.335m.

2.1.4 Student expenditure

With 20,265 students attending UCC, their expenditure in Cork and its environs is a valuable contribution to the local economy. The students primarily spend their money on the following items: accommodation, food and drink, transport, social activities, health costs, and communication.

Economically, it is important to distinguish between the expenditure of Irish students and that of International students. The expenditure of international students however is expenditure which would not have occurred elsewhere in the economy. An economic multiplier is applied resulting in each of direct, indirect and induced effects of this expenditure. Economically, the impact of international students is seen as an export and thus we will look at this in more detail in section 2.1.5 below.

The average monthly spend of an Irish student is €844. Assuming a 9.5-month academic year (September to May) and multiplying by the number of Irish students means that the induced expenditure of Irish students equates to €135.680m per annum. As this is induced expenditure, an economic multiplier is not applied. This expenditure is vital for the economic vibrancy of the Cork region and thousands of livelihoods are reliant on it each year.

EXHIBIT 2.5: Economic impact of Irish student spending (in €)

Types of spending	Irish student monthly expenditure (€)
Accommodation	334.00
Food and drink	177.00
Social activity	71.00
Shopping and other categories	0.00
Transport	99.00
Other	66.00
Communications	33.00
Health costs	18.00
Childcare	12.00
Debt payment	34.00
Total	**844.00**
No. of students	16,922
No. of months	9.50
Total induced expenditure	**135,680,596**

Source: CSO/UCC Careers Office / Education.ie – Student Expenditure Survey[14]

[14] CSO for multipliers. UCC Careers Office for student numbers.

2.1.5 Visitor and international student expenditure

Visitors

Data from the Irish Tourist Board (Bord Failte) in 2015[15] indicated that UCC was in the top 50 free visitor attractions in terms of numbers of visitors. They estimated that each year, 50,000 visitors come through the gates of UCC. Again, using their average spend per visit in Ireland data of €520 it means that visitors to UCC spend €26m annually in Cork and beyond. Assuming one seventh (one day out of a seven-day visit) of that expenditure is UCC supported means that €3.714m is spent by UCC visitors each year.

EXHIBIT 2.6: Economic Impact of visitor spending (in €)

Economic impact of visitor spending	2016
Economic impact of visitor spending - direct	3,714,286
Economic Impact of visitor spending - indirect	274,857
Economic impact of visitor spending - induced	2,949,143
Economic impact of visitor spending - indirect & induced	3,224,000
Overall economic impact of visitor spending	6,938,286

Source: CSO, Bord Failte Visitor Numbers & spend per visit

As this expenditure is not expenditure which would have taken place elsewhere in the economy, an economic multiplier can be applied. This means that there is direct, indirect and induced effect of this spending. The Type I multiplier is 1.074 meaning that there are indirect effects of €274,857 per annum as a result of this expenditure. Furthermore, there are induced effects in the amount of €2,949,143 which makes total knock on effects of €3,224,000. Thus, the Type II output multiplier is 1.868 meaning €6.938m in output from this source annually.

International students

EXHIBIT 2.7: Economic impact of international student expenditure (in €)

Types of spending	**Irish student monthly expenditure (€)**
Accommodation	385.00
Food and drink	151.67
Social activity	108.33
Shopping and other categories	86.67
Transport	58.50
Other	86.83
Communications	0.00
Health costs	0.00
Childcare	0.00
Debt payment	0.00
Total	**877.00**
No. of students	3,343
No. of months	9.50
Total direct expenditure	**27,852,205**

Source: CSO/UCC Careers Office / Education.ie – Student Expenditure Survey[16]

EXHIBIT 2.7 above illustrates the direct expenditure of UCC's international student population with 2016 taken as a representative year. Economic multipliers are applied as this is expenditure which would not have otherwise occurred in the economy. Applying the Type I multiplier of 1.238 means that there are indirect effects from this expenditure in the amount of €6,629,000. Similarly, there is €18,048,000 in induced effects as a result of the direct expenditure making total knock on effects of €24,677,000. This combined with direct expenditure gives a total output of €52.529m from international students. This can be verified by applying the Type II multiplier of 1.886 to the direct expenditure of €27.852m, equating to €52.529m.

The impact of international students is hugely significant. A recent Russell Group report in the UK estimated that for each 7 international students attending universities in the UK, it added £1m to the economy there.[17]

[15] Irish Tourist Board (Bord Failte) Annual Report 2015, published 2016.
[16] CSO for multiplier/ UCC Careers Office for student numbers.
[17] Russell Group. http://russellgroup.ac.uk/media/5631/fact-sheet-3-48bn-v5.pdf ...

2.1.6 Expenditure summary

EXHIBIT 2.8 below summarises the potential expenditure impact in any one year (with FYE 2016 as an example year) for the combined University, its staff, its students, its visitors, as well as the graduate class of one year. The University expenditure has been adjusted for FRS impact, depreciation and interest, the visitor numbers are themselves conservative as well as graduate expenditure relating to the differential in spending that a UCC graduate may have over a non-graduate as a consequence of the economic value added by UCC to his/her earning potential.

EXHIBIT 2.7: The Economic Impact of UCC supported expenditure (in €000's)

Economic impact of expenditure (in €000's)	Expenditure 2016			
	Direct	Indirect	Induced	Total
UCC - The University, including subsidiaries (less pension, dep & into)	293,117	19,345	72,985	395,708
UCC Staff (their expenditure in local economy)	-	-	96,485	96,485
UCC Irish Students (their expenditure in local economy)	-	-	135,681	135,681
UCC Graduates (differential in spending by 3 years graduates working in Ireland)	-	-	40,335	40,335
UCC Visitors (one year's visitors based on 2015 visitor numbers)	3,714	884	2,340	6,938
UCC International Students (their expenditure in the local economy)	27,852	6,629	18,048	52,529
Totals	**324,683**	**26,858**	**365,874**	**727,676**

Source: UCC Audited Financial Statements & UCC Careers Office/CSO/revenue.ie/taxcalc.ie/IAPF survey/Bord Failte

The University expenditure has direct, indirect and induced effects and an economic multiplier is applied to this expenditure to quantify the total effects. In the case of the staff, students and graduates no economic multiplier is applied as these expenditures are induced by the spending of UCC. However, in the case of UCC visitors and the international students, economic multipliers are applied resulting in direct, indirect and induced effects of this expenditure.

The overall total economic impact as generated by expenditure is considerable at €728m per annum. This is not the total economic impact as the tax contribution needs to be added to this for total impact. This is calculated later and set out in section 2.6 below.

The economic expenditure impact is sizeable and would leave a gaping hole in the economy of Cork and the South-West Region if UCC was not present in its current guise.

2.2 Taxation impact

The University's charitable status means that UCC is exempt from corporation tax. However, taking into account the VAT contribution, social insurance contributions of UCC, as well as the payroll and social insurance contributions of UCC's staff, its graduates and its students, and indeed the VAT payable by visitors, then this represents a fiscal contribution to the Exchequer of over €110 million annually.

2.2.1 The University

UCC: VAT, Statutory deductions

UCC has paid almost €14.7m in VAT over the past 3 financial years. This is paid across all goods and services, from professional services to equipment suppliers. This is evidenced below in **EXHIBIT 2.9** which shows the annual VAT paid by VAT reporting period.

EXHIBIT 2.9: VAT paid by UCC for last 3 financial years (in €)

VAT Period	2016	2015	2014
November/December	1,134,936	1,143,290	985,239
September/October	1,212,814	122,478	921,896
July/August	1,034,196	879,962	780,726
May/June	590,655	1,072,966	684,444
March/April	552,229	1,156,143	558,905
January/February	671,201	703,598	407,824
Total Actual	**5,196,031**	**5,078,437**	**4,339,034**

Source: UCC Finance Office

As well as paying VAT, the University also pays employers PRSI. From Exhibit 2.10 below, this amounted to €14.179m. We will revert to the remaining items in the table under section 2.2.2 below as these are items being paid by the staff but collected by UCC.

EXHIBIT 2.10: Statutory deductions paid to the Exchequer by UCC (in €)

Deduction item	2016	2015	2014
PAYE	30,121,101	28,966,661	29,234,416
PRSI - employee	5,367,526	5,198,220	4,977,326
PRSI - employer	14,179,743	13,425,517	12,791,475
PRD - pension levy	7,683,329	9,361,842	9,242,541
USC	7,846,381	9,389,644	9,475,947
TOTALS	**65,198,079**	**66,341,885**	**65,721,705**

Source: UCC Finance Office

In addition to the VAT paid and the employers PRSI paid to the Exchequer, the University also plays a significant role in relation to the collection of Relevant Contracts Tax (RCT) AND Professional Services Withholding Tax (PSWT) for the Revenue Commissioners. The collection of these taxes by UCC for the Exchequer facilitates tax compliance across a huge cohort of relevant suppliers across all sectors of the economy.

Combining VAT €5,196,031 and employers PRSI €14,179,743, the University paid **€19,375,774** to the Exchequer in 2016.

2.2.2 UCC staff

Tax contribution including social insurance contributions

By deducting employers PRSI from the below table (as the University is responsible for paying this) we can see that UCC staff paid statutory deductions of **€51.018m** to the Exchequer in 2016. These included PAYE, PRSI, PRD (Pension Levy) and USC which a sizeable contribution each year.

EXHIBIT 2.10: Statutory deductions paid to the Exchequer by UCC (in €)

Deduction item	2016	2015	2014
PAYE	30,121,101	28,966,661	29,234,416
PRSI - employee	5,367,526	5,198,220	4,977,326
PRSI - employer	14,179,743	13,425,517	12,791,475
PRD - pension levy	7,683,329	9,361,842	9,242,541
USC	7,846,381	9,389,644	9,475,947
TOTALS	**65,198,079**	**66,341,885**	**65,721,705**

Source: UCC Finance Office

In addition, the majority of staff pay property tax and pay VAT on their expenditure.

For local property tax, we assume that 50% of the staff (1,501 FTE) is responsible for paying property tax of €450 on an annual basis which is reflective of average house prices in Cork and its environs in 2016. This equates to **€0.675m**.

VAT on expenditure for the staff is based on what is available for spending in the economy €96.465m at Exhibit 2.3 at blended VAT rate of 14.5%, which equates to **€13.990m annually**.

On a combined basis, including statutory deductions + property tax + VAT on expenditure, the staff of UCC contribute **€65.683m** to the Exchequer each year.

2.2.3 UCC students

Tax contribution including Social Insurance contributions and VAT on expenditure

EXHIBIT 2.11: Tax and social insurance contributions of UCC students

Tax and social insurance contribution of UCC students	2016	2015	2014
Total no. of students at UCC	20,265	19,943	19,256
Estimated no. of students earning part-time average wage (5%)	1,013	997	963
Average part-time wage	16,597	16,332	16,005
USC	258	331	44
PRSI	-	-	-
Income tax	-	-	-
Total tax and SIC paid per UCC student	258	331	44
Total tax and SIC paid by UCC students	261,084	330,436	42,355

Source: UCC Admissions Office / Revenue.ie / Taxcalc.ie

We have taken a conservative approach in relation to the amount of tax being paid by UCC students. If a mere 5% of UCC students (1,013 out of a student population of 20,265), work part-time earn the average part-time wage of €16,597, then each of those students would lie outside the tax net. However, they would be liable for USC of €258 per annum which equates to €261,084 per annum to the Exchequer each year. This calculation is illustrated above in **EXHIBIT 2.11.**

In relation to VAT on expenditure, we have seen that UCC students (both Irish and international) make a combined annual expenditure of €163,532,801, taking 2016 as a reference year. Using a blended rate of 14.5%, this equates to €23,712,256.

When VAT on expenditure is combined with payroll taxes including social insurance contributions then UCC students make a telling Exchequer contribution of €23,973,340 annually.

2.2.4 UCC graduates

Tax Contribution including Social Insurance Contributions and VAT on expenditure

Based upon the mean UCC graduate income of €28,591 (2016), we can establish that the total payroll tax take, including social insurance contributions, for a UCC graduate is €4,428 per annum. If we multiply that by the number of UCC graduates that remain in Ireland and work, we can establish that the class of 2016 (one year's graduates only) contribute €10,205,388 annually to the Exchequer in the form of tax and social insurance contributions. This is detailed in **EXHIBIT 2.12** below.

EXHIBIT 2.12: Tax and social insurance contributions paid by UCC graduates (in €)

Tax and social insurance contributions paid by UCC graduates	2016	2015	2014	2013
Taxes & social insurance contributions paid by UCC graduates	-	-	-	-
Average salary of UCC graduate	28,591	26,297	26,178	26,310
USC	866	739	733	740
PRSI	1,144	1,052	1,047	921
Income tax	2,418	1,959	1,936	1,962
Total tax (and contribution) take per graduate	4,428	3,751	3,716	3,623
Total number of graduates in employment in Ireland	2,305	1,992	1,908	1,875
Tax and social insurance contributions paid by UCC graduates	10,205,388	7,471,456	7,089,308	6,793,050

Source: Careers office / Revenue.ie / taxcalc.ie

In addition, we have already established that graduates of UCC have incremental expenditure in the economy over non-graduates and that this premium is €5,833 per annum. Consequently, we know that the additional expenditure for one year's graduates is €13,445,065. If we take this in the context of 3 years graduates in line with typical graduate programmes then, as we have seen the additional expenditure amounts to €40,335,195. Applying a blended VAT rate to this expenditure of 14.5% we can establish that VAT on the additional expenditure of UCC graduates equates to €5,848,603 per annum taking 2016 as a representative year.

Combining tax, social insurance contributions and the VAT on the additional graduate expenditure then total contribution to the Exchequer from UCC graduates is **€16,053,991**.

2.2.5 UCC visitors

VAT from visitor expenditures

Taking the direct visitor expenditure figure of €3,714,286, as discussed in Section 2.1.5, and applying a blended VAT rate of 14.5%, VAT on visitor expenditure could potentially be worth up to **€538,571** per annum.

2.2.6 Taxation summary

Dark Yellow = Actuals
Yellow = based on estimates

EXHIBIT 2.13: Summary of total tax contribution supported by UCC (in €)

Taxes and social, insurance contribution by category	2016	2015	2014
UCC - VAT on expenditure	5,196,031	5,078,437	4,339,034
UCC - Employers PRSI	14,179,743	13,425,517	12,791,475
UCC - RCT & PSWT	(1,870,225)	(1,820,509)	(2,269,969)
UCC Staff - PAYE	30,121,101	28,966,661	29,234,416
UCC Staff - PRSI	5,367,526	5,198,220	4,977,326
UCC Staff - USC	7,846,381	9,389,644	9,475,947
UCC Staff - PRD (Pension Levy)	7,683,329	9,361,842	9,242,541
UCC Staff - LPT	675,000	626,850	610,875
UCC Staff - VAT on expenditure	13,990,364	12,764,948	12,157,974
UCC Students - PAYE and SIC	253,312	249,287	240,700
UCC Students - VAT on expenditure	23,712,256	23,331,596	22,519,973
UCC Graduates - PAYE	5,574,100	3,903,200	3,693,125
UCC Graduates - PRSI	2,636,120	2,095,360	1,997,905
UCC Graduates - USC	1,995,168	1,472,896	1,398,278
UCC Graduates - VAT on incremental expenditure only	5,848,603	3,973,860	3,920,825
UCC Visitors - VAT on expenditure	538,571	266,000	266,000
Total Taxation Impact	**125,617,605**	**118,283,810**	**114,596,425**

Source: Audited Financial Statement/CSO/Revenue.ie and taxcalc.ie/HEA/UCC Careers Office/Bord Failte[18]

The overall tax contribution (including SIC) of the University, its staff, students, graduates and visitors is significant at €125m per annum. During this period, UCC received approximately €151,800,000 from the state in the form of the core grant, research investment and the HEA fee contribution.

The tax contribution means that the state gets 82.75% of its UCC funding back in the form of taxes from the University, its staff, students, graduates and visitors, as detailed above. Therefore, for every €1 invested by the State in UCC, it gets €0.83 cent in return in the form of VAT and taxes including social insurance contributions.

[18] Audited Financial Statements 2014/15/16. CSO for the average part-time salary. Revenue.ie for tax rates. HEA. Official number of students at UCC, 2015. UCC Careers Office for graduate numbers and employment. Bord Fáilte for visitor spending rates.

2.3 Employment impact

So far, the report has examined the economic impact supported by UCC from an expenditure and taxation perspective. However, one of the fundamental fiscal impacts of UCC is the employment that it creates in Ireland and the South-West economy. This employment comes in the form of 'direct' employees i.e. those directly contracted to UCC, and those jobs that are indirectly (including induced effects) supported by UCC's contribution to expenditure through the University itself, staff, students, graduates and visitors.

The University makes a significant contribution to the region in terms of the direct employment of academic staff. However, the University also employs technically skilled architects, engineers, administration and service staff. Thus, UCC contributes at all levels of employment directly. Indirectly (including induced effects), the University supports jobs across a similar spectrum, from professional auditors to food and beverage suppliers, as well as construction and other jobs supported in the economy by UCC's capital projects.

2.3.1 Direct employment

Taking 2016 as a representative year, we can see from Exhibit 2.14 below that UCC employs 3,002 staff directly across teaching and research, technical, central administration and services and other roles. It is through this expenditure that other jobs are supported elsewhere in the economy. This is examined in more detail in Section 2.4.3 below.

EXHIBIT 2.14: Staffing at UCC by profession (in number of staff)

No. of staff at UCC	2016	2015	2014	2013
Teaching and research	1,646	1,546	1,490	1,408
Technical	113	103	105	105
Central admin and services	935	852	874	876
Other	308	285	246	243
Total	**3,002**	**2,786**	**2,715**	**2,632**

Source: Audited Financial Statements[19]

The employment of 3,002 staff (at FYE 2016) is a considerable direct employment number in the local economy. Exhibit 2.15 below shows how UCC has ranked consistently as a top 3 employer in Cork City over the past 20 years. Not only that, but it is important to note that UCC also pays around 1,500 hourly paid casual staff on a monthly basis which is money into the pockets of circa 4,500 people in the Cork region each month.

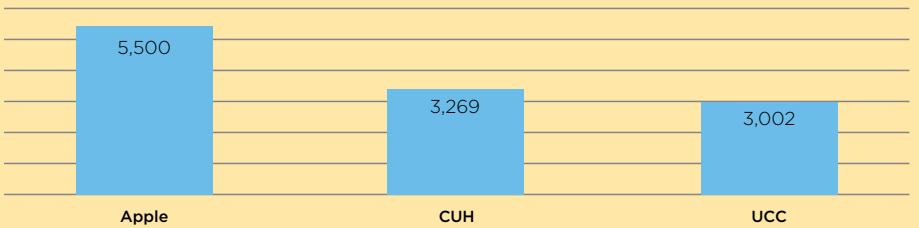
EXHIBIT 2.15: UCC's importance in Cork City employment

UCC's importance in Cork City employment	2016	2011	2006	2001
UCC's position as top employer in Cork City	3rd	3rd	2nd	2nd

Source: CSO Census[20]

EXHIBIT 2.16 below shows the position as it currently stands and UCC remains in the top 3 employers in Cork City, after Apple and Cork University Hospital (CUH). To be consistently within the top 3 employers in the city highlights the importance of UCC to employment in Cork and the surrounding area.

EXHIBIT 2.16: Cork City's top 3 employers



Source: Audited Financial Statement / HSE Website / Apple Website[21]

The University makes a significant contribution to employment in Cork City and the South-West Region, but the University's direct employment numbers are a significant proportion of education numbers, nationally. UCC staff represents almost 2% of the number of staff employed in education nationally, at primary, secondary and tertiary level. Furthermore, when one narrows the scope to the seven Irish universities, UCC makes a telling contribution by employing almost 20% of those employed in Irish universities.

[20] CSO: http://www.cso.ie/en/census
[21] Audited Financial Statements 2014/15/16. http://www.cuh.hse.ie/ https://www.apple.com/jobs/ie/

EXHIBIT 2.17: UCC staff numbers

UCC staff numbers	2016	2015	2014	2013
No. of staff at UCC	3,002	2,786	2,715	2,632
No. of people employed in Irish universities	15,189	14,450	14,119	14,007
No. of staff at UCC as a % of those employed in Irish universities	19.76%	19.28%	19.23%	18.79%

Source: Audited Financial Statements/ CSO / HEA

2.3.2 Indirect employment (including induced effects)

The indirect employment impact is as significant as the direct employment and, as a consequence of the expenditure of the University, its staff, students, graduates and visitors, we estimate that up to 17,321 additional Full Time Equivalent (FTE) jobs are supported elsewhere in the economy.

The starting point for the jobs is the number of those directly employed by UCC, 3,002 in 2016. If we apply an official university jobs Type I multiplier of 1.16 to this,[22] then there are an additional 3,482 jobs supported by these UCC jobs. (This multiplier is in line with the jobs multiplier of 1.17 used in the UK Economic Impact Survey.) This results in 6,484 jobs, both direct and indirect being supported by the University itself. This is outlined in **EXHIBIT 2.18** below.

EXHIBIT 2.18: Employment impact of UCC (University only)

	2016	2015	2013
No. of staff at UCC	3,002	2,786	2,715
Multiplier	1.16	1.16	1.16
Jobs supported elsewhere as a result of UCC jobs	3,482	3,232	3,149
Total jobs supported by UCC (direct and indirect)	6,484	6,018	5,864
Total jobs supported by UCC (induced)	1,849	1,800	1,848
Total jobs supported by UCC (direct, indirect and induced)	**8,333**	**7,818**	**7,712**
Jobs supported elsewhere in economy - Capital expenditure only (included in total jobs supported)	899	2,140	301

Source: UCC Finance Office / Lucey et al 2104 for multiplier

[22] The Economic Impact of Higher Education Institutions in Ireland. October 2014.

Again, using UCC's specific Type II jobs multiplier of 5.36 jobs for every €1m of expenditure, we can see that the induced employment from UCC's expenditure over the past 3 years has been 1,849 (€345m in expenditure x 5.36), 1,800 and 1,848, respectively. Thus, the total jobs supported by the University itself amounted to 8,333.

One point of note are the jobs supported by capital projects, which amounted to 899 in 2016, which we will return to in more detail in section 2.4 below. While included in the overall jobs impact, these jobs were vital to a construction sector which had been decimated in the 2009 to 2014 period post financial crisis.

In relation to the staff expenditure, we do not apply a multiplier to ascertain the jobs impact as the expenditure is induced. Dividing the staff expenditure by the average national wage in 2016, one could argue that UCC staff expenditure supported 2,613 jobs elsewhere in the economy. However, adopting a more conservative approach and to avoid any possible double-counting, we do not include the jobs supported by staff expenditure as they are captured by the multiplier applied to the university expenditure.

Applying the same methodology to the expenditure of Irish students and the incremental expenditure of graduates, we can establish 3,675 and 1,092 further jobs are supported through their expenditure.

As UCC visitors and UCC International students both have direct expenditure in the local economy and it is not expenditure which would have occurred elsewhere in the economy we can categorise the employment impact in terms of direct, indirect and induced by dividing expenditure figures by the average national wage in 2016 and establish that 187 and 1,421 further jobs are supported by their respective expenditures.

2.3.3 Employment Summary

EXHIBIT 2.19: Overall employment impact of UCC

Jobs Impact of UCC (in €000's & and number of jobs)	Total Expenditure	Direct Jobs	Indirect Jobs	Induced Jobs	Total Jobs
UCC - The University incl. subsidiaries (less pension, dep and int)	395,708	3,002	3,482	1,849	8,333
UCC Staff (their expenditure in local economy)	96,485	-	-	2613	(2,613)
UCC Irish Students (their expenditure in local economy)	135,681	-	-	3675	3,675
UCC Graduates (differential in spending by 3 year graduates working in Ireland)	40,335	-	-	1092	1,092
UCC Visitors (one year's visitors based on 2015 visitor numbers)	6,938	100	24	63	187
UCC International Students (their expenditure in the local economy)	52,529	754	179	488	1,421
Totals	**727,676**	**3,856**	**3,685**	**9,780**	**14,708**

Source: Audited Financial Statements/CSO/Revenue.ie/taxcalc.ie/HEA/UCC Careers Office/Bord Failte[23]

EXHIBIT 2.19 above gives a summary of the FTE jobs supported by the expenditure of the University, its staff, students, graduates and visitors. In total, 14,708 FTE jobs in the Irish economy are supported by UCC in any one year. This is hugely significant to the fiscal economy of Cork City and the South-West Region.

2.4 Capital projects and expenditure impact

UCC's capital projects are beneficial to the local economy in a number of ways. They serve to improve the facilities and infrastructure of the University and the City itself, which in turn serves to increase UCC's attractiveness to potential students and businesses alike. They also create employment during the construction phase and beyond that, long-term employment for not only the staff but also services such as cleaners, security and maintenance etc.

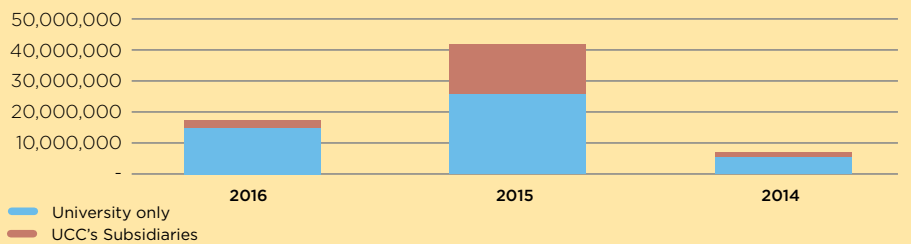
2.4.1 Infrastructure, facilities and construction sector impact

While capital expenditure falls within the overall expenditure of the University, we feel that capital projects and expenditure warrant independent analysis. Between 2014 and 2016, the University (including subsidiaries) spent €65 million in capital expenditure at a time where capital expenditures were low in the City and its environs. In 2015 alone, UCC spent €42m. Key infrastructure projects at this time included the world class Western Gateway Building, Beaufort Building in Ringaskiddy and the Assert Centre at Aras Watson, UCC. This is detailed in **EXHIBIT 2.20** below.

EXHIBIT 2.20: Economic impact of capital projects (in €)

Capital expenditures	2016	2015	2014
University only	15,368,587	26,744,724	4,362,304
UCC's subsidiaries	2,538,000	15,417,000	1,497,000
Total capital expenditure	17,906,587	42,161,724	5,859,304
Key expenditure items	1. Western Gateway 2. Paediatrics Depts. 3. Student Hub	1. Western Gateway 2. Beaufort Building 3. Assert Centre at Aras Watson, UCC	1. Beaufort Building 2. Assert Centre, at Aras Watson, UCC 3. Food Science building

Consolidated Capital Expenditure at UCC



Source: Audited Financial Statements / CSO[24]

[23] Audited Financial Statements 2014/15/16. CSO for the average salary and multipliers. Revenue.ie for tax rates. HEA. Official number of students at UCC, 2015. UCC Careers Office for graduate numbers and employment. Bord Failte for visitor spending rates.
[24] Audited Financial Statements 2014/15/16. CSO for the construction multipliers.

2.4.2 Employment benefit

Referring to **EXHIBIT 2.21** below, UCC spent €17.906m on capital expenditure in 2016. Applying the appropriate sectoral Type I multiplier to this expenditure (1.585) we can establish that the indirect economic impact is €10.475m. By applying the Type II multiplier of 1.854 which also takes into account induced effects of the expenditure, it can be established that there is a further €4.816m induced impact as a result of the direct €17.906m capital expenditure spent by UCC in 2016. In total, the economic impact amounts to €33.198m. If this is divided by the national average wage in 2016 it can be established that UCC's capital expenditure supported 899 jobs in 2016 which is significant. These jobs are included in the 17,321 jobs supported by UCC and as detailed in **EXHIBIT 2.19**.

EXHIBIT 2.19: Economic impact of capital expenditure (in €)

Economic impact of capital expenditure	**2016**	**2015**	**2014**
Capital expenditure at UCC – direct	17,906,587	42,161,724	5,859,304
Economic impact of capital projects - indirect	10,475,353	24,664,609	3,427,693
Economic impact of capital projects - induced	4,816,872	11,341,504	1,576,153
Total economic impact of capital projects at UCC	**33,198,812**	**78,167,836**	**10,863,150**
National average wage	36,919	36,519	36,090
Jobs supported by capital projects at UCC	**899**	**2,140**	**301**

Source: Audited Financial Statements / CSO

2.4.3 Future expansion plans

UCC has an ambitious €241m development plan 2016 to 2026. In November 2016, UCC signed a European Investment Bank Loan Agreement to fund €100m of that development plan. Projects include:

- €64m investment into student accommodation
- €37m for a new Cork University Dental School
- €27m to fund Western Campus Development including Cork Science and Innovation Park, and additional sports facilities
- €90m for a new student hub
- €23m to fund Clinical Medical School for the Cork hospitals and associated research

This is the single largest capital investment planned in Cork and it will have a real positive impact on the local fiscal environment. Delivering on the plan will also help transform the physical environment of UCC by delivering crucial infrastructural projects to allow UCC to meet increasing demand. In addition, there are further capital projects planned such as the Cork University Business School which fall outside the scope of the current plan and are a further testament to UCC's commitment to the city and surrounding region.

Applying the same sectoral Type I and Type II multipliers to the programme, the economic impact per project can be established. These are set below in **EXHIBIT 2.22**.

EXHIBIT 2.22: Economic impact of UCC's Capital Development Plan (in €)

	Student Accommodation	**Dental School**	**Western Campus & CSAIP**	**Student Hub**	**Clinical Med School**	**Totals**
Direct expenditure	64,000,000	37,000,000	27,000,000	90,000,000	23,000,000	241,000,000
Economic impact of the capital project - indirect	37,440,000	21,645,000	15,795,000	52,650,000	13,455,000	140,985,000
Economic impact of the capital project - induced	17,216,000	9,953,000	7,263,000	24,210,000	6,187,000	64,829,000
Total economic impact of capital project	**118,656,000**	**68,598,000**	**50,058,000**	**166,860,000**	**42,642,000**	**446,814,000**
Average wage (based on 5% increase on 2016 level)	38,765	39,765	38,765	38,765	38,765	-
Jobs supported by capital project	**3,061**	**1,725**	**1,291**	**4,304**	**1,100**	**11,482**

Source: UCC / CSO for multiplier and average industrial wage

The total impact of the expenditure would amount to €446.814 million. Even allowing for a 5% increase in the average 2016 wage of €36,919 to €38,765, this combined expenditure will support the equivalent of 11,482 FTE jobs.

2.5 Visitors and export impact

2.5.1 International students impact

International student and international visitor (including for business and academic purposes) expenditure is seen as an export from the local economy in fiscal terms. This is dealt with in detail in Section 2.1.5 above. In total, the €27.852m in direct expenditure has total knock-on impact of €24.677m (both indirect and induced effects), making a total economic output of €52.529m in 2016. This is detailed in **EXHIBIT 2.7**. This expenditure is sufficient to support 1,421 jobs on an annual basis.

2.5.2 Visitors impact

Similarly, as illustrated by Exhibit 2.6, the annual €3.714 million in direct spending generates an additional €3.224m million in indirect and induced expenditure, making €6.938m in total output. This in itself is sufficient to support the equivalent of 187 FTE jobs.

2.5.3 Graduation ceremonies impact on the local economy

EXHIBIT 2.23: Economic impact of graduation ceremonies only (in €)

	2016	2015	2014
No. of undergraduates	2,945	2,528	2,254
No. of postgraduates	4,097	4,148	4,648
Total no. of graduates	**7,042**	**6,676**	**6,902**
No. of graduates that attend graduation (80%)	5,634	5,341	5,522
Average spending on graduation ceremony	750	750	750
Value of UCC graduation ceremonies to local economy	4,225,200	4,005,600	4,141,200

Source: HEA for Graduate Numbers / UCC Conferring Office

EXHIBIT 2.23 above outlines the direct expenditure impact of just one aspect of UCC life. In 2016, UCC had 7,042 graduates. Assuming 80% attendance rate and an average of €750 spend on each graduation (clothes, restaurant meals, socialising, accommodation, accessories, photography, cloak hire etc.), it is estimated that the graduation ceremonies bring €4 million in expenditure to the local economy each year.

2.6 Key findings

EXHIBIT 2.24: Summary - Fiscal impact in one year 2016 (in €000's)

Summary table – Financial Impact in 1 year	Expenditure		Taxation	Employment	
	Expenditure (direct)	Expenditure (indirect/ induced)	Taxation and SIC contributions (direct /indirect /induced)	Jobs (direct FTE)	Jobs (indirect/ induced FTE)
UCC - The University (expenditure less frs impact, dep & int)	293,117	92,330	19,374	3,002	5,331
UCC Staff (their expenditure in the local economy)	-	96,485	65,682	-	(2,613)
UCC Irish Students (their expenditure in local economy)	-	135,681	23,973	-	3,675
UCC Graduates (incremental expenditure in economy over non-graduates)	-	40,335	16,052	-	1,092
UCC Visitors (one year's expenditure in local economy)	3,714	3,224	537	100	87
UCC International Students (their expenditure in local economy)	27,852	24,677	-	754	667
Total economic impact (output)	324,683	392,732	125,618	3,856	10,852
Total economic impact (output) by category		**727,676**	**125,618**		**14,708**
Overall Economic Output			**853,294**		**14,708 jobs**

EXHIBIT 2.24 gives a snapshot of the economic importance of UCC to the Cork City and South-West economies.

- Overall, **the total economic impact (Gross Value Added) of UCC is €853m per annum**. That impact means that UCC generates **€2.3m per day for the Irish economy**. The impact generated by **expenditure is €727m** annually and the **fiscal contribution, including taxes and social insurance contributions, amounts to a further €125m** each year.
- Taking 2016 as a representative year, UCC produced €853m in output for a €151m state investment. That is a return of **€5.68 to the Irish Economy for every €1 of state investment** in UCC.

  This compares very well with the Leading European Research Universities (LERU Group), where their return is €5.
- **UCC's turnover is €350m** per annum, of which 43% (€151m) is invested by the state. UCC secures the remaining 57% of the investment from non-Exchequer sources. In 2016, **for every €1 invested by the state in UCC**, the state directly got approximately €0.83 cent in return in the form of VAT and payroll taxes, including employee contributions.
- On top of that, **UCC supports 14,708 jobs on an annual basis**, which equates to approximately 1 in every 15 jobs in Cork City and County.

In addition, up to a further **11,482 FTE jobs** will be supported over the lifetime of **UCC's €241 million capital development plan (2016-2026)**. The approved development plan alone (which excludes key strategic projects such as the new business school) is the largest planned by any organisation in Cork and will impact positively on the economy of the South-West to the tune of **€446m** including all direct, indirect and induced effects.

Leading Action 6 in Sustaining Excellence (Strategic Plan 2013 to 2017) focused on strengthening UCC's capacity for research and to meet national and economic social development needs.

UCC is clearly making a telling contribution to **Enabling, Financing and Employing** Cork City and the South-West Region. It is important to note that the total impact does not include expenditure, taxation and jobs generated by any spin off companies which have arisen out of UCC centres such as Tyndall National Institute or APC Microbiome Ireland or indeed from any of the incubation and start up programmes such as IGNITE, Blackstone Launchpad or Gateway. Through systematically looking at expenditure, taxation and employment for each of the University, its staff, students, graduates and visitors, we can quantify the importance of UCC to the fiscal economy of Cork and the South-West Region.

WORKFORCE DEVELOPMENT IMPACT

UCC GRADUATES THE **MOST UNDERGRADUATES** OF ANY IRISH UNIVERSITY.

EMPLOYMENT RATES OF UCC GRADUATES ARE AT HISTORIC HIGH LEVELS AT **94%** FOR UNDERGRADUATE LEVEL AND **95%** AT POSTGRADUATE LEVEL.

SECTION 3:

THE WORKFORCE DEVELOPMENT IMPACT OF UCC

Another significant impact is that UCC plays a key role in the development of the Irish workforce. UCC graduates and develops thousands of top graduates who are highly sought after by the business community each year. Compared to non-graduates, UCC's graduates achieve significantly higher starting salaries.

These extra starting salaries, multiplied by the growing number of UCC's graduates each year creates additional economic value of €24.8million annually, which is hugely significant over the lifetime of a professional career and undoubtedly enhances the Irish economy in terms of the expenditure and the financial health of citizens.

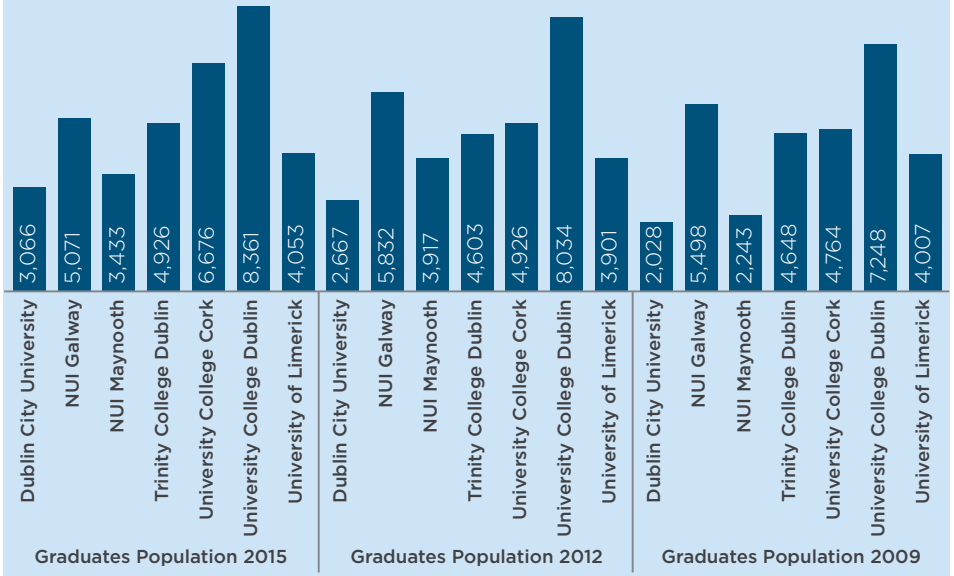
3.1 UCC as a leading university

UCC has a strong reputation for high-quality educational programs and research, which allows it to attract a growing number of students every year. UCC continues to be ranked in the top 2% of universities world-wide as ranked by QS.[25] Some examples of UCC's reputation as a world class university are as follows:

- In 2017, UCC became the first Irish University to be named Sunday Times University of the Year for 2 consecutive years (Irish Edition), reinforcing its leading position in Irish education.
- According to the CWTS Leiden Ranking 2015, UCC has been recognised as one of the leading universities worldwide for scientific research, ranking 1st in Ireland, 16th in Europe and 52nd worldwide.
- UCC's performance in the QS World University Rankings by subject 2017 has reinforced its position as a leading university internationally, with 16 subject areas featuring in the top tier globally (up 6 from 2011).
- Per QS University Rankings June 2017, UCC is in the top 1.1% of universities worldwide.

The higher education sector in Ireland consists of universities, specialist colleges (offering courses in a single subject area), and institutes of technology, which traditionally provided vocation-centric programs. As illustrated in Exhibit 3.1, the number of total graduates in UCC usually remained constant at 3rd position, with 4,764 graduates in 2009 and 4,926 in 2012, just behind UCD and NUI Galway. However, this figure increased dramatically to 6,676 in 2015, which made UCC the second largest graduate-producing university in Ireland.

EXHIBIT 3.1: Total number of graduates by university (in number of graduates)



Source: HEA

This progression was carried into 2016 and, as we can see from **EXHIBIT 3.2** below, UCC cemented its second-place overall position at 7,042 in terms of the number of graduates in one year versus 8,864 at UCD.

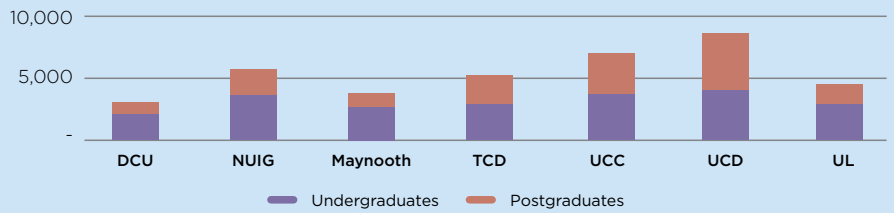
However, it's important to point out that for the first time, **UCC has moved into first place** in terms of the number of graduates in Ireland at the undergraduate level: 4,097. This is an important milestone for UCC and reflects the focus placed on this very area in the strategic plan for UCC 2013 to 2017.

[25] UCC Strategic Plan 2017 – 2022, 'Shared Ambition, Independent Thinking'. 2017

EXHIBIT 3.2: Number of graduates by university in 2016 by level of study (in number of graduates)

	DCU	NUIG	Maynooth	TCD	**UCC**	UCD	UL	Total
Undergraduate	1,946	3,548	2,348	2,855	**4,097**	3,974	2,964	21,732
Postgraduate	1,115	1,973	1,209	2,370	**2,945**	4,890	1,488	15,990
Total	3,061	5,521	3,557	5,225	**7,042**	8,864	4,452	37,722

Graduate Population by University 2016



Source: HEA

Examining UCC's graduate statistics, we can see the growth areas of postgraduate education and also the fields of study growth areas. This is outlined below in Exhibit 3.3. There is particularly strong growth in the area of business administration and law since 2012, with the total number of graduates more than doubling in that period. In 2016, business administration and law graduates made up 28.5% of UCC's graduate population.

EXHIBIT 3.3: Graduate population of UCC by fields of study and award level and year (in numbers)

Field of study	**2016**			**2015**			**2014**		
	UG	**PG**	**Total**	**UG**	**PG**	**Total**	**UG**	**PG**	**Total**
Education	58	288	346	55	125	180	49	352	401
Humanities and arts	729	281	1,010	587	314	901	672	77	749
Social sciences, journalism and Information	272	220	492	395	198	593	408	96	504
Business, administration and law	973	1,035	2,008	1,253	871	2,124	684	309	993
Science, mathematics and computing	734	459	1,193	579	457	1,036	550	224	774
Engineering, manufacturing and construction	209	191	400	236	209	445	235	58	293
Health and welfare	1,097	415	1,512	1,031	297	1,328	876	295	1,171
Services	25	56	81	12	57	69	-	41	41
Total graduates	**4,097**	**2,945**	**7,042**	**4,148**	**2,528**	**6,676**	**3,474**	**1,452**	**4,926**

Source: Higher Education Authority http://hea.ie/statistics

Humanities and Arts including Social Sciences, Journalism and Information have seen strong growth in terms of graduates, as has the field of Health and Welfare. UCC has a rich tradition in the areas of science, mathematics and computing and this core competence has also seen strong growth in the 2012 to 2016 period.

Another key point worth highlighting is UCC's **impressive student progression rates** from 1st Year to 2nd Year. In the past 3 academic years UCC's overall progression rates have been **91.60%** (2014/15 to 2015/16), **90.50%** (2015/16 to 2016/17) and **93.40%** (2016/17 to 2017/18) respectively. A HEA report[26] published in April 2017 stated that progression rates in third level institutions in Ireland were averaging 85% for the academic year 2014/15 with UCC being a huge 6.6% ahead of the national average.

[25] UCC Strategic Plan 2017 – 2022, 'Shared Ambition, Independent Thinking'. 2017
[26] HEA: March 2017. A Study of Progression in Higher Education 2013/2014 to 2014/2015

These retention rates are a positive reflection of the proactive work being done by UCC in this regard which includes the following:

- UCC appointed a dedicated 1st Year Experience Coordinator in 2008
- Students are asked for feedback each year in respect of University initiatives
- UCC offers a tailored orientation programme to specific small groups and involve as many academic staff as possible. This includes 'failte fest' (Saturday before 1st semester) when more than 2,000 first years attend as well as friends and family of the students
- UCC engages consistently with prospective students via various social media platforms
- UCC assigns each 1st year student a peer support leader. They meet their peer support leaders at orientation
- UCC offers workshops throughout 1st year with the support of the UCC Skills Centre
- UCC proactively contacts students in 1st year who do not perform well in exams to offer additional support and guidance
- Students who formally withdraw from University must undergo an exit interview; data is kept from these interviews which helps inform UCC's retention policy
- UCC operates a change of course policy and students can change course in the first month of 1st year provided they have sufficient points for the course and there is adequate capacity. Academic staff are very supportive of this initiative and, since its introduction in 2013, almost 400 students have changed course to date

UCC's impressive 1st year retention rate of 93.4% for the academic years 2016/17 to 2017/18 puts it on a par with some of America's elite third level institutions and ahead of prestigious universities such as Boston University, George Washington University and Syracuse University.[27]

3.2 The role of UCC in Ireland's higher education

3.2.1 Undergraduate education

As can be seen from Exhibit 3.4, seven public universities in Ireland awarded 21,733 undergraduate degrees, certificates and diplomas in 2016, almost 19% (4,148) of which were awarded by UCC. This is the largest number of undergraduates among all these seven public universities.

UCC is in 1st place in these three growth areas: business, administration and law; science, mathematics and computing; health and welfare.

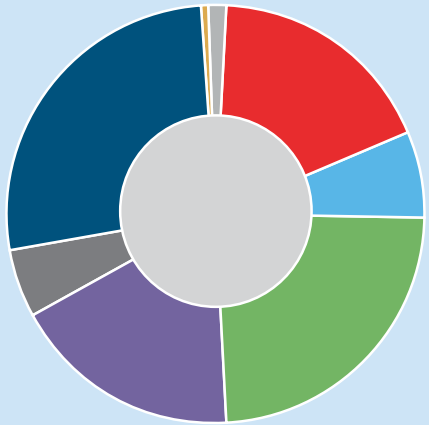
EXHIBIT 3.4: Total undergraduates by university and field of study 2016

	DCU	NUIG	Maynooth	TCD	**UCC**	UCD	UL	Total
Generic programmes	-	-	13	1	**-**	115	-	129
Education	87	250	184	157	**58**	-	310	1,046
Humanities and arts	336	1,100	734	582	**729**	618	353	4,452
Social sciences, journalism and information	201	157	461	342	**272**	393	111	1,937
Business, administration and law	493	514	340	263	**973**	782	657	4,022
Science, mathematics and computing	414	517	379	511	**734**	455	428	3,438
Engineering, manufacturing and construction	83	234	58	146	**209**	293	433	1,456
Agriculture, forestry and veterinary	-	-	-	-	**-**	391	-	391
Health and welfare	332	765	153	853	**1,097**	795	613	4,608
Services	-	11	26	-	**25**	133	59	254
Total	1,946	3,548	2,348	2,855	**4,097**	3,975	2,964	21,733

[27] USNews.com. Freshman Retention Rates – National Universities

EXHIBIT 3.5: UCC's undergraduate graduates by field of study 2016 (in number of graduates)

Education	734
Humanities & arts	729
Social Sciences, journalism & information	272
Business, administration & law	973
Science, mathematics & computing	734
Engineering, manufacturing & construction	209
Health & Welfare	25
Services	58



Source: HEA

3.2.2 Postgraduate education

As presented in **EXHIBIT 3.6**, 15,990 postgraduate certificates, diplomas, masters and PhD degrees were awarded by Ireland's seven public universities in 2016, which has increased by 8.9% on 2015. 4,890 postgraduate degrees were awarded by UCD, followed by 2,945 from UCC. The UCC figure has more than doubled since 2012 when this number was 1,452. The growth has seen UCC move from fourth to second place and now, UCC is encouragingly in second place across 5 different fields of study in 2016 and first in respect of service related postgraduates.

Again, UCC has seen rapid development in the postgraduate cohort and is producing more and more top graduates who are supporting the South-West, Irish, and also worldwide economies. Having the second largest number of postgraduates has enabled UCC to provide a better-educated, high-quality, highly skilled workforce to a wide range of industry areas.

[28] HEA: Postgraduates refer to all the postgraduate certificates, diplomas, masters and PhD degrees.

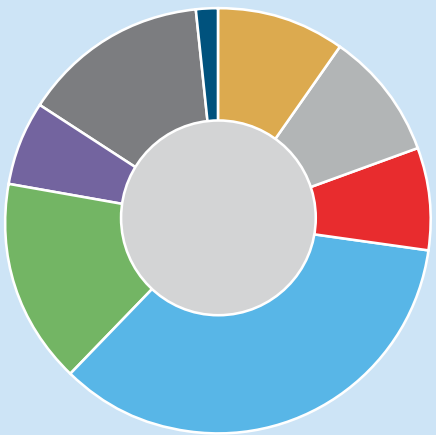
EXHIBIT 3.5: University postgraduates by field of study 2016 (in number of students)

	DCU	NUIG	Maynooth	TCD	**UCC**	UCD	UL	Total
Generic programmes	15	-	-	1	**-**	-	-	16
Education	164	238	558	313	**288**	253	161	1,975
Humanities and arts	82	168	149	378	**281**	203	165	1,426
Social sciences, journalism and info	133	268	61	265	**220**	386	162	1,495
Business, administration and law	413	467	165	490	**1,035**	2,023	446	5,039
Science, mathematics and computing	180	228	155	273	**459**	616	166	2,077
Engineering, manufacturing and construction	38	126	11	104	**191**	410	104	984
Agriculture, forestry and veterinary	-	-	-	-	**-**	127	-	127
Health and welfare	90	447	67	529	**415**	868	229	2,645
Services	-	31	43	17	**56**	4	55	206
Total	1,115	1,973	1,209	2,370	**2,945**	4,890	1,488	15,990

Source: HEA

EXHIBIT 3.7: Total UCC postgraduate graduates by fields of study 2016

Education	288
Humanities & arts	281
Social Sciences, journalism & information	220
Business, administration & law	1035
Science, mathematics & computing	459
Engineering, manufacturing & construction	191
Health & Welfare	415
Services	56



Source: Higher Education Authority[28]

Examining UCC's postgraduate graduates in more detail, we can establish that UCC is extremely strong in three particular fields of study, namely: Business administration and law, Health and Welfare and Science mathematics and computing, whereby 65% of UCC's postgraduate graduates are from these areas.

Producing a high number of quality graduates at both graduate and postgraduate level is a key priority for UCC. Access to top quality talent is one of the key reasons why there is a technology cluster in the Cork City region.

This reinforces the point that it is the quality of the graduates that matters. UCC takes pride in its leadership position in teaching and learning and the quality of graduates is of paramount importance. UCC is producing socially responsible graduates across all sectors, many of whom volunteer and engage actively in the communities in which they choose to live, having graduated from UCC. More importantly, they are leaving UCC for high value careers.

3.3 Employment of UCC graduates

Exhibit 3.8 shows the employment rates of UCC in both undergraduate and postgraduate levels from 2009 to 2015 and comparatively for 2016. In the case of undergraduates, 2016 saw 94% in employment or further study (or were not available to respond to the survey). In the same year, 95% of post graduates were in employment, completing further study or not available for employment. These percentages, which represent historic highs for UCC, have increased from 93% and 89% respectively in 2009, which was immediately following the financial crisis.

At the undergraduate level, in 2016, 38% of graduates went on to do further study, which is in line with other Irish universities. This reflects the changing trends in higher education. Interestingly, this figure was 49% in 2009. Immediate job prospects are clearly brighter in 2016 than they were in 2009 for undergraduates. Similarly, at postgraduate level 13% went on to do further study in 2016 while this figure was 22% in 2009, just as austerity measures were being introduced in Ireland.

EXHIBIT 3.8: Employment of UCC graduates by award levels and year

	2016			2015			2014		
	In employment / Further study / not available	Seeking Employment	Response Rate	In employment / Further study / not available	Seeking employment	Response Rate	In employment / Further study / not available	Seeking Employment	Response Rate
Primary degrees (ordinary bachelor's degree, honours bachelor's degree)	94%	6%	84%	96%	4%	84%	95%	5%	75%
Higher degrees and diplomas (higher diploma, post-graduate diploma, master's degree taught / research, PhD)	95%	5%	71%	91%	9%	73%	89%	11%	52%

Source: UCC Career Services[29]

3.4 Salaries of UCC graduates

In order to get a true reflection of the value added from studying at UCC, the team compared starting salaries, not only between undergraduates and postgraduates, but also between UCC's graduates and non-graduates, those who did not enter college or did not graduate from the University.

3.4.1 Salary of undergraduates and postgraduates

It is evident from Exhibit 3.9 below that median starting salaries (highlighted) for undergraduates in these three reference years fall within the same category, €21,000 to €24,999, but did increase to the €25,000 to €28,999 category in 2016. This reflects increased demand for graduates in the Irish marketplace currently.

[29] UCC Careers Office: UG refers to all the undergraduate honors degrees, ordinary degrees, certificates and diplomas. PG refers to all the postgraduate certificates, diplomas, masters and PhD degrees.

For postgraduates, the median salaries in 2016, 2015 and 2009 are from €29,000 to €32,999, while the range in 2012 was less at €25,000 to €28,999, possibly reflecting economic conditions in Ireland at that time. Nonetheless, we still can say that postgraduates tend to achieve higher salaries than undergraduates, which can also explain why around 38% of the UCC undergraduates take part in further study, shown in Section 3.3 above.

It is important to note that the salaries quoted in this section of the report refer to salaries of graduates in the first 12 months after graduation.

EXHIBIT 3.9: Starting salaries of UCC graduates by salary range, award levels and year

Salary range	2016		2015		2012		2009	
	UG	PG	UG	PG	UG	PG	UG	PG
Up to €16,999	12%	6%	9.1%	8.0%	23.0%	10.0%	17.0%	13.0%
€17,000 - €20,999	12%	7%	18.3%	7.3%	11.0%	7.5%	14.5%	9.0%
€21,000 - €24,999	20%	16%	25.4%	16.4%	22.0%	16.0%	22.0%	13.0%
€25,000 - €28,999	18%	16%	17.2%	16.1%	21.5%	22.5%	17.0%	10.0%
€29,000 - €32,999	21%	16%	14.7%	14.2%	11.0%	13.5%	10.0%	13.0%
€33,000 - €36,999	10%	12%	8.4%	13.9%	5.5%	9.0%	13.0%	11.0%
€37,000 - €40,999	3%	9%	2.9%	9.7%	2.0%	6.0%	2.5%	6.0%
€41,000 +	4%	18%	4.1%	14.5%	4.0%	15.5%	4.0%	25.0%
Total	100%	100%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Response rates	73%	71%	70.0%	70.0%	64.0%	63.0%	58.0%	70.0%

Source: UCC Career Services[30]

It is important to point out that these are medians and ranges and that, within each of the undergraduate and postgraduate cohorts, there are outliers. For example, in 2016, 4% of undergraduate respondents were earning more than €41,000. At postgraduate level, this number was 18% of respondents.

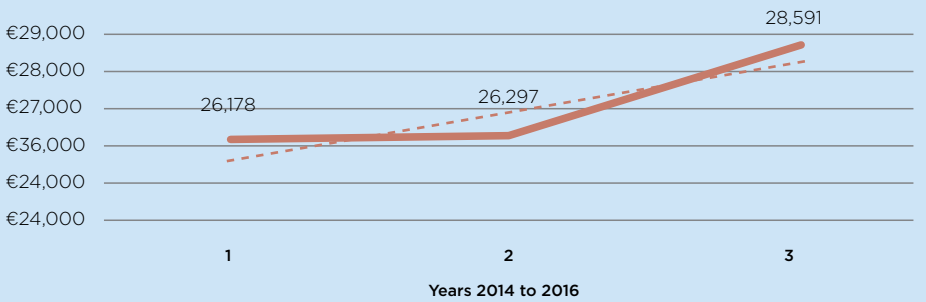
EXHIBIT 3.10: Analysis of UCC's mean starting salary (in €)

	2016	2015	2014
Median undergraduate salary - midpoint	27,000	23,000	23,000
Number of students working in Ireland	1,388	1,171	1,150
Median postgraduate salary - midpoint	31,000	31,000	31,000
Number of students working in Ireland	917	821	758

Source: UCC Careers Office

We can establish a mean starting salary for UCC graduates over the past three years. This is outlined in Exhibit 3.10 above and has risen from €26,178 in 2014 to €28,591 in 2016. This is illustrated graphically in **EXHIBIT 3.11** below.

EXHIBIT 3.11: UCC median starting salary 2014 to 2016



Source: UCC Career Services

The upward trend is encouraging and, based upon this data, we can expect to see more and more UCC graduates remain in Ireland to work and contribute to the financial wellbeing of Irish citizens. UCC's mean starting salary of €28,591 in 2016 **is slightly ahead of the national average of €28,554** across all sectors.[31]

It is important to note that these salaries represent those in the first year after graduation and do not reflect the increase in salary or promotional opportunities that UCC graduates have vis-à-vis non-graduates.

[30] UCC Career Services Annual First Destination Report
[31] Grad Ireland - Graduate Salary & Graduate Recruitment trends survey. 2017.

3.4.2 Salary of non-graduates

In order to establish the additional economic benefit, or value added by graduating from UCC, as opposed to being a non-graduate (those who did not enter or complete third level education), we compared the starting salaries of UCC's graduates (in the first year after graduation) with those of non-graduates. We used two benchmarks as representative of a starting non-graduate salary. The first is the Irish Government's living wage[32] of €11.50 per hour, multiplied by 37 hours of a typical working week and by 52 weeks amounts to €22,126 per annum and is indicative of a non-graduate's starting salary. This is set out in **EXHIBIT 3.12** below.

The premium or differential earned by the UCC graduate over this non-graduate benchmark is €6,465 per annum. If we multiply this by the number of graduates remaining in Ireland to work, then we can establish that the economic value added is €14.9m for one year's graduates of UCC. If we consider this in the context of a ten-year time frame, we can see that the impact of this premium is in excess of €140m. It is obviously even more significant over the lifetime of a professional career. Indeed the professional career should see more promotional opportunities for graduates than for non-graduates.

EXHIBIT 3.12: Analysis of economic value added by being a graduate of UCC in 2016 (in €)

Educational level	Mean starting salary at UCC	Premium over non-graduate benchmark	No. of graduates working in Ireland	Total annual premium
UCC graduates mean starting salary	28,591	0	2,305	-
Benchmark 1: Non-graduates - living wage	22,126	6,465	2,305	14,902,570
Benchmark 2: Non-graduates - minimum wage	17,797	10,794	2,305	24,880,915

Source: UCC Career Services / CSO/ Government.ie

Similarly (and as outlined above in Exhibit 3.12), we have established the differential or premium in earnings of UCC graduates over non-graduates by use of the minimum wage in Ireland as a second benchmark. Applying the same methodology, we can see that the premium amounts to €10,794. We can establish the economic value added of the graduation class of 2016 as being €24.8m. In the context of multiple years, graduates producing that economic value added concurrently, then we can see the magnitude of the economic benefit of graduating from UCC. Ten years amounting to €240m. Again, over the lifetime of a professional career this impact is amplified. It is important to note that this calculation is conservative does not take into account increases in salary or promotional opportunities that UCC graduates may have in their career vis-à-vis non-graduates. In addition, it is based on the first year after graduation as robust data in relation to graduate salaries after 5 and 10 years is currently not available.

3.4.3 The cost of a degree (input) versus the earning potential (output)

We have seen that the UCC graduate premium (UCC graduate versus non-graduate) can be around €10,794 per annum in some instances. Let us now consider a simple input-output model where the input is the cost of the degree and the output is the earning potential over the lifetime of a professional career.

Assuming the annual student fees for a primary degree are €3,000 as this input by the state or by the student's household. If we add the living costs of €8,018 per annum, as used in section 2 of this report, which are also met by the household, then the total cost is €44,072 over a four-year degree programme. The additional earning potential of the UCC student over a non-graduate, over the life time of a 40-year career, is €431,760 (€10,794 x 40). Thus, the additional benefit is 10.2 times the cost.

The Present Value of additional UCC graduate earning potential €431,760 discounted by 3% over a 40 year period is €132,359. This compares favourably to the UK Russell Group[33] average of £88,000 (€101,149 at 0.87 exchange rate) for the 2015/2016 period.

[32] Living Wage. The 2016 Living Wage rate is €11.50 per hour. This is the average gross salary required by a single individual (without dependents) in full-time employment to afford a socially acceptable minimum standard of living across Ireland.

[33] The Economic Impact of the Russell Group Universities. October 2017.

3.4.4 The cost of UCC education per academic year

Assuming 24 hours of lectures and 5 labs/tutorials, making 29 contact hours per module, and assuming 10 modules per academic year, then total contact hours are 290. For the household contribution alone of €3,000, then the cost to the students of the education (excluding living costs) equates to €10.34 per hour. In the context of becoming the next great engineer, scientist or lawyer this cost represents fantastic value for money.

3.4.5 The graduate ecosystem 2016

As economic conditions in Ireland continue to improve and as opportunities continue to present themselves for Ireland on the back of Brexit, the graduate marketplace is becoming busier as discerning employers are all chasing the top graduates in each field of study. The trend is that more employers are active in this marketplace, salaries are increasing for our graduates, internships are back in vogue and technology is part and parcel of the selection process.

The following are some key points from Grad Ireland Survey in 2016, published in 2017:[34]

- Average graduate intakes increased by 18%
- Starting graduate salaries across all sectors and regions increased to €28,554
- Most available jobs in banking and financial services (32%), accounting related (16%), IT and telecoms (14%)
- 76% of firms offer internships and 93% of these are paid (average €1,400 to €1,599 per month)
- 62% of recruiting firms employed graduates who had interned with them

In summary, the trend is that more employers are active in this marketplace, salaries are increasing for graduates and internships are in vogue.

UCC Career Services leads UCC's engagement with graduate employers across all sectors. Multiple open days, invited employers, Q&A sessions, aptitude test preparation and one-on-one interview preparation are all services that are available to UCC students. UCC Careers Services supports work placements (of which there were 831 in the academic year to Sept 2017) with all the top employers. UCC is extending its reach into the business community in terms building linkages and relationships. The work placement engagement also instils UCC students with confidence in terms of the practical application of UCC learnings with a leading international employer, something which is of vital importance when it comes to the graduate selection process of UCC students. This is reflected in UCC's successful graduate employment rates.

[34] Grad Ireland Annual Survey 2016, Published 2017.

3.5 Key findings

Key findings:

- Graduates of UCC that remain and work in Ireland create extra economic value for the nation of up to €24.8 million in the first year after graduation when compared to non-university graduates.
- UCC's performance in the QS World University Rankings by subject 2017 has reinforced its position as a leading university internationally, with 16 subject areas featuring in the top tier globally (up 6 from 2011). The 2018 QS World University Rankings ranked UCC amongst the top 1.1% of universities worldwide.
- UCC's impressive 1st year retention rate of 93.4% for the academic years 2016/17 to 2017/18 puts it on a par with some of America's elite third level institutions and ahead of prestigious universities such as Boston University, George Washington University and Syracuse University.
- In 2016, UCC graduated more undergraduates (4,097) than any other University in Ireland. Furthermore, and crucially for the economy, UCC is developing graduates in the sectors that have an economic need and which are 'hot' in terms of graduate intake. Per Grad Ireland research published in 2017, the most available jobs were in banking and financial services (32%), accounting related (16%), IT and telecoms (14%). At the undergraduate level, UCC leads the way in terms of graduate numbers for business administration and law, science mathematics and computing, addressing this economic need.
- Employment rates of UCC graduates (which include those in further study) are at historic high levels at 94% for undergraduate level and 95% at postgraduate level (March 2017, those in employment and further study up to 12 months following graduation).
- In pure financial terms, the additional earning potential (output) from being a graduate of UCC as opposed to a non-graduate is 10.2 times the cost (input) to that undergraduate degree.

We have calculated that the UCC graduate premium (UCC graduate versus non-graduate) is around €10,794 per annum. The input is the cost of the degree (€3,000 annual student contribution plus living costs of €8,018 per annum) which equates to €44,072 and the output is the additional earning potential over the lifetime of a professional career of 40 years, €431,760 (€10,794 x 40). Thus, the additional benefit is 10.2 times the cost.

The Present Value of additional UCC graduate earning potential €431,760, discounted by 3% over a 40 year period, is €132,359. This compares favourably to the UK Russell Group[35] average of £88,000 (€101,149 at 0.87 exchange rate) for the 2015/2016 period.

[35] The Economic Impact of the Russell Group Universities. October 2017.

BUSINESS IMPACT

UCC'S IRISH STUDENTS GENERATE €135 MILLION FOR THE LOCAL ECONOMY THIS EXPENDITURE SUPPORTS **3,675 JOBS** IN THE IRISH ECONOMY.

UCC'S INTERNATIONAL STUDENTS GENERATE €52.5 MILLION FOR THE LOCAL ECONOMY THIS EXPENDITURE SUPPORTS A FURTHER **1,421 JOBS** IN THE IRISH ECONOMY.

SECTION 4:

THE BUSINESS AND FOREIGN DIRECT INVESTMENT IMPACT OF UCC

UCC acts as a catalyst for growth in Ireland. The university plays a lead role in attracting FDI to the Cork region and access to top talent and agile world-class research centres in the vicinity of Cork is a key reason why seven of the world's top ten pharma companies are located in Cork. UCC has developed an extensive business innovation ecosystem through Blackstone Launchpad for students, IGNITE for graduates and Gateway for existing research staff as it fosters entrepreneurialism throughout campus and beyond.

UCC is a key reason why firms cluster around Cork and we will take a deeper look at both the Tech and Pharma clusters in more detail. Furthermore, UCC supports local business and SMEs in the South-West Region through its expenditures and those of its staff, students, recent graduates as well as those who visit UCC to study or for leisure purposes. Many small businesses survive and prosper because of UCC. UCC helps drive economic activity locally and improves the financial health of citizens.

4.1 The foreign direct investment impact of UCC

The IDA is Ireland's national agency with responsibility for FDI which has been a pillar of Irish economic policy for almost 40 years. UCC plays a key role in attracting FDI to the Cork region and has close links with global companies, and importantly, this engagement and these links are across all sectors of the economy.

Taking a top-down approach, we can see from **EXHIBIT 4.1** below that after 'Dublin and the mid-East region', the South-West Region of Ireland has had the highest growth in terms of the employment of people working for IDA supported companies. Employment in these FDI companies has increased by 29% in the region since 2012. When one considers the Midlands, the Border Region or the South-East, which have the flattest growth rates, the common denominator is the absence of a leading university akin to UCC. Growth in FDI employment has been centred on areas with universities and UCC has been crucial in supporting the growth in employment in the South-West.

EXHIBIT 4.1: IDA (FDI) Employment by region (in number of jobs)

Region	2016	2015	2014	2013	2012
Dublin & mid-East	96,300	90,765	84,510	81,150	76,320
South-West	**36,059**	**34,232**	**30,319**	**29,064**	**27,921**
Mid-West	17,143	15,627	14,714	14,107	13,900
West	22,070	20,406	19,512	18,956	18,171
South-East	13,369	12,693	12,462	12,003	12,072
Border	10,656	10,090	9,677	9,127	8,661
Midlands	4,280	4,222	4,023	3,915	3,937
IDA Ireland	**199,877**	**188,035**	**175,217**	**168,322**	**160,982**

Source: IDA, Source DJEI Annual Employment Survey 2016[36]

In addition, what is striking about Exhibit 4.1 above is that the growth in FDI employment in the region is highly correlated with the growth of UCC. Overall, student numbers are up close to 11% in the intervening period, investment in creation and discovery has increased by 21% and the number of graduates from UCC has increased by 43% since 2012. UCC's enrolment of more students, increasing investment in research and production of more highly skilled graduates which help attract FDI to the region due the availability of skills.

EXHIBIT 4.2 takes a closer look at the FDI employment in Ireland by sector. We can see from the data that the three areas with the highest growth in employment terms are pharmaceuticals, computer, electronic and optical equipment, and international financial services and software. These sectors are closely aligned to some of UCC's core competencies in terms of teaching and learning. As we have seen in section 3 of this report, UCC leads nationally in terms of graduate numbers for business administration and law, science mathematics and computing at undergraduate level for these fields of study, which in turn directly feeds employment in these three key sectors of the Irish economy.

EXHIBIT 4.2: Total employment by sector in IDA supported companies (in numbers of jobs)

Sector	2016	2015	2014	2013	2012
Pharmaceuticals	26,880	25,029	23,084	22,799	22,346
Computer electronic and optical equipment	20,213	20,454	18,120	17,292	16,310
Medical & dental instruments / supplies	28,911	26,903	26,663	25,652	25,496
Metals and engineering	11,482	11,441	11,145	11,325	11,272
Miscellaneous industry	7,421	7,175	6,828	7,067	6,847
International financial services & software	104,970	97,033	89,377	84,187	78,711
Totals	199,877	188,035	175,217	168,322	160,982

Source: IDA, Source DJEI Annual Employment Survey 2016

[36] Department of Jobs Enterprise and Innovation (now DBEI) Annual Employment Survey 2016

UCC has a long tradition of business engagement with each of these sectors. It has forged and developed business relationships through many channels such as research, collaboration, work placements, recruitment and investment. Some businesses have started out as suppliers and the repeated business from UCC over years has manifested itself in terms of inward investment in creation and discovery and joint ventures and partnerships. Similarly, the world leading Tyndall National Institute at UCC has long standing relationships with global names such as Intel. Tyndall's work in photonics among other areas has global impact and enhances the reputation of UCC internationally. The same may be said for UCC's fintech, semantics and blockchain research, which is leading-edge as is evidenced by UCC's collaboration with State Street and other global financial firms.

FDI companies are important for multiple reasons to the success or otherwise of a particular region. They sell their goods and services nationally and internationally, they employ local people, they pay local people and they export from Ireland. Not only that, they source Irish materials, they engage Irish services providers and thus their expenditures in Ireland have knock-on effects elsewhere in the economy. In 2015, for example, FDI expenditure in the Irish economy, which is direct expenditure on payroll materials and services, amounted to €20.8bn.

We can see from Exhibit 4.3 below that there are 167 FDI companies in the South-West Region of Ireland (Cork and Kerry) and that these employ 36,059 people in the region, which is an increase of 1,827 jobs on 2015. 33,976 of the jobs are Cork-based, while 2,083 are based in Kerry and, combined, they account for 11.77% of the total workforce of the region in 2016. In Dublin and the Mid-East, this equates to 10.5% so FDI companies are of greater importance in the South-West Region (5.2% of the population in Cork and Kerry work in FDI companies and this is 5% in Dublin).

The graduates that leave UCC and Ireland each year are the "Foreign Direct Investors" of the future. The export of talent and in this case, well educated, socially responsible UCC graduates has a positive implication FDI and inward investment down the line.

EXHIBIT 4.3 Analysis of IDA supported jobs (& activity) in the South West - 2016

Cork	**2016**	**2015**
Number of companies	154	150
Total jobs	**33,976**	**32,301**
New jobs created	2,602	4,535
Gross losses	-927	-679
Net change	1,675	3,856
Kerry		
Number of companies	13	12
Total jobs	**2,083**	**1,931**
New jobs created	186	89
Gross losses	-34	-32
Net change	152	57
South-West (Cork + Kerry)		
Number of companies	167	162
Total jobs	**36,059**	**34,232**
Net jobs	1,827	3,913

Source: IDA

4.2 The business impact of UCC research, development and technology transfer

UCC has played a significant role in the transformation of the Irish labour force, facilitated by the research and development expertise of researchers and the training of a highly skilled, flexible workforce to meet the requirements of enterprises and the state. Up to 70% of UCC's licence agreements are between UCC and Irish High Potential Start Ups. The remaining 30% comprises agreements with multinational companies, almost all of which have a base in Ireland and just fewer than 50% have a research or development activity in Ireland. It is also important to note that, in addition to the direct technology transfer evidenced by this performance, over 80% of these technologies arise from research programmes between UCC and the licensee companies. Thus, UCC is focussing on developing substantive research partnerships with domestic firms as well as multinationals that represent genuine exchanges of information and ideas between the University and its enterprise research partners within the local economy.

Substantial research and development is one of the primary drivers of economic growth and so countries and regions which have universities performing large amounts of research and development are more likely and able to attract large scale multinational corporations.

The surge in FDI activity in the South-West as opposed to other regions can be attributed to the skilled workforce and graduates from the region, and the substantial ongoing research activities, and the fact that companies will be in a position to exploit the many technologies and innovative outputs of the University. This is also evidenced by the location of various research clusters scattered around the region, particularly in Cork. These will be examined in more detail in section 5 of this report. Below are a number of case studies highlighting UCC as the primary reason for multinational corporations choosing to locate in the South-West.

4.2.1 Research, development and technology transfer case studies

CASE STUDY 01: EMC Research Europe

In 2011, UCC became the anchor university research partner for EMC Research Europe. EMC Corporation announced an expansion in its cloud computing, big data and data centre research programmes. UCC had collaborated with EMC since it established its International Operations campus in Cork in 1988. EMC researchers were co-located on the UCC campus in partnership with UCC's **Cork Constraint Computation Centre (4C)**. This alliance, co-funded by the Science Foundation Ireland, acted as a platform for the collaboration of UCC's leading researchers and innovators, and provided access to specialist industry and academic expertise. This programme also created a platform for collaboration across other areas of research.

> *"This new European research initiative is a key step in the further development of Ireland's support role for EMC at a European and global level"*

CASE STUDY 02: UCC & Lilly Collaborative Research

Over the past several years, a unique partnership between a team in UCC and Lilly (Kinsale/Indianapolis) focused on enhancing capability in Pharmaceutical Process Development at the academic-industry interface has resulted in collaborative research publications increasing the visibility of Ireland as a leading location for Pharmaceutical Process R&D. It also raised awareness within Lilly of the capability of Irish university PhD graduates to undertake leading-edge process development and provided the researchers involved with outstanding experience to underpin careers in the pharma sector.

Lilly, Kinsale is a key scale-up site within the global corporation for new products for both small and biopharma molecules. Forward thinking leadership over the past decade has ensured the strategic importance of the Irish site within the overall company.

The UCC-Lilly partnership focuses on enhancing capability in Pharmaceutical Process Development at the academic-industry interface including:

1. a direct research collaboration, partly supported by Enterprise Ireland Innovation Programme whereby 6 postdoctoral researchers (2 at a time) were employed in the UCC team working on projects identified by Lilly scientists, with direct, ongoing joint supervision by Prof. Anita Maguire and chemists at Lilly (Kinsale/Indianapolis), with team meetings on a monthly basis over a 5-year period.
2. a postdoctoral programme whereby high quality PhD graduates from the team in UCC went to Lilly in Indianapolis as postdoctoral researchers in place of a more traditional academic environment internationally.

The collaboration proved very fruitful for all parties: the team in UCC gained access to very real industrial challenges, the Lilly chemists in Kinsale involvement in high level Process Development, and the chemists in Lilly Indianapolis solved some challenges that had no evident solutions. The postdoctoral exchange raised the awareness within Lilly globally of the capacity of PhD graduates from Irish universities to undertake first-class process development, and provided the individuals involved with outstanding industrial experience. Many of the postdoctoral researchers have subsequently joined the local Lilly site with outstanding success, have been key to building our local development capability and have enhanced the site reputation within the overall company.
Humphrey Moynihan PhD.[37]

Humphrey Moynihan is Senior Lecturer in Organic Chemistry (Pharmaceutical/ Medicinal) in the Dept. of Chemistry, UCC, and is also a PI in the Analytical and Biological Chemistry Research Facility, UCC.

CASE STUDY 03: Intel & Tyndall National Institute

Intel has enjoyed a long-standing relationship with the Tyndall National Institute since it first set up a manufacturing site in Ireland in 1989. The relationship has matured over time and is now firmly built on collaboration and productive partnership. In 2010, Intel commenced a major research programme with Tyndall, which was renewed in 2012, and again in 2016, when Intel announced a further commitment to invest $1.5 million in research to be carried out at Tyndall over a three-year term. The collaboration also provides Intel with a commercial exploitation license for technology created by the Tyndall team.

> *"The fact that we renewed the programme is a great testament to the quality of the research carried out by Tyndall. Intel can spend anywhere in the world, and we typically spend where the work is leading edge. We have found the work to be of an excellent standard at Tyndall"*

> *"We anticipate that Tyndall will continue to deliver on projects, and to adapt and be flexible, as they have done so far"*

While we will return to the creation and discovery impact of UCC in more detail in section 5 of this report, it is evident that the vast research capabilities of the University attract large, multinational corporations to Ireland, specifically in the South-West.

Business and research partnerships form the basis for business engagement and this has a positive knock-on effect on the local economy. From the supply of goods and services to facility management companies, and on to the fit out of sophisticated clean room facilities, the impact of UCC-led business engagement in relation to research is crucial to the economic well-being of the region. Contracts are written, legal agreements put in place, advisors are employed across all sectors. Companies are set up, new staff are hired, and new patents are filed and put in place. Licence agreements are put in place and income begins to flow.

UCC facilitates and entrepreneurial ecosystem which goes hand-in-glove with the FDI companies which have chosen Cork and the South-West as their base. Not only do these companies employ significant numbers directly (with UCC alumni employed in management roles in each of the companies mentioned above), they also contribute in terms of corporation tax, payroll expenses, materials and services sourced in Ireland as well as aiding UCC's business innovation ecosystem.

[37] Humphrey Moynihan, UCC, January 2018.

4.3 The impact of UCC on business innovation

4.3.1 Assistance in entrepreneurship and business formation

Since the early 1980s, UCC has enjoyed its place at the national forefront in developing a capacity for commercialisation of its research outputs and supporting industry. It was the first Irish university to establish a Technology Transfer policy, a dedicated Industrial Liaison Office and to establish a campus company.

UCC's main focus lies with research and innovation which lead to the creation of high value jobs and are a key tenet of UCC's new strategic plan. The exploitation of research through technology transfer, licensing and spin-out companies will provide the value and return on investment. Since 2005, there have been 689 invention disclosures, 223 initial patent filings, 165 licence options and 21 company spin-outs.

These companies have been created from the technology developed within UCC's research centres themselves, as well as further companies created through UCC's Blackstone LaunchPad for UCC students, IGNITE program for UCC graduates and Gateway program for UCC staff and alumni. Most have proven to be robust and durable companies, employing highly qualified third and fourth-level graduates and experienced entrepreneurs in the region.

In recent years, UCC has significantly enhanced its commitment and investment in entrepreneurship, innovation and collaborative research and development and it now has an extensive business innovation ecosystem through its various incubation programmes.

Blackstone LaunchPad at UCC

Blackstone LaunchPad at UCC is a campus-based experiential entrepreneurship programme open to all UCC students, (staff and alumni) offering coaching, ideation and venture creation support. It is modelled on a successful programme originated at the University of Miami and was further developed and expanded by the Blackstone Charitable Foundation. This dedicated support service was established in March 2016 and its presence on campus comes in the form of its Director, Manager and its team of student ambassadors.

As of October 1, 2017, 2,862 (primarily current students) have registered with Blackstone LaunchPad at UCC. Since its inception, over 70 events have been held by the Launchpad at its base in the ultra-modern Creative Zone in the Boole Library. These range from talks, academies, seminars and idea generation symposiums to practical legal and financial advice workshops for start-up businesses. In one year alone, 161 entrepreneurs have had one-to-one meetings with Blackstone LaunchPad at UCC.

Blackstone LaunchPad is engaged internationally through its affiliate programme and also in relation to the University of Munster challenge in Germany, CUBS challenge in Boston and IGEM. Visiting students have come from Montana and Buffalo and have had a positive impact on Blackstone LaunchPad at UCC as well as on the local economy. The LaunchPad also contributes through the expenditure of its annual budget, its events and through leasing out its space from time to time. However, its key role is as an influencer, changing the mind-set of students. Furthermore, where appropriate, it passes students and idea generators onto IGNITE, UCC's graduate entrepreneurship programme.

CASE STUDY: Blackstone LaunchPad: ApisProtect

One such entrepreneur to avail of the expertise at Blackstone LaunchPad was Fiona Edwards Murphy. Her project is known as ApisProtect and is an extremely interesting venture. ApisProtect uses in-hive, Internet of Things (IoT) enabled sensors, big data, and machine learning to unobtrusively monitor hives. Smart alerts with actionable insights are provided to the beekeeper allowing them to make effective decisions, reduce colony losses and increase productivity.

ApisProtect is inspired by the co-founder's experiences in application of IoT technology in a variety of areas including structural health monitoring, education and agriculture. The growing plight of the honey bee throughout the globe inspired her to use this technology to enable beekeepers to help protect and understand their bees. Her work in this field has been recognised by Google, IBM, the Irish Research Council, and the IEEE. Andrew Wood joined ApisProtect in July 2016, bringing decades of experience of international commerce and successful raising of finance, to help successfully bring this technology to a global scale.

ApisProtect operates in the Ag-Tech Industry. It has already successfully raised funding and now employs two people. It has launched a validation study, deploying version 1 of their product on 200 beehives internationally. The primary aim is to rapidly expand the database, scale up machine learning algorithms, and build the reputation ahead of their first publicly available launch in 2018.

IGNITE at UCC

IGNITE is UCC's Graduate Business Innovation Centre. Its goal is to build sustainable businesses, create high value employment, develop the next generation of business owners, provide investment opportunities, launch innovative products and services, and nurture entrepreneurial thinking and most importantly to connect industry and business with education. It was established in 2010 and the first programme launched in January 2011. It incorporates a 12-month incubation programme, hosted by UCC for graduates of UCC. It is designed to help recent graduates turn innovative ideas into commercially sustainable businesses.

The programme is funded by UCC, Bank of Ireland, Musgraves, Cork City and County Councils and the local enterprise offices. While based at UCC's Western Gateway building, the programme is open to recent graduates of any third level institution in the country. The IGNITE approach is all about business development, personal development throughout the process as well as network development.

On the first level, IGNITE provides some seed funding, an initial €5,000 investment into the business. Beyond that, however, IGNITE offers workshops, seminars and guest speakers. It provides access to industry partners (100 actively involved to date), research and innovation resources, seed finance and guidance, physical space to operate, business mentors as well as the core start your own business programme. In many ways, it acts as the bridge and the connection between education and the business and industry community.

As of June 2017, there has been a total of 70 businesses supported by IGNITE; it was responsible for the creation of 142 jobs locally (including full-time, part-time and internships) and it had helped 18 of those businesses secure funding. It has connected businesses with Enterprise Ireland as well as budding entrepreneurs, and supported a cohort of emerging start-ups which were founded at UCC.

CASE STUDY: IGNITE: AnaBio Technologies

One such start-up is that of AnaBio Technologies, founded by Dr Sinéad Bleiel, PhD. AnaBio is an R&D business concerned primarily with protein gels and licensing technologies around proteins and, in particular, oral medicine. Dr Bleiel was a PhD student through Teagasc and has developed her business with the initial help of IGNITE at UCC. Dr Bleiel and her team have grown the business to a point where it now employs 20 people and it has recently moved into a purpose-built facility in Carrigtwohill, County Cork. An IGNITE-supported business is now supporting jobs, expenditure and taxation in the local economy. Dr Bleiel commented that, "I had the technical skills, IGNITE helped me to develop the commercial skills to turn my business into a reality."

In many ways, the work of IGNITE aligns well with the overall strategy of UCC. There is huge potential of international students coming to Ireland to study and, subsequently, opening businesses and attracting foreign capital to the Cork region.

IGNITE has ambitious plans and helps to satisfy the international and the domestic demand by expanding to an intake of two cohorts of entrepreneurs annually commencing in 2018. In doing so, it will add to its growing pool of IGNITE alumni, increase its list of role models, provide internship and work placement opportunities for students, provide case studies for research as well as supporting student societies. Overall, it provides engagement between business and industry and UCC, aids international recognition and contributes to UCC's entrepreneurial reputation.

Gateway at UCC

Gateway UCC is an innovation and Business Incubation Centre to support and accelerate the development of UCC intellectual property (IP) based start-ups, spin-out and spin-in companies. It helps to commercialise IP from UCC research and innovation activities. Essentially, it is focused on existing UCC researchers, more specifically translating research into commercially successful, export-focused businesses.

Since its inception in 2010 (and as of March 2017), Gateway has assisted 45 company start-ups and has helped support almost 300 jobs. It is estimated to support just under €20m annually in terms of salaries and household income and produce a €7m annual tax return to the Exchequer. The companies are typically High Potential Start-Up companies and have attracted more that €30m investment both private and public funds.

Under the auspices of the Office of Technology Transfer, Gateway UCC provides 21 own door offices, 1,300 sq. metres of which are on campus. These are across 5 UCC locations, including the Western Gateway Building, Tyndall National Institute and the Biotransfer Unit. It provides 10 hot-desk spaces for new start-ups, 8 bio-incubation laboratories and adjoining offices. Most importantly, it provides access to UCC network of researchers and supports the linkages into academic departments. Its facilities include access to a dedicated boardroom, audio-visual and video conferencing facilities as well as access to the award-winning SPRINT Accelerator Start-Up Business Programme tailored and designed for Researchers who wish to start-up ventures using IP they have developed as part of their research output from the univeristy.

Gateway is a comprehensive business support programme. It provides mentoring and access to financial advice, seminars, one-to-one consultancy and workshops. It also provides introduction to venture capital opportunities and to business angel programmes.

CASE STUDY: GATEWAY: ATLANTIA FOOD CLINICAL TRIALS

Start-ups and spin-outs have emerged across all sectors in the economy. One such example is that of Atlantia Food Clinical Trials. Recently nominated for the Cork Company of the Year award, it operates in the health and food sphere and provides clinical trials for food companies. Atlantia has a particular strength in providing human dietary intervention studies and food human intervention studies in the area of digestive health, in accordance with EFSA guidelines on scientific requirements for assessing health claim validation related to gut and immune function.

It trials and tests food in order to ascertain the accuracy of health claims made in relation to certain food stuffs. A spin-out of UCC's world renowned research in the areas of food and alimentary health, Atlantia, with the support of Gateway, quickly outgrew its UCC base and within 2 years was employing 25 people in the Cork suburb of Blackpool. Not only that, but it had established itself on the international stage and some of its clients include world leading food companies such as Kraft and Nestle, as well as a host of domestic Irish producers it's turnover from primarily international clients is in excess of €4m.

4.3.2 UCC and international business innovation

The surge in FDI activity (IDA) and that of Enterprise Ireland in the South-West can be attributed to the skilled workforce and graduates from the region, and the substantial ongoing research activities, and the fact that companies will be in a position to exploit the many technologies and innovative outputs of UCC.

UCC's international business innovation model mirrors that of Enterprise Ireland. In relation to start-ups, UCC is producing high potential start-ups across all sectors, it is innovating in terms of being first nationally in terms of investment in creation and discovery and first in terms of securing industry investment. Finally, it is scaling in terms of the international footprint of its research centres and spin out companies.

This is also evidenced by the location of various research clusters scattered around the region, particularly in Cork. FDI business clusters include Life Sciences and Food and Technology, while global business services are becoming increasingly important. Cork has a growing cluster in Marine and Energy related business and research groups. Cork's Life Sciences cluster spans the pharmaceutical, bio-pharma and medical device sector. Companies benefit from a world class support infrastructure and a supply of highly qualified, industry ready graduates.

EXHIBIT 4.4 below takes a closer look at Cork's pharmaceutical cluster. 7 of the top 10 pharma companies in the world have significant operations in Cork, while 8 out of 10 are located in Munster, Roche having its Irish operations in Co Clare.[38] Each of Johnson and Johnson, Pfizer, Novartis, Merck, GSK, Gilead and AbbVie are located within a 20-mile radius of UCC. Yes, Cork has physical advantages over other locations in terms of the natural construct of Cork's deep harbour and financial advantages in the form of corporation tax, but a key reason why these companies have chosen Cork is the access to highly skilled graduate talent.

Not only that, but the outside of the top 10 pharma companies in the world, many others have a huge impact on the financial well-being of Cork's citizens. These include Lilly, which has a long-standing relationship with UCC, as we have seen. As the diffusion of knowledge proliferates, it is usually high-tech and start-up firms that tend to cluster around universities. In the Irish context, large international and national companies do not perform significant Research and Development in Ireland themselves. This means that UCC has the opportunity to forge strong Research and Development links with large companies. Leveraging partnerships with university research teams is attractive to many of these companies to enhance capacity and international credibility in order to attract great R&D investment to the Irish site. Research within UCC also has the potential to produce breakthrough advances that can fundamentally alter our economic growth through productivity impacts. It can be argued that companies look at the benefits which will accrue to them from UCC research and development outputs, should they set up business in the South-West Region.

EXHIBIT 4.4 Top 10 pharmaceutical companies in the world 2017
(2016 revenue in billions, USD, origin and local presence)

	2016 Revenue	Origin	Munster
1. Johnson & Johnson	71.89	USA	Yes
2. Pfizer	52.82	USA	Yes
3. Roche	50.11	Switzerland	Yes *
4. Novartis	48.52	Switzerland	Yes
5. Merck & Co.	39.80	USA	Yes
6. Sanofi	36.57	France	No
7. GlaxoSmithKline	34.79	UK	Yes
8. Gilead	30.30	USA	Yes
9. AbbVie	25.50	USA	Yes
10. Bayer	25.20	Germany	No

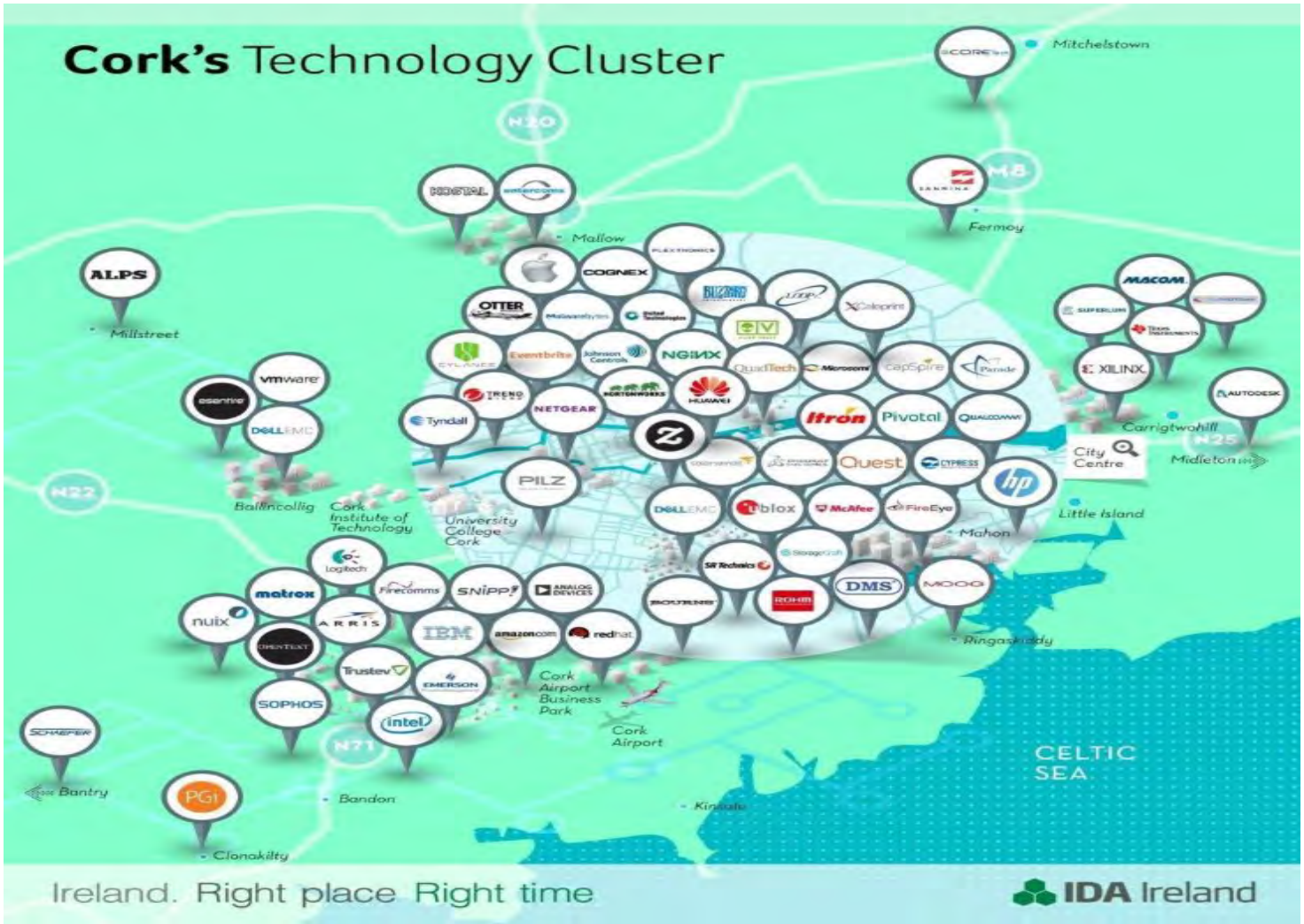
Source: Pro Clinical.Com

* Roche is located in Co. Clare. All other Munster based Pharma companies are based in Co. Cork.

[38] Pro Clinical.Com https://blog.proclinical.com/who-are-the-top-pharmaceutical-companies-in-the-world-2017

EXHIBIT 4.5 below shows the Cork Technology Cluster. As many as 50 global technology companies in both manufacturing and services have located in Cork in recent years, thus developing a strong and vibrant tech cluster. High quality technical talent is both available and easily attracted.

EXHIBIT 4.5



Source: IDA

One such example of the impact that the University can have in attracting multi-nationals is that of Oculus/InfiniLED.

CASE STUDY: INTERNATIONAL BUSINESS INNOVATION: OCULUS AND INFINILED

InfiniLED is a micro-LED focused spin-out company emanating from UCC's world renowned Tyndall National Institute. Tyndall senior researchers created the breakthrough IP several years ago and immediately noted its commercial potential. Tyndall, in conjunction with UCC's Technology Transfer Office and through funding from Enterprise Ireland, set about putting a commercialisation support structure in place to best exploit the technology, primarily through the addition of a technology specialist and an experienced entrepreneur/business mentor to the team. The company was spun-out of Tyndall in 2011, at which time a formal infrastructure access agreement was put in place to facilitate access by the company to Tyndall's national fabrication facilities in order to aid technology and product development. In 2016, after a sustained period of continued support from Tyndall, InfiniLED was acquired by Facebook, on behalf of its Oculus VR division.

The impact of Facebook/Oculus acquiring the Tyndall/UCC spin-off and related IP is considerable, particularly the substantial economic impact of their decision to build on the existing strong relationship with Tyndall and, as a result, to substantially invest in growing and developing the InfiniLED/Oculus team in Ireland.

In addition, the wealth creation aspect locally in terms of the founder and shareholder/investor return following the acquisition is also significant. A further substantial impact is the potential for Tyndall, through its already strong working relationship with the company, to further enhance this further through increased collaboration with the rapidly developing local Oculus technology hub, and the provision and facilitation of comprehensive dedicated high-tech facilities for the company within Tyndall.

The company is currently accelerating its growth through an aggressive recruitment campaign, bringing international technology experts to live and work in Cork. It is understood that the company has very ambitious growth plans, reflected in its significant investment in large-scale office accommodation in the recently developed high-spec Capitol complex in the middle of Cork city. It has been, and continues to be, a real success story for innovation and technology leadership at Tyndall National Institute and UCC, with substantial ongoing direct benefit for the local and national economy.

4.4 The impact of UCC on local business

Beyond UCC's role in relation to attracting FDI, the business impact of UCC's research activities and its role in relation to the provision of a business innovation ecosystem, UCC has a business impact on a more fundamental level, namely UCC's impact on local businesses. More specifically this relates to the expenditure of the University itself, its staff, students, recent graduates and visitors alike.

EXHIBIT 4.6 below outlines the extent of the expenditure impact supported by UCC and we have examined this in section 2 of this report. If we look at what the University spends directly in a year (€293m), the staff can potentially spend in the economy (€96m), Irish students (€135m), graduates (€40m), visitors (€3.7m) and international students (€27.8), we can say that up to €595m of UCC's total supported expenditure of €727m can be expended in the local economy on an annual basis. This is hugely significant for the SMEs and small businesses in particular which are clustered around UCC.

EXHIBIT 4.4 Top 10 pharmaceutical companies in the world 2017 (2016 revenue in billions, USD, origin and local presence)

Economic Impact of Expenditure (in thousands of EUR)	Expenditure 2016			
	Direct	Indirect	Induced	Total
UCC - The University, including subsidiaries (less pension, dep & int)	293,117	19,345	72,985	395,708
UCC staff (their expenditure in local economy)	-	-	96,485	96,485
UCC Irish students (their expenditure in local economy)	-	-	135,681	135,681
UCC graduates (differential in spending by 3 years graduates working in Ireland)	-	-	40,335	40,335
UCC visitors (one year's visitors based on 2015 visitor numbers)	3,714	884	2,340	6,938
UCC international students (their expenditure in the local economy)	27,852	6,629	18,048	52,529
Totals	324,683	26,858	365,874	727,676

Source: UCC Audited Financial Statements & UCC Careers Office / CSO / revenue.ie / taxcalc.ie / IAPF survey / Bord Failte

4.4.1 The University

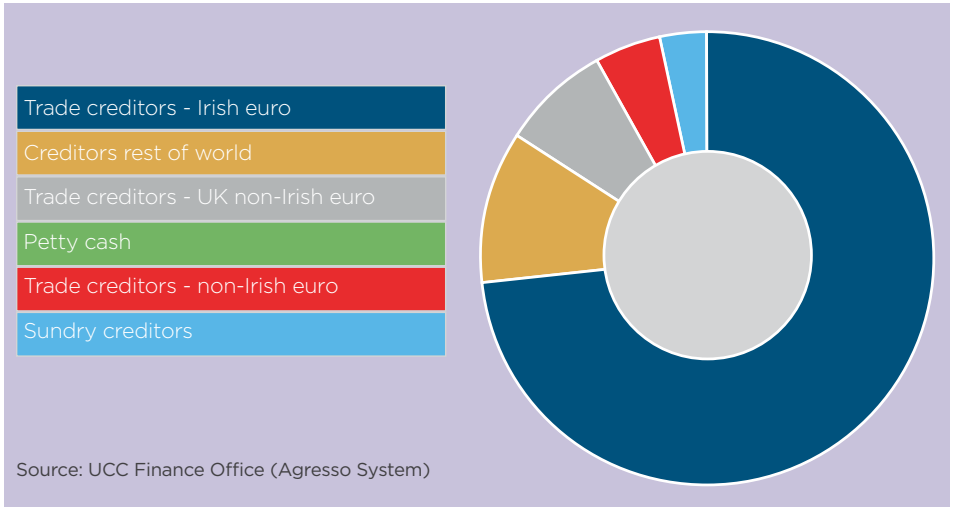
UCC spends locally

In relation to University spending, the direct expenditure has knock-on implications in terms of indirect and induced effects. UCC operates a devolved discretion model, whereby the schools within UCC have discretion and are thereby accountable to manage their respective budgets, with ultimate responsibility resting with the Bursar in the Finance Office. Nationally, the introduction of Office for Government Procurement (OGP)[39] in 2013/14 has influenced local control over spending, particularly in the arears of stationery, travel management, computer hardware and professional services.

Essentially, any procurement costing €25,000 or above must be tendered. Despite this, as evidenced in **EXHIBIT 4.7** below, we can see that over 81% of UCC's suppliers in the calendar year 2016 were Irish (including petty cash and sundry creditors).

EXHIBIT 4.7: Analysis of UCC suppliers in 2016 (calendar years, in €)

Supplier group	Amount
Trade creditors - Irish euro	74,206,472
Creditors - rest of world	7,722,319
Trade creditors - UK non-Irish euro	5,992,007
Petty cash	44,004
Trade creditors - non-Irish euro	3,944,645
Sundry creditors	2,774,860
Internal suppliers	-
	94,684,307



Source: UCC Finance Office (Agresso System)

UCC's expenditure is across all sectors, from energy providers to the provision of consumables. If, for example, we examine the 10 top suppliers by single payment (in the calendar years 2016), we can see construction companies, professional services, design companies and facilities management companies. The impact is deep and is broad with 9 of those 10 suppliers being domiciled in Ireland. UCC spends locally.

4.4.2 UCC staff

Data is not available on what the staff of UCC spend their money on. However, if we consider UCC staff in the context of normal household expenditure in 2016 in line with CSO data, we note that the expenditure may be in line with the following: food (21%), medical costs (8%), clothing and footwear (5%), alcohol and tobacco (5%), holidays (6%), transport (21%), pensions (6%) and housing (28%).

Thus, the impact is spread across the local economy from retail shops to restaurants, doctors and dentists, clothes and shoe shops, entertainment, transport companies and petrol stations, landlords and local authorities. €96m is a significant contribution to the local economy each year.

4.4.3 UCC students

Similarly, Irish students spend their money across all sectors of the local economy as follows:

EXHIBIT 4.8: Typical Monthly expenditure for an Irish Student (in €)

Types of spending	Monthly Expenditure
Accommodation	334
Food	177
Transportation	99
Communication	33
Health costs	18
Childcare	12
Debt payment (except mortgage)	34
Social and leisure activities	71
Other regular living costs	66
Total	844

Source: CSO/UCC Careers Office / Education.ie – Student Expenditure Survey[40]

Over a 9.5-month term and across the Irish student population, it equates to potential spending in the local economy of €135m per annum. Without doubt, there are grocery shops, bars, restaurants, takeaways, phone providers, transport companies benefiting from the expenditure of UCC students across the region.

4.4.4 UCC graduates

In 2016, 2,305 UCC graduates remained in Ireland and joined the workforce while others took their talents abroad, sought to upskill further by completing further study or were part of the small minority that were seeking employment. Working off an average UCC graduate salary, we have already established that the total available for spending per graduate was €20,629 and in the context of 2,305 graduates, this amounts to €47m annually. In the context of a 3-year graduate income, this may amount to €141m.

[39] Office for Government Procurement (OGP)
[40] CSO for multipliers. UCC Careers Office for student numbers.

Adopting a more conservative approach, we have compared the spending (after tax and social insurance contributions) of a UCC graduate to that of a non-graduate. We have already established that graduates of UCC have incremental expenditure in the economy over non-graduates and that this premium is €5,833 per annum. Consequently, we know that the additional expenditure for one year's graduates is €13,445,065. If we take this in the context of 3 years graduates in line with typical graduate programmes, then, as we have seen, the additional expenditure amounts to €40,335,195.

Again, this additional expenditure is spread across sectors and regions in Ireland, in line with where UCC graduates are based.

4.4.5 International students and visitors

In economic terms, the expenditures of international students and visitors are deemed to be an export and are extremely crucial to the total economic output of UCC. In simple terms, these expenditures wouldn't have taken place in the economy if it were not for UCC and, thus, their impact is commensurate with the expenditure of the University itself in terms of economic value added. Their expenditures have knock-on implications for the economy in terms of indirect and induced effects.

EXHIBIT 4.9: Typical monthly expenditure for an international student (in €)

Types of Spending	Monthly spending
Accommodation	385
Food and drink	151
Social activities	108
Shopping and other categories	86
Transport	58
Other	86
Total	877

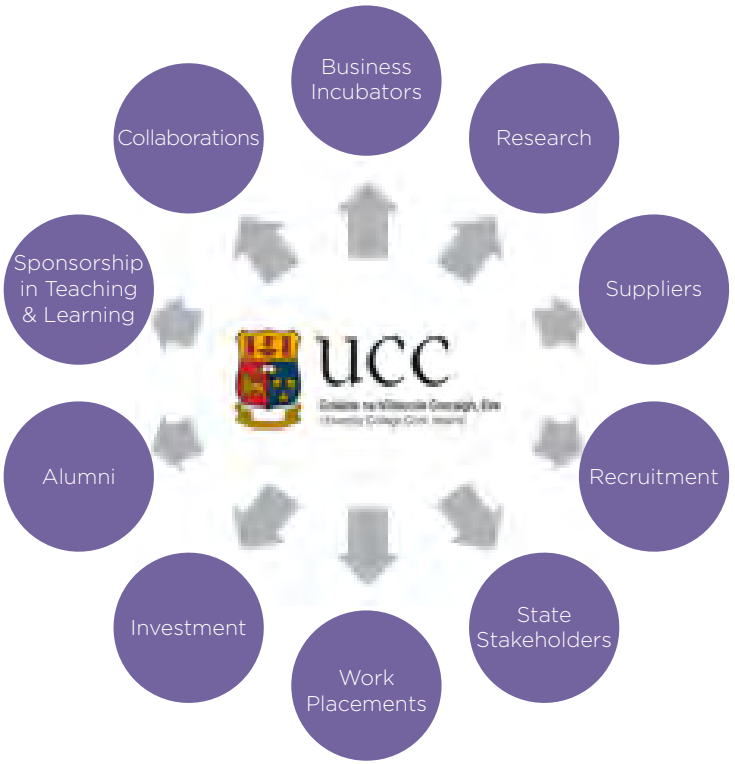
Source: CSO/UCC Careers Office / Education.ie – Student Expenditure Survey[41]

[41] CSO for multipliers. UCC Careers Office for student numbers.

4.5 Key findings

UCC provides physical space and facility hire to the business community. It also provides access to enterprise partners to key research infrastructure and the provision of technical services. Many Irish sites use UCC infrastructure to undertake advanced R&D activities and then leverage this to attract further R&D activity and investment. In addition to the pure economic benefit this activity enhances relationships across the industry interface.

EXHIBIT 4.8: Typical Monthly expenditure for an Irish Student (in €)



Source: Various UCC Sources

So, whether it is through recruitment, research, a work placement or a sponsorship of a PhD student, UCC engages consistently with the business community at home and abroad. Suppliers, investors and collaborators are all part of the business engagement process.

UCC needs to continue to be proactive and work at these relationships for the betterment of UCC and the region as a whole. UCC has to recognise the potential that exists in the business community with regard to non-traditional collaboration and embrace the fact that there is huge untapped potential worldwide in relation to UCC alumni, foreign direct investors of tomorrow.

Key findings

- UCC acts as an **attractor of FDI** and domestic investment into the South-West Region. The growth of FDI employment in the region is highly correlated with that of UCC. The growing reputation of UCC's creation and discovery environment has helped to facilitate world leading clusters, such as pharmaceuticals, where **7 of the top 10 pharma companies in the world are located in the environs of UCC**, where there is a highly skilled graduate population readily available.
- UCC's Research and Development capabilities contribute greatly to the overall impact that the University has on the region. Through proactive collaboration, UCC has forged partnerships with many global names including Dell EMC, Intel, Pfizer and Eli Lilly, and these partnerships have remained strong through various economic climates. **UCC facilitates the industry sector in expanding R&D capabilities of the region** with resulting economic impact through enhanced importance, expanded roles, anchoring employment in Ireland.
- UCC has a huge impact on local business through the expenditure of the University itself, its staff, Irish students, recent graduates, international students and visitors alike. These expenditures impact across the economy and throughout the entire region.

  For example, **UCC's international students** support total expenditures (direct, indirect and induced) in the Cork region of **€52.5m per annum**. This expenditure supports **1,421 jobs** in the Irish economy each year.

Similarly, **UCC's Irish students** have direct expenditure of **€135m** in the local economy and this expenditure supports **3,675 jobs** in the Irish economy. UCC supports local enterprise as companies strive to enhance R&D activities at Irish sites and thereby enhance their importance within the global corporation.

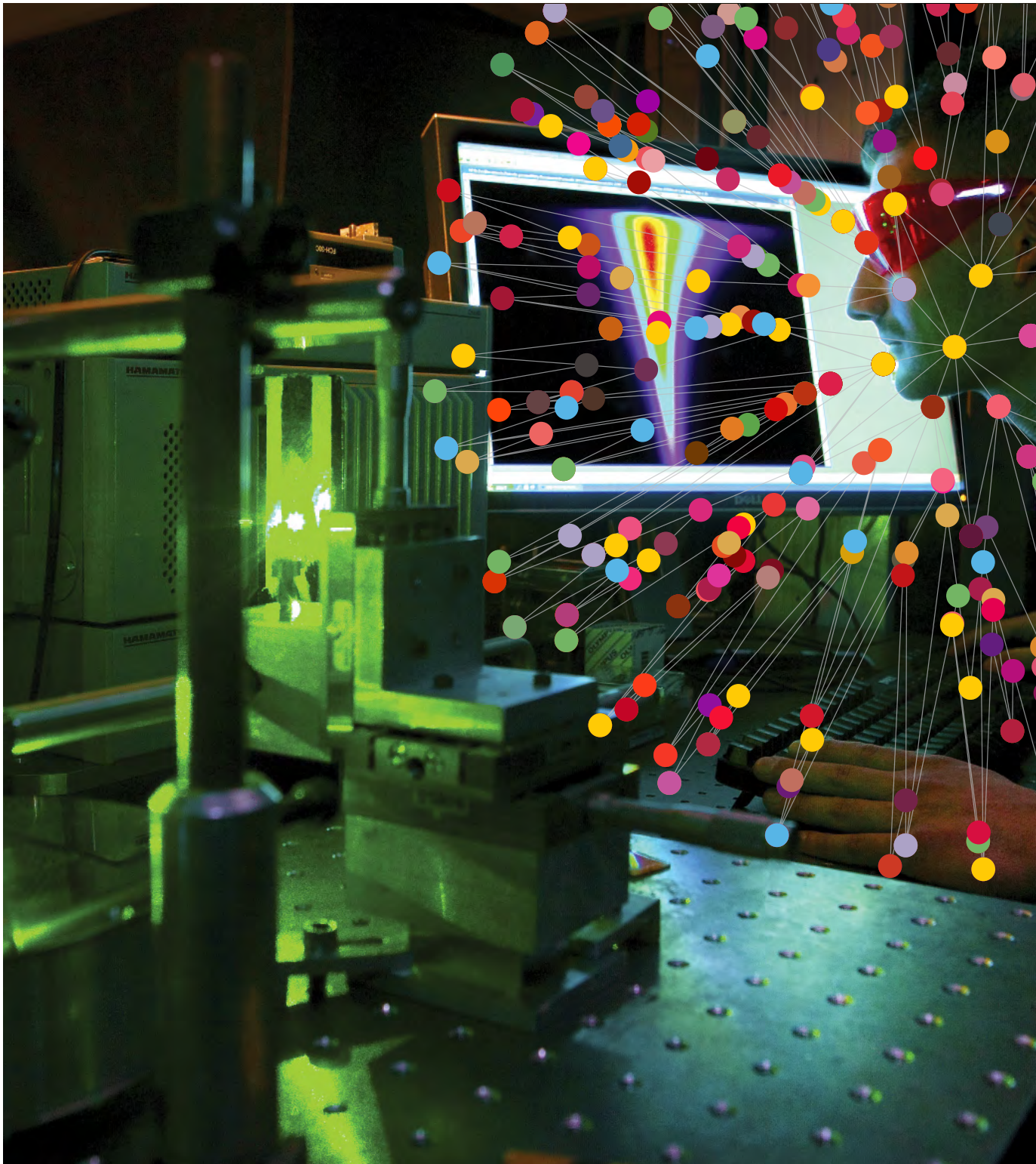
- The business innovation impact of UCC is plain to see. UCC has created a bespoke entrepreneurial ecosystem comprising **Blackstone LaunchPad, IGNITE and Gateway as business incubators, often providing the bridge between education and business**.
- UCC provides world-class training for business people. Business talent is nurtured and developed at UCC and this commitment to the business community is reflected in UCC's plans for **the new Cork University Business School in the centre of the city**.
- The UCC-owned **Irish Management Institute (IMI) significantly enhances the University's resources for its delivery of executive education in Ireland**.

CREATION & DISCOVERY IMPACT

€10 MILLION IN R&D SECURED AND INVESTED BY UCC'S INDUSTRY PARTNERS MAKES IT THE LEADING UNIVERSITY BY A DISTANCE WITH REGARD **TO R&D COLLABORATIONS WITH INDUSTRY.**

UCC'S **€96 MILLION INVESTMENT** IN **CREATION & DISCOVERY** = LEADING IRISH UNIVERSITY WITH REGARD TO ACTIVELY SEEKING AND SECURING INVESTMENT IN RESEARCH AND DEVELOPMENT.

UCC'S APC MICROBIOME IRELAND IS RANKED **NUMBER 1 FOR** RESEARCH IN **ANTIMICROBIALS AND IN PROBIOTICS** (CWTS BIBLIOMETRIC, LEIDEN).



SECTION 5:

THE CREATION AND DISCOVERY IMPACT OF UCC

University College Cork acts as an essential engine for growth for the South-West Region of Ireland through its vast research and development capabilities, the transfer of technology and knowledge to the private sector, the creation of companies based on technology and intellectual property fostered within the University and the plethora of ways investment in creation and discovery impacts society and serves our community.

Beyond the pure financial benefits of investing in research and development, which include the employment, the expenditure impact and the tax take from UCC's research ecosystem, UCC's

creation and discovery investment has lifelong and life-wide impacts. Ranging from INFANT's ground-breaking work in relation to perinatal care to its world leading position through Tyndall National Institute's expertise in photonics, the work emanating from UCC impacts the lives of millions of people around the globe.

5.1 The role of UCC in knowledge creation and discovery

As a research-led, world-class university, the ethos of creation and discovery emanates from, and is clustered around, multiple research centres and intrinsically linked to UCC's four colleges (College of Science Engineering and Food Science, College of Medicine and Health, College of Business and Law and the college of Arts, Celtic Studies and the Social Sciences), its four pillars of strength. In this report, we have presented data in the format that that it has been accounted for. While in practice, each of the research centres are domiciled within one of UCC's four colleges, the level of activity is such that some centres are reported independent of their college for accounting purposes.

Centres range in size from multimillion-Euro budgets being driven by hundreds of principal investigators, to concentrated, bespoke pieces of work by expert teams of two or three individual researchers. Hundreds of research projects co-exist across UCC's 9 thematic research areas. These thematic areas are aligned with UCC's Strategic Plan 2017-2022, "Independent Thinking, Shared Ambition" as follows:

1. Chronic and infectious diseases
2. Culture, society, rights and identities
3. Financial and business services
4. Food and health
5. Future and emerging technologies
6. Gender, equality and diversity
7. Human health, activity and social wellbeing across the lifespan
8. Innovation in teaching and learning
9. Sustainability and climate action

UCC researchers and their innovations have helped to position the University as a global leader in numerous research sectors. The University boasts several of Ireland's elite research centres, including the Tyndall National Institute and the APC Microbiome Ireland (APC), both recognised as world leaders in the arears of technology and food and health. Similarly, the Environmental Research Institute (ERI) and the Marine and Renewable Energy Institute (MaREI) are internationally recognised and are at the forefront of sustainability and climate action policy across Europe.

In line with UCC's second strategic goal, which is to "be a leading university for research, discovery, innovation, entrepreneurship, commercialisations and societal impact", UCC's ability to form collaborative and professional relationships across sectors underpins its position as the top Irish university in terms of research investment and the top Irish university with regard to industry investment.

The obvious financial and societal benefits are the by-products of a unique entrepreneurial environment that UCC has created and cultivated, driven by strategic clusters of excellence and acting as a catalyst to propel the South-West Region forward on the global stage.

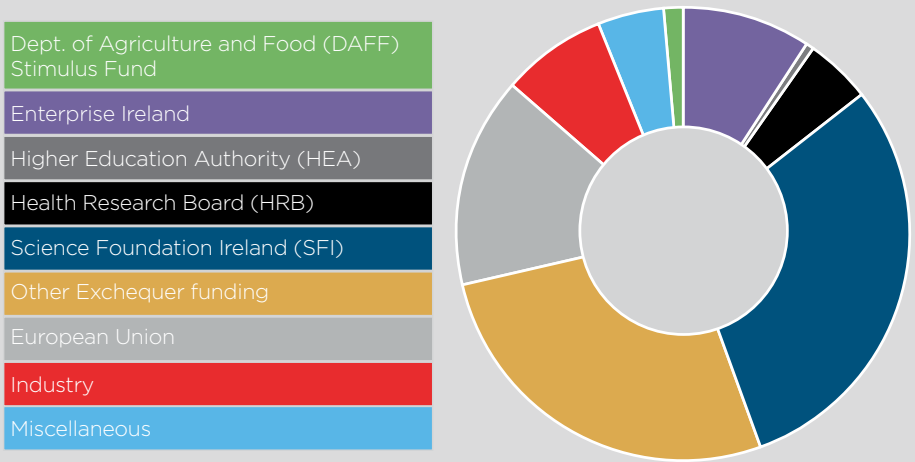
5.1.1 UCC's investment in creation and discovery profile

Investment in creation and discovery from multiple sources now represents almost 28% of UCC's total annual income. To date, the state has been a significant contributor to research, in pursuit of the knowledge-based economy, and this has involved funding higher education research primarily in science, technology, engineering and mathematics (STEM) areas, as well as encouraging the diffusion of knowledge through technology transfer, commercialisation and patenting of discoveries. Due to decreases in the funds available to third level institutions, the search for research income takes place in an environment which has become increasingly competitive, and third level institutions are now vying for funding outside of the traditional channels.

UCC has been highly successful in proactively repositioning its resource base away from state funding and towards funding from the European Union and industry partners. This trend is likely to continue as UCC strives to maintain its current position as the leading national university in terms of overall investment, and indeed its number one position in relation to industry investment.

EXHIBIT 5.1: Sources of investment in creation and discovery at UCC (what is spent by UCC in €)

Funding body	2016		2015	
Dept. of Agriculture and Food (DAFF) Stimulus Fund	1,158,132	1.2%	3,072,302	3.4%
Enterprise Ireland	9,361,762	9.7%	9,278,093	10.3%
Higher Education Authority (HEA)	708,326	0.7%	2,204,705	2.5%
Health Research Board (HRB)	4,032,907	4.2%	4,507,464	5.0%
Science Foundation Ireland (SFI)	32,179,466	33.4%	30,342,135	33.8%
Other Exchequer funding	18,851,241	19.6%	13,973,247	15.6%
European Union	14,701,481	15.3%	14,807,703	16.5%
Industry	10,277,014	10.7%	6,214,422	6.9%
Miscellaneous	5,079,286	5.3%	5,419,307	6.0%
	96,349,615	**100.0%**	**89,819,378**	**100%**



Source: UCC Finance Office

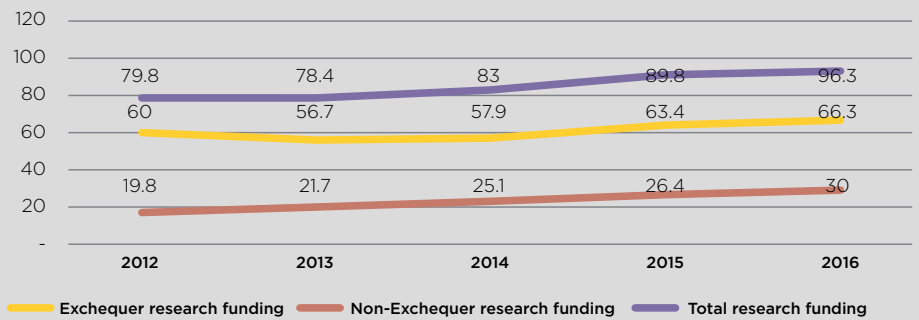
EXHIBIT 5.1 above provides detail in relation to UCC's investment partners in respect of creation and discovery. Within this, the strategic importance of Science Foundation Ireland alliance is noteworthy at over 33% of the investment. Similarly, the commitment of other Exchequer investment, the European Union and Enterprise Ireland is evident. This is further borne out by UCC's €10m investment in creation and discovery directly from industry in 2016.

EXHIBIT 5.2 below gives us a snapshot of the changing face of investment in creation and discovery over the past 5 years, notably the trend in relation to increased non-Exchequer sources and the reduced reliance on Exchequer sources of investment. While, in monetary terms, Exchequer funding has grown by 10% in the five-year period to €66m invested, it has reduced from representing over 75% of inward investment to less than 69% in 5 years. Thus over 31% of investment in creation and discovery comes from non-Exchequer sources.

EXHIBIT 5.2: UCC- Investment in creation and discovery - A snapshot (in €m)

Research income (what is expended by UCC)	2016	2015	2014	2013	2012
Exchequer research funding	66.3	63.4	57.9	56.7	60
Non-Exchequer research funding	30.0	26.4	25.1	21.7	19.8
Total research funding	96.3	89.8	83	78.4	79.8

UCC's Sources of Investment in Creation & Discovery 2016 - Exchequer / Non-Exchequer (€m)



Source: UCC Finance Office

EXHIBIT 5.3 below provides greater detail in relation to Exchequer/non-Exchequer inward investment in creation and discovery. From an Exchequer perspective, we note the importance of Science Foundation Ireland (48% of Exchequer funding in 2016), Enterprise Ireland, Irish Government departments and Health Research Board in particular, which together account for almost 83% of UCC's 2016 total. Similarly, we note the position in relation to the EU and industry as being the main sources of non-Exchequer inward investment last year.

EXHIBIT 5.3: Sources of investment in UCC's creation and discovery - Exchequer/non-Exchequer (in EUR)

Exchequer Funding	**9/30/2016**		**9/30/2015**	
DAFF	3,056,012		3,072,302	
Enterprise Ireland	9,361,762		9,278,093	
Health boards	920,984		882,419	
Higher Education Authority	708,326		2,204,705	
Health Research Board	4,032,907		4,507,464	
Irish-funded research	300,650		196,786	
Irish Research Council	3,432,201		2,858,381	
Other funded projects	34,759		17,492	
Science Foundation Ireland	32,179,466		30,342,135	
SFI Industry				
Teagasc	1,005,646		931,215	
Tyndall National Institute				
Tyndall (Miscellaneous)	2,028,152		2,003,315	
Miscellaneous	30,742		510,268	
Government departments	**9,200,227**		**6,573,371**	
	66,291,834	**69%**	63,377,946	**71%**
Non-Exchequer Funding				
European Union	14,701,481		14,807,703	
Foundation funded research	1,531,019		1,839,387	
Foreign industry	2,535,662		2,751,359	
Foreign research institute	1,333,786		1,702,635	
Irish charities	7,400		51,844	
Irish-funded research	884,283		998,703	
Industry	4,176,743		1,782,020	
Industry/EI projects	559,612		393,544	
Miscellaneous	1,305,690		692,971	
MISC invest Northern Ireland	172		11,582	
SFI Industry	3,004,997		1,287,499	
Other funded projects	**16,936**		**122,185**	
	30,057,781	**31%**	**26,441,432**	**29%**
Total funding	**96,349,615**	**100%**	**89,819,378**	**100%**

Source: UCC Finance Office

While we have looked at inward investment in creation and discovery from an Exchequer/non-Exchequer perspective, **EXHIBIT 5.4** below provides detailed analysis of the investment by college and research centre.

It is important to point out that the resources input into certain priority research areas such as the arts or business may be little more than the human capital invested to a project itself, and that this may differ substantially from the resources input to technological advances or developments in relation to life sciences. The spread of inward investment is noteworthy and reflects the strategic importance that research has been awarded by successive strategic plans and university management teams at UCC. Nonetheless we deem it important to highlight the key drivers of UCC's inward investment in creation and discovery.

Firstly, the world-class research centres themselves account for 58% of the investment followed by the College of Science, Engineering and Food Science (19%) and the College of Medicine and Health (16.4%), these account for 93.4% of the investment.

Secondly, the Environmental Research Institute (ERI) and the APC Microbiome Ireland, as world leaders in the areas of climate action and sustainability and alimentary health, respectively, are of strategic importance to creation and discovery at UCC, representing over 15% of inward investment. Economically and societally, they are crucial to the research ecosystem at UCC, while all the while enhancing the international reputation of UCC's R&D capabilities.

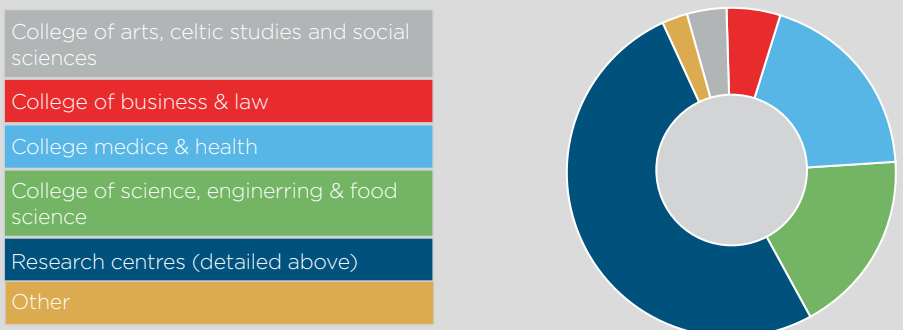
And thirdly, the analysis shows how crucial the Tyndall National Institute is to UCC as well as to the wider region. Beyond the 250 direct jobs and the 200 or so PhD students driving innovation from the centre annually, there are obvious financial benefits to the Centre operating in the city. The knock-on impact is significant, and we will return to Tyndall National Institute in Section 6 of this report. The Tyndall National Institute is known the world over and in a UCC context it constitutes over 30% of UCC's inward investment in creation and discovery.

EXHIBIT 5.4: Research income by college & centre at UCC – what is spent (in €)

College	30/09/2016		30/09/2015	
College of Arts, Celtic studies and Social Sciences	2,121,621	2.2%	1,832,665	2.0%
College of Business and Law	2,777,357	2.9%	2,684,854	3.0%
College of Medicine and Health	15,834,422	16.4%	14,643,512	16.3%
College of Science, Engineering and Food Science	18,335,385	19.0%	17,995,641	20.0%
Research centres (detailed below)	55,846,152	58.0%	51,828,047	57.7%
Other (detailed below)	1,434,678	1.5%	834,658	0.9%
Total	**96,349,615**	**100%**	**89,819,378**	**100%**

Research Centres	% of Overall		% of Overall	
Tyndall	29,185,336	30.3%	30,120,753	33.5%
Environmental research institute	10,938,213	11.4%	9,883,060	11.0%
Oral health services research centre	495,875	0.5%	344,787	0.4%
Boole centre for research in informatics	522,839	0.5%	319,307	0.4%
Biosciences institute	111,597	0.1%	201,070	0.2%
Analytical & biological chemistry research fac	2,282,524	2.4%	2,347,571	2.6%
Biomerit centre	560,110	0.6%	469,244	0.5%
Alimentary pharmabiotic centre	3,713,739	3.9%	7,667,816	8.5%
Food for health Ireland	368,103	0.4%	474,439	0.5%
	55,846,152	58.0%	51,828,047	57.7%
Other				
International education centre	1,584	0.0%	5,259	0.0%
Technology transfer unit	635,140	0.7%	588,591	0.7%
Strategic research fund	936,269	1.0%	77,516	-0.1%
Research grant provision	225,550	-0.2%	35,811	0.0%
Miscellaneous	90,402	0.1%	354,135	0.4%
	1,434,678	**100%**	**834,658**	**100%**

UCC Investment in Creation & Discovery (Expended) by UCC College 2016 in €'s



Source: UCC Finance Office

At this point, it is important to point out that inward investment in creation and discovery (research income), from an accounting perspective, relates to what the University expended in a particular year. These funds may be committed in a particular year and drawn down in stages over a number of years.

Thus, it is as important to distinguish between what is expended and what contracts are won on an annual basis. **EXHIBIT 5.5** below illustrates the sources of what was received in each of the past two years. As expected, these are in line with what was expended by the University, with the SFI, the EU and Enterprise Ireland being the top three sources of receipts. On an overall basis, UCC was in receipt of €102m in 2016 and, as we have seen, from previous exhibits it expended €96m, cementing its place in terms of being 1st place nationally for investment in creation and discovery.

EXHIBIT 5.5: Sources of UCC research receipts (what is received by UCC in €)

Exchequer funding	**9/30/2016**		**9/30/2015**	
DAFF	1,598,523		2,992,916	
Enterprise Ireland	9,459,477		7,568,730	
Health boards	1,342,271		474,540	
Higher Education Authority	413,416		2,104,677	
Health Research Board	5,112,665		5,762,827	
Irish-funded research	185,711		158,216	
Irish Research Council	4,858,354		2,842,863	
Other funded projects			171	
Science Foundation Ireland	39,562,993		26,367,482	
Teagasc	1,244,109		961,015	
Tyndall National Institute	-		-	
Tyndall (Miscellaneous)	1,456,099		2,076,565	
Miscellaneous	573,758		1,036,651	
Government departments	7,710,528		6,240,689	
	73,517,904	**72%**	**56,513,698**	**64%**
Non-Exchequer Funding				
European Union	13,782,230		14,585,995	
Foundation-funded research	1,284,686		2,287,062	
Foreign industry	3,465,602		2,594,026	
Foreign Research Institute	1,226,415		2,299,986	
Irish charities	6,274		51,749	
Irish-funded research	726,107		1,157,477	
Industry	4,037,366		5,199,896	
Industry/EI projects	307,568		284,169	
Miscellaneous	805,766		838,339	
Misc. invest Northern Ireland	-		13,000	
SFI industry	3,421,813		2,477,502	
Other funded projects	11,382		-	
	29,075,209	**28%**	**31,789,201**	**36.00%**
Total Funding	**102,593,113**		**88,302,899**	

Source: UCC Finance Office

It is a key goal for UCC to continue to expand its R&D capabilities across all areas of the University so as to drive the research-led teaching and learning agenda as well as growing and diversifying the inward investment in creation and discovery. The number of new research accounts is one way to measure this and Exhibit 5.6 below examines this by College and by funding source.

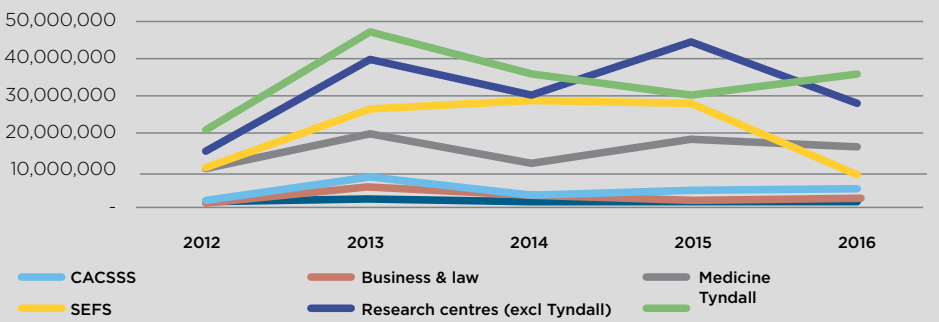
On an overall basis, we note that 2013, 2014 and 2015 were particularly good years in terms of new accounts being added and this is evidenced across the colleges and the centres themselves. The centres added around €10m in 2012 and, by 2016, this had grown to €26.7m. Similarly, Tyndall added €15.8m in 2012 and this had grown to €34.5m by 2016.

The funding sources of the new accounts has been well spread with SFI, the EU and industry projects, accounting for almost 80% of the new accounts added in 2016.

EXHIBIT 5.6: New accounts added in creation and discovery at UCC by College and source of funds (in €)

School/Research centre	2016	2015	2014	2013	2012
CACSSS	3,151,302	2,542,325	2,386,788	2,085,534	1,287,831
Business and Law	1,353,536	1,522,909	2,318,946	7,699,729	919,793
Medicine	13,361,560	15,725,897	10,798,621	16,880,038	11,172,046
SEFS	6,709,717	22,816,341	23,284,545	22,495,729	13,058,219
Research centres (excluding Tyndall)	26,701,112	43,884,043	24,370,264	32,261,915	9,803,742
Tyndall	34,553,665	29,600,237	33,189,097	38,594,270	15,878,165
Other	295,326	172,359	532,000	4,525,184	1,041,926
	86,126,218	116,264,111	96,880,261	124,542,399	53,161,722
Funding source					
Enterprise Ireland	6,564,741	13,287,884	16,425,772	19,412,381	5,268,116
HEA	-	-	-	1,075,365	761,680
EU	11,367,178	21,532,947	16,371,887	15,995,931	13,084,937
DAFF	324,437	2,718,451	2,994,352	5,388,267	1,318,138
SFI	41,178,496	42,899,995	39,241,548	61,975,140	11,217,036
Industry	15,796,262	20,491,944	8,759,950	2,473,798	4,767,790
Other *					
	86,126,218	116,264,111	96,880,261	124,542,399	53,161,722
No. of new accounts	620	780	816	628	438
Average volume of research grant awarded	138,913.25	149,057	118,726	198,316	121,374

Analysis of New Research Accounts at UCC by UCC College & Centre (in €)



Source: UCC Finance Office

2013 was a crucial year for new creation and discovery accounts and UCC in volume terms with €124m being added through 628 new accounts. 2014 saw 816 new accounts added and while the number of new accounts has reduced year from 2014 to 2016, we note that the trend has increased upward in relation to the average volume of investment grant awarded, rising from €118k to €138k in that period.

Beyond the number of new accounts, what underlines UCC proactivity and diligence in relation to creation and discovery is the fact that the Research Pipeline itself continues to be healthy at the end of the financial year. For example, for the two years referenced above (2015 and 2016), the research pipeline stood at €116m and €86m, respectively.

The spread of funding sources is also impressive. In 2016, for example, 48% related to SFI, 18% industry, 13% EU and 13% other, including the Irish Research Council, the Environmental Protection Agency, the Health Research Board and the Department of Enterprise Trade and Investment. The remaining 8% related to Enterprise Ireland

5.2 The role of UCC in technology and knowledge transfer

UCC has a proactive approach to knowledge transfer dating back to the establishment of the first technology transfer office in 1983 (then called Industrial Liaison Office, subsequently renamed in 2007) in an Irish university. A key goal of successive strategic plans was noted in UCC's strategic plan "Sustaining Excellence 2013-2017", where the goal was to achieve "excellence in knowledge transfer", to "stimulate economic and social benefit" and to rely on the commercialisation of the technology developed within the University to instil a culture and community of entrepreneurship and innovation. In line with these goals, UCC positioned itself as lead partner in a technology transfer consortium, the Bridge Network, alongside Teagasc, Cork Institute of Technology (CIT) and the Institute of Technology Tralee (ITT). The consortium aims to build a coherent approach to intellectual property management across the partners, leveraging UCC's expertise in this space. The institutions will pool their efforts into the association, with combined research revenue of €145 million.

UCC continues to expand the innovative platform of transfer activity as evidenced by the 2,216 new research accounts added in the three years from 2014 to 2016. Over 350 of these are either partially or fully funded by industry. These partnerships ranged in scale from Innovation Vouchers in collaboration with Enterprise Ireland, to multimillion, recurrent collaborative programmes with domestic and multinational companies. The overall value of the industry contributions for the three-year period to 2016 exceeds €45 million.

EXHIBIT 5.7 takes a closer look at UCC's role in technology transfer across the areas of invention disclosures, patent filings, licence options and spin-out companies. UCC has a track record of establishing spin-out companies to capture the economic potential of the University's intellectual property and expertise. In the period 2009 to 2016, 21 companies were established specifically based on UCC technologies. The longevity of these companies is impressive and 20 out of the 21 continue to trade today, thus adding economic value.

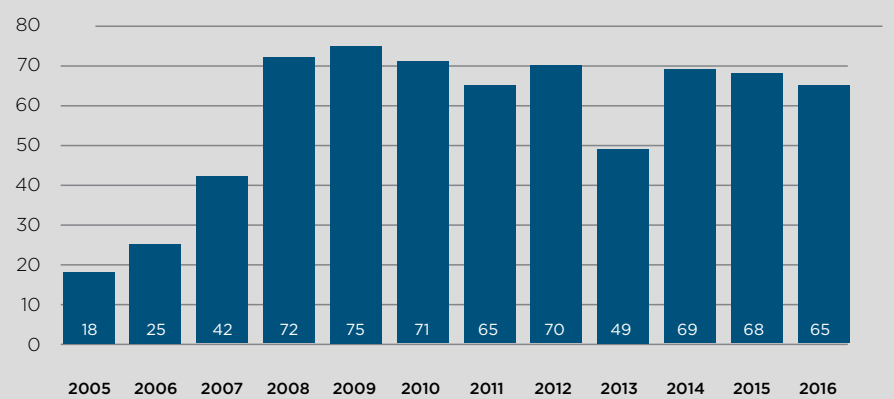
UCC's active commercialisation portfolio also includes its patents. Since 2005, UCC has filed 223 new patent applications, with 12 being filed in 2016 and a similar number in 2015. Crucially, UCC has maintained output in relation to licence options at 21, 21 and 22, respectively, over the past three years: 165 in total since 2005. Similarly, for invention disclosures, UCC has produced 69, 68 and 65 over the past three years and a total of 689 since 2005.

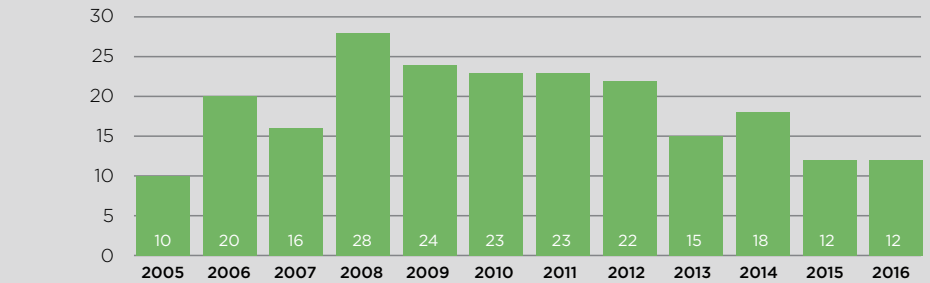
EXHIBIT 5.7: UCC's role in technology transfer (in numbers)

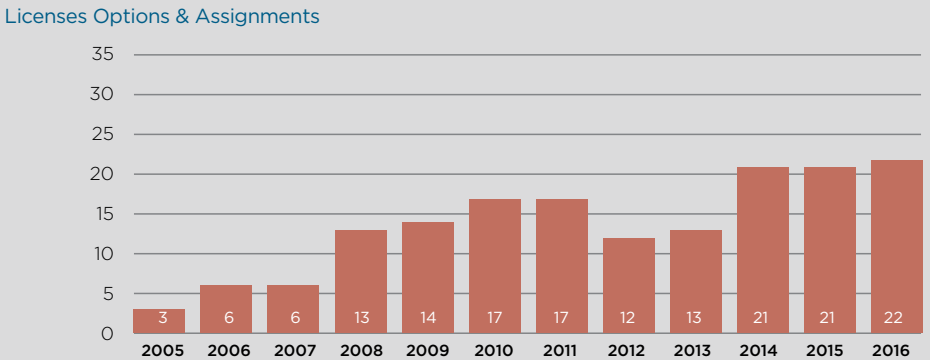
Research Activities	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Invention Disclosures	18	25	42	72	75	71	65	70	49	69	68	65	**689**
Initial Patent Filings	10	20	16	28	24	23	23	22	15	18	12	12	**223**
License Options	3	6	6	13	14	17	17	12	13	21	21	22	**165**
Company Spin-outs					4	3	3		2	2	3	4	**21**

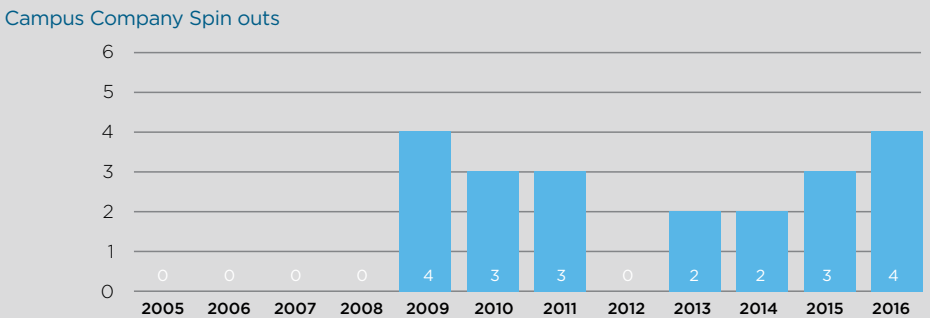
Source: UCC Office of Technology Transfer

Invention Disclosures









Source: UCC Office of Technology Transfer

They signify activity in this area across the University. They are also important from a research and development capability and related reputational enhancement perspective.

EXHIBIT 5.8 below highlights the publication analysis of UCC. Peer-reviewed research publications are one of the key research outputs generated by the University and have experienced significant growth over the past decade. This progression aligns closely with the sizeable investments made in the University's research over recent years. The University has achieved continued growth in research output metrics, including the frequency with which research is published and the citation impact of this research.

EXHIBIT 5.8: Publication analysis - UCC (in numbers)

UCC publication analysis	2006-10	2007-11	2008-12	2009-13	2010-14	2011-15
Number of articles	4,257	4,562	4,869	5,282	5,579	5,708
No. of citations	24,473	29,543	33,624	38,972	42,630	44,665
Average citation/article	5.75	6.48	6.91	7.38	7.64	7.82

Source: UCC Research Support Office

From this analysis it is clear that both the number of articles and citations has experienced growth since the 2006 to 2010 reference period, with the number of citations almost doubling in that period. Similarly, the average citation per article has increased from 5.75 initially to 7.82 in the most recent available reference period. These are important from an international reputational perspective but also a key metric in terms of university rankings.

Finally, the number of institutions collaborating with UCC researchers in the period 2011 to 2016 is examined in **EXHIBIT 5.9** below. These include state institutions, private research institutions as well as other universities. As one would imagine, European collaborations are particularly strong at 1,351 for the period but collaborations in North America and Asia Pacific are also noteworthy.

EXHIBIT 5.9: Institutions collaborating with UCC researchers on publications (2011-2016)

Location	Number
North America	431
South America	80
Europe	1,351
Africa	63
Middle East	98
Asia Pacific	409

Source: UCC Research Support Office

5.3 The role of UCC in commercializing knowledge

Dissemination of ideas via intellectual property benefits society and stimulates further creative activity. **EXHIBIT 5.10** below is a comparative analysis of IP and IP transactions across the seven Irish universities in 2016.

EXHIBIT 5.10: Intellectual property and intellectual property transactions 2016 - A comparative analysis

	DCU	Maynooth	NUIG	TCD	**UCC**	UCD	UL
Number of inventions/software disclosures received	35	12	54	53	65	65	43
Number of new patent applications filed	14	5	10	13	12	21	14
Patent applications filed progressed to PCT	33	25	33	47	42	50	40
Patents granted	16	2	9	53	7	8	5
Number of patent families owned by RPO at year end	119	10	110	116	72	92	62
Number of licensing options and assignments executed	30	7	11	28	22	22	14
Market launch of products and services based on RPO	0	1	0	3	2	3	2

Source: Knowledge Transfer Ireland Annual Review 2016[42]

UCC's leading position, in relation to the number of inventions/software disclosures received during the year and strong showing in relation to patent applications filed, which were progressed to People Centred Technology (PCT) and indeed the market launch of products and services based on Research Performing Organisations (RPO), is notable.

EXHIBIT 5.11 below looks at UCC's role in commercialising knowledge relative to other Irish universities through the lens of research expenditure and research agreements. It is noteworthy that in the area of investment in creation and discovery (research investment), industry investment and number of innovative voucher project initiatives UCC leads the way. Interesting UCC's industry investment is over twice that of its nearest competitor Trinity College Dublin (TCD) yet TCD has 136 collaborative research agreements with Industry to UCC's 41 which are far larger individual investments in volume terms.

UCC's leading position is important and UCC has taken steps to ensure that this is maintained by the focus that this has been given the current strategic plan- independent thinking- shared ambition which covers the period 2017 to 2022.

EXHIBIT 5.10: Intellectual property and intellectual property transactions 2016 - A comparative analysis

	DCU	Maynooth	NUIG	TCD	**UCC**	UCD	UL
Research expenditure	35,700,000	22,838,425	52,886,545	90,972,152	96,350,000	81,780,000	30,206,110
Industry	2,356,200	228,384	3,152,038	4,548,608	10,598,500	4,178,958	3,624,733
No. of collaborative research agreements - industry	84	66	61	136	41	89	67
No. of innovative voucher project initiatives - industry	20	4	10	10	21	19	10
No. of consultancy services agreements - industry	1	2	0	5	3	44	6
Total number of collaboration, voucher, consultancy	105	72	71	151	65	152	83

Source: Knowledge Transfer Ireland Annual Review 2016

[42] Knowledge Transfer Ireland (KTI) Annual Review 2016, Published 2017

5.4 The impact of creation and discovery on our society and in our community

5.4.1 Financial impact

At the most fundamental level (as of September 2017), there is 939 staff (or 883.25 Full Time Equivalents) whose salary is funded exclusively by creation and discovery (research) at UCC.

There are 532.08 academic research staff, 234.88 administrative research staff and 116.29 research staff in technical roles. Interestingly, there are 471.44 females working in whole time research roles to 411.81 males, making our total of 883.25 FTEs

EXHIBIT 5.12: Economic impact of UCC's research staff (those exclusively funded by research only) (in € and numbers of jobs)

	Amount	No. of staff	Impact
1. Potential expenditure in the economy	32,140	883	**28,379,620**
2. Taxes & social insurance contributions	21,612	883	**23,198,440**
Total Output			**51,578,060**
	Direct	**Indirect & induced**	**Total**
3. Employment	883	1,538	**2,421**

Source: Audited Financial Statements / UCC HR

In addition, as noted, creation and discovery at UCC directly employs 883 staff. Applying the Type I University jobs multiplier of 1.16 to this, we can state that a further 1,024 jobs are supported elsewhere in the economy as a result of UCC's cohort of pure research staff. And taking the Type II jobs multiplier of 5.36 for every €1m of budget expended and applying it to UCC's research budget of €96m, we can establish that a further 514 jobs are induced and supported as a result of UCC's expenditure in the economy. In total, there are 2,421 jobs (direct, indirect and induced) supported by UCC creation and discovery. The jobs, combined with the financial output, undoubtedly serves to improve the fiscal well-being of the citizens in the region.

5.4.2: Impact of research on our society and in our community

We have looked at the financial impact of research at UCC, but what of the creation and discovery impact on our society and in our community. As we have seen, UCC is organised into 9 broad thematic priority research areas as follows:

EXHIBIT 5.13: Intellectual property and intellectual property transactions 2016 - A comparative analysis

If we consider these priority areas as impact zones, then we can begin to appreciate the depth, breadth and impact that UCC is having societally. Right across these areas teaching, learning and practice is being enhanced, public and fiscal policy is being shaped, socially responsible staff, students and graduates are being influenced and are influencing, and environmentally aware citizens are being moulded. As knowledge is being created, developed and shared the external impact of UCC's creation and discovery ecosystem proliferates.

5.5 Creation and discovery - Conclusion

UCC is clearly driving growth for the South-West Region through its vast research and development capabilities. It has a crucial role to play in knowledge creation and discovery, technology and knowledge transfer as well as a key role in commercialising that knowledge. On top of that, UCC creation and discovery has a real impact on our society and in our community. Work emanating from UCC impacts the lives of millions of people around the globe.

As a research-led world class university, the ethos of creation and discovery emanates from and is clustered around multiple research centres and intrinsically linked to the four colleges, its four pillars of strength.

UCC is home to some brilliant academics and their innovations have helped to position the University as a global leader in numerous research sectors. The University boasts several of Ireland's elite research centres including the Tyndall National Research Institute (Tyndall) and APC Microbiome Ireland, both recognised as world leaders in the arears of technology, food and health.

In line with UCC's second strategic goal, which is to "be a leading university for research, discovery, innovation, entrepreneurship, commercialisations and societal impact", UCC's ability to form collaborative and professional relationships across sectors underpins its position as the top Irish university in terms of research investment and the top Irish university with regard to industry investment.

UCC works hard to maintain its position as the leading Irish research-led university. It requires consistent external engagement and an inter- and multi-disciplinary approach to research, with collaboration at the core. The strategic plan for research published in 2017 sets out the strategy for creation and discovery at UCC and this plan is consistent with Ireland's cluster-based centres of excellence approach to research and development, which help drive our knowledge-based economy. This is very much in evidence through UCC's commitment to the Cork Science and Innovation Park at Curraheen in Bishopstown.

The obvious financial and societal benefits are the by-products of a unique entrepreneurial environment which UCC has created and cultivates on the western fringes of Cork City, driven by strategic clusters of excellence and acting as a catalyst to propel the South-West region forward on the global stage.

5.6 Key findings

Key findings:

- **UCC's €96m investment (Financial Year end 2016)** in creation and discovery means that it is the **leading Irish university** with regard to **actively seeking and securing investment** in research and development. Similarly, the **€10m** secured and invested by UCC's industry partners makes it **the leading Irish university by a distance** with regard to research and development investment collaborations with **industry**.

  An impressive and diversified research pipeline figure of €86m as of September 2016 underlines the proactivity and diligence of UCC in this critical area.

  UCC hosts several of Ireland's elite research centres, including the Alimentary Pharmabiotic Centre (APC), now known as **APC Microbiome Ireland** and recognised as world leaders in the area of food and health. Such centres are home to brilliant scientists, and their inter-disciplinary work impacts the lives of millions of people around the globe. 4 of the top most cited researchers include Dr Paul Ross in Food and Health Science, Prof Dr Elke Arendt in Food and Nutritional Sciences, Prof Dr John Cryan in Anatomy and Neuroscience, and Prof Dr Catherine Stanton in the area of food, health and nutrition. In relation to **how often APC Microbiome Ireland's ground-breaking work is cited**, APC Microbiome Ireland has a normalised citation score of 1.83, which is **almost twice the world average**. APC is ranked number 1 globally for research in antimicrobials and probiotics (CWTS bibliometric, Leiden).

- UCC's research centres themselves account for 58% (and they are aligned to the four colleges) of the investment followed by the college of science, engineering and food science (19%) and the college of medicine and health (16.4%). Combined, they account for 93.4% of the investment. This shows that research being completed at UCC is not purely focused on dedicated research centres and that active academics within the colleges are also driving research-led teaching, learning and innovation across the University.

- **Tyndall National Institute**, through its **€30m turnover** each year, 250 staff and 200+ PhD researchers, is the only institute of this scale, nationally. It contributes to the impact of the nation at a level which is unmatched in smaller scale Research Innovation and Communications Units. It **comprises 30% of UCC's annual investment in creation and discovery** and its international reputation is second to none. Indeed, its investment in research and development each year is **itself greater than that of 2 of the 7 Irish universities**.

- Beyond science and technology, other recent outstanding achievements of scholarship include the production of **Atlas of the Irish Revolution**, published by Cork University Press and edited by John Crowley, Donal Ó Drisceoil, Mike Murphy and John Borgonovo, which was awarded the Irish Book of the Year 2017. Incidentally, **UCC is one of only two** Irish universities with its own publishing house.

SOCIETAL IMPACT

UCC IS CHANGING THE PHYSICAL LANDSCAPE OF CORK CITY FOR THE BETTER. **UCC'S €241 MILLION DEVELOPMENT PLAN IS THE LARGEST PLANNED BY ANY ORGANISATION IN CORK.**

23% UCC IS A LEADER IN ACCESS TO THIRD LEVEL EDUCATION. **OVER 23% OF UCC'S UNDERGRADUATE INTAKE ARE MATURE STUDENTS, STUDENTS WITH DISABILITIES OR NON-TRADITIONAL COLLEGE-GOERS,** REFLECTING THE ETHOS OF EQUALITY, DIVERSITY AND INCLUSION FOR ALL.

UCC HAS JUST PUBLISHED ITS **FIRST CIVIC ENGAGEMENT PLAN** FOR THE PERIOD 2017 TO 2022.

UCC IS THE **PRIMARY ACADEMIC PARTNER** SUPPORTING NINE HOSPITALS IN THE SOUTH SOUTH WEST HOSPITAL GROUP.

SECTION 6:

THE IMPACT OF UCC ON OUR SOCIETY AND IN OUR COMMUNITY

UCC's impact on society and the community highlights the fact UCC's impact is as wide as its financial impact is deep. UCC is a university in the community, of the community and for the community, committed to delivering value in a trustworthy and transparent fashion.

This report reviews UCC's 'local to global impact' from a financial, workforce development, business and creation and discovery perspective, and we have seen case studies which evidence the depth and breadth of the impact.

In this section of the report, we examine UCC's impact on social responsibility and the promotion of responsible processes, the socio-cultural impact including the lead role that UCC has taken in relation to widening participation as well as the physical environment impact. We look at the impact of consistent and real engagement with our community, the impact on the health of our citizens and finish by reviewing UCC from an environmental and sustainability impact perspective.

6.1 The impact of UCC on social responsibility and the promotion of responsible processes

When considering the influence of third level institutions, an impact which can easily be overlooked is the impact that the university has on its students (soon-to-be graduates) as well as on the staff population in relation to social responsibility and the promotion of responsible processes.

Universities are diverse institutions that help broaden the minds of up to 7,000 graduates per year in terms of ethics, equality and culture as much as they aid in terms of educational development. Personal development is, in many ways, just as important as the workforce development impact of UCC. Whether it is involvement in clubs and societies or engagement with communities or charities, volunteerism and involvement beyond the curriculum is encouraged and fostered at UCC.

Many students and staff volunteer and give freely of their time by sitting on boards, holding leadership and advisory positions in every facet of modern life, from charities such as Cork Deaf Enterprises to local credit unions and, indeed, hundreds of sports clubs in and around Cork and the South-West Region of Ireland.

UCC works programme recognises the contribution made by UCC students and, each year, hundreds of UCC students are formally recognised for volunteering across campus and in our local community. Similarly, UCC students volunteer at **'nightline'**, a confidential, non-judgemental, non-directive, anonymous listening service run by students for students. This important service operates each Monday, Tuesday, Wednesday and Thursday night from 9pm-1am during the college year. Other students choose to become **peer support leaders** as they seek to give back to the wider UCC community while studying. Each year, well-rounded and learned young people leave UCC having had a much fuller educational experience.

UCC helps shape the minds and attitudes of the 20,000-strong student population that pass through the gates of the University each day. Added to that is the 3,000 full-time staff and the 1,500 hourly paid part-time staff and, all of a sudden, you have a cohort with a population similar to the size of Kilkenny city.

The internal environment of UCC, which promotes responsible processes such as the green campus, recycling and fair-trade, can have a multiplier effect externally in the local communities in which the UCC family live and participate, as they go about their daily lives. The UCC family act as influencers as responsible processes garnered at the University, reflecting the ethos of UCC, are promoted locally and globally.

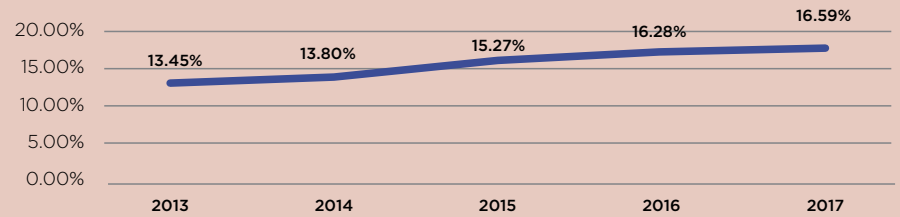
6.2 The socio-cultural impact of UCC

UCC is a truly multi-cultural university and is fast gaining a reputation internationally in respect of undergraduate and postgraduate programmes as well as for its R&D capabilities. Exhibit 6.1 below gives an appreciation of the growing trend of internationalisation of UCC's student population.

EXHIBIT 6.1: International headcount trend (in number of students)

	2016/17	2015/16	2014/15	2013/14	2012/13
Visiting JYA Headcount	783	809	747	611	585
Summer school	-	34	40	46	40
Visiting fee paying headcount	23	13	24	14	18
Visiting exchange headcount	742	670	624	617	611
Visiting PG (resources only)	4	3	6	3	7
Economic fee UG	795	715	616	580	558
Economic fee PG	544	497	435	335	361
International domicile	386	382	319	270	232
Total	**3,277**	**3,123**	**2,811**	**2,476**	**2,412**
Total student population	19,747	19,187	18,412	17,947	17,933
% International	16.59%	16.28%	15.27%	13.80%	13.45%
International Other	1,308	1,208	1,161	1,108	1,027

International Students as a % of Student Population



Source: UCC External Relations Office

The international student headcount at UCC has increased from 13.45% to 16.59% in a five-year period. This puts it on a par with Russel Group of UK Universities.[43] UCC aims to grow this to 19% in the timescale coinciding with the current strategic plan 2017 to 2022. The spread of the domicile of the international students is noteworthy and increasing numbers are coming from Asia, the Middle East and South America as well as from the more traditional bases of Europe and North America. The changing profile of the student base improves the overall student experience as well as enhancing the reputation of UCC internationally. As we have seen, there is also an economic benefit to Ireland as well as to the University itself in relation to international students coming to UCC to study. Many of these students choose to settle and work in Ireland and their value added to the economy is significant. Others are the source of foreign capital, which is brought to Ireland and invested locally on foot of the student's experience at UCC.

In addition, UCC has a particularly high level of staff from overseas. Nearly 30% of UCC's staff are from overseas. This reflects the reputation of the University as well as the attractiveness of Cork as a place for people to come and settle in. The cost of living is comparatively lower than other European cities and the quality of life in the area is repeatedly cited as a reason why staff choose Cork and UCC over other European universities. UCC staff is increasingly more qualified and now nearly 77% of the academic staff have a PhD. It is true that this serves UCC well in terms of world-wide rankings but, at the same time, when coupled with the internationalisation of the staff, it improves **diversity** and multi-culturalism within society.

UCC has taken a lead role nationally with regard to **widening participation** in third level education. We have seen how UCC is growing its international student numbers. It has also grown its student base at the postgraduate level to 24.6% of student population as at March 2017. UCC has ambitious plans to grow this to 30% in the coming year as the trend of completed Masters and PhDs continues to increase in Ireland.

UCC is ahead of targets with regard to the intake at undergraduate level. UCC's source of widening participation is in relation to the intake of mature students, students with disabilities as well as non-traditional college goers. UCC's intake of mature students, is for example, 373 versus 325 as of March 2017. It is also ahead in respect of the intake of students with disabilities at 281 versus a target of 195 and, furthermore, it is ahead in relation to the intake of UCC plus students at 258 versus 200. These are reflected below in **EXHIBIT 6.2**. A total of 23.08% is the leading intake at undergraduate level of any Irish university.

EXHIBIT 6.2: International headcount trend (in number of students)

	2016/17	2015/16	2014/15	2013/14	2012/13
UG intake	3,951	3,867	3,751	3,383	3,543
UCC plus intake	258	247	221	190	208
Mature intake	373	368	408	379	403
Disability support services	281	246	250	201	193
Total access intake	**912**	**861**	**879**	**770**	**804**
Total	23.08%	22.27%	23.43%	22.76%	22.69%

Source: UCC Admissions Office

Access for all is not just the case in respect of undergraduate intake and, as we can see from **EXHIBIT 6.3** below, the overall number has increased year on year for the past 5 years and is a testament to the focus that UCC places on participation in its strategic planning process.

[43] The Economic Impact of the Russell Group Universities. October 2017.

EXHIBIT 6.3: Access trend headcount based on entire student population (in number of students)

	2016/17	2015/16	2014/15	2013/14	2012/13
UCC plus	770	733	675	597	544
Mature	1,265	1,310	1,368	1,439	1,506
Disability support services	1,233	1,122	1,022	919	866
Total	3,268	3,165	3,065	2,955	2,916

Source: UCC Admissions Office

Scholarships and studentships also help to widen the participation. **EXHIBIT 6.4** below gives the total number of studentships for each of the last 5 years. 3,122 have been in receipt of studentships over the past 5 years. Again, the upward trend is noteworthy. UCC also operates an excellent sports scholarship programme and offers scholarships and bursaries for students who excel in their respective sports such as rugby, soccer, GAA sports, hockey and athletics.

EXHIBIT 6.4: Studentships at UCC (in number of recipients)

Year	Department	Research	Tyndall	Summer	Total
Sep-13	107	371	95	25	598
Sep-14	83	396	102	41	622
Sep-15	62	446	85	40	633
Sep-16	61	450	95	21	627
Sep-17	44	463	105	30	642
Overall Total					**3,122**

Source: UCC Registrar's Office

UCC has been offering **Adult Continuing Education (ACE)** programmes to Cork and the greater Munster area since 1946 and is proud to celebrate 65 years of educational services to the community. It has been instrumental in widening participation at third level. The first Diploma in Social and Economic Science course was formally opened at a public meeting at UCC on the 14th October 1946 and 24 students were awarded the diploma in June 1948.

[44] National Planning Framework. Ireland 2040 – Our Plan. Draft Plan published December 2017.

Since then, ACE's purpose is to provide opportunities in lifelong learning for all adults, irrespective of age and previous educational achievements.

While some students may be uneasy about coming to the University for the first time, the staff at ACE attempt in all courses to cater for the particular needs of adult learners. The staff adopt the particular approach needed to enhance adults' learning so that all students may have a rewarding educational experience.

It must be noted that the course offered by ACE and those available through the government's **Springboard** programme have been highly successful in widening participation. Not only that, but these courses are very practical and reflect the regional skills needed in the South-West Region. The strategy is closely aligned to the Irish Government's National Plan 2040[44] with regard to targeted investment in relation to lifelong (and life-wide) learning.

UCC's acquisition of the **Irish Management Institute (IMI)** is also focused on widening participation. It is focused on providing excellence in design, transformational learning experiences and superior quality customer service. IMI has a core Executive Education division which is dedicated to the design and delivery of premium executive education. This includes programme designers, expert programme administrators, managers and deliverers and is responsible for IMI's quality assurance process. It is the only centre in Ireland for benchmarking and assessment of management practice using international peer-reviewed methodology.

IMI has moved to a platform business model of delivery whereby the institute uses a broad network of world-class educators to deliver its programmes. This allows IMI to operate as an organisation without boundaries in terms of its capacity for expertise while ensuring a fully scalable model for programme delivery. IMI's Design and Delivery units are the core drivers of methodological tools which ensure a consistent drive to achieve learning outcomes throughout the programme.

Over 60% of Ireland's top 1000 companies have worked directly with IMI in the last 5 years. IMI works extensively in both the public and private sectors to provide cutting-edge executive education for Irish business. Around 2,500 managers attend programmes at IMI per year. 25% of these are from the most senior positions in the organisation, the remainder are either high potential managers and graduates or front-line managers in key operational roles. These managers come from SMEs all the way up to foreign-owned multinationals.

In addition, IMI has an associate network made up of over around 200 industry-focused educators and coaches that work with companies across Ireland and abroad. IMI's links to Irish business are cemented through its Board and Council and will be further enhanced by the establishment of the new Advisory Board of CEOs from organisations throughout Ireland.

IMI's physical campus in Dublin is made up of a main executive education building, which includes training and meeting rooms, a restaurant and knowledge centre. In addition, there is a conference centre and a 50 room residence for on-campus learning experiences. The business administration block houses IMI's staff of 45. The campus has hosted heads of state, European Commissioners, Taoisigh, leading international business speakers and managers from across Ireland, Europe, the US and Africa. UCC owned Irish Management Institute (IMI) significantly enhances the University's resources for its delivery of executive education in Ireland.

UCC is a highly effective university and this effectiveness is even greater when one considers UCC's superior access intake over other Irish universities. The socio-cultural impact of participation for mature students, students with disabilities as well as those non-traditional college-goers undoubtedly reflects diversity, equality and fairness for all.

6.2.1 Examples of UCC's heritage and cultural impact

In its 173-year history, UCC has stimulated cultural expressions in language, literature, music, performance, visual narratives, history and heritage. The University also serves as a repository for our national and international patrimony, the origins of its collecting dating back to 1849. Patterns of collecting continue to this day. The University has in its care collections artefact and archival collections which are of national and international significance, including the Seán Ó Riada Collection; the George Boole Archive; the Bantry House Archive; a collection of Gaelic manuscripts (including the Torna Collection) and The Great Book of Ireland.

The creative voices of the UCC community are internationally known - Seán Ó Riada, Seán Ó Faoláin, Frank O' Connor, Aloys Fleischmann, John Montague, Seán Ó Tuama, amongst others. The scholarship of established historians Dermot Keogh, John A. Murphy and Joe Lee is well known. Less well known, but equally stimulating, are the voices of emerging generation of commentators who are beginning to contribute to national cultural, political and social discourse - practitioners in film and dramatic arts, writers and commentators. UCC academics frequently participate in national television documentaries series for example, Arts Lives and Hidden History Series as well as working as consultant academic advisors on major films.

Building on research, Cork University Press, published in late 2017, and edited by UCC staff, John Crowley, Donál Ó Drisceoil, Mike Murphy, The Atlas of the Irish Revolution. This ground-breaking book sold 23,670 copies in 5 months and won three major awards as follows: Bord Gáis, Best Irish Non-fiction book of the Year, Bord Gáis, Best Irish Book of the Year (overall winner) and RTÉ Liveline's Book of the Year.

The University has developed goals in its Strategic Plan, 2017 – 2022 to build on existing strengths and enhance our interaction with the public by hosting lectures, concerts, exhibitions and other events to increase the profile of the visual and performing arts and to make the University's rich collections available to the community and to act as a catalyst for change and creativity, sparking new connections, partnerships, practices, and exchange of ideas and expertise, particularly in the domain of the creative arts and culture, cultural heritage and the Irish language and literatures. These initiatives build on our established

successes and will support proactive engagement at local, national and international level, to crystallise our external relationships and develop initiatives to work more extensively with civil society and consolidate the University's role as a key participant in the creative and cultural landscape. The work that the University has done in this sphere of creative and community arts – its programmes of innovative arts practice research and its role as custodian of our cultural heritage – all serve to create bridges between the academic work of the University and the Irish and international creative arts and technologies sectors.

6.3 The impact of UCC on the physical environment

While a primary focus of UCC has long been shaping graduates, who are both work-ready and world- ready, one cannot ignore the development of the physical environment on the western fringes of Cork City. UCC has consistently invested in infrastructure and this is reflected in the increasing footprint of the University across the city via the University itself, across Munster via investment in the South Western Hospital Group, the Marine Engineering building at Ringaskiddy and others and, again, more recently in Dublin through UCCs merger with the Irish Management Institute. Indeed, UCC's partnership with another Cork institution, the Cork Opera House, who between them have been serving the people of Cork and the South-West Region for over 330 years, is a very recent example of how UCC continues to help shape the physical landscape of Cork and beyond.

While UCC is renowned for the efficient use of space at its disposal and graduates more graduates per acre than any other Irish university (and indeed more graduates per kilowatt hour), UCC offers a real blend of history and modernity. The main quadrangle is a constant reminder of the illustrious history of UCC. Similarly, buildings such as the UCC Observatory and the presence of the Honan Chapel on campus are not only part of the physical environment, but also reflect the cultural draw of UCC as a visitor and tourist attraction. The ultra-modern and world-renowned Glucksman Gallery on campus impacts the cultural environment as much as the stunning building itself shapes institutional and architectural landscape of Cork City.

UCC has ambitious plans to continue to shape the physical environment of Cork City and the surrounding area and the plans in relation to UCC's new dental school building are testament to this commitment to Cork and its locality. Furthermore, UCC has ambitious plans in relation to the **new business school** which is to be located in the centre of Cork City and will give UCC an even stronger presence in Cork among the business community.

The creation of the standalone business school will assist UCC in achieving strategic objectives which are provided for the in the current strategic plan such as strengthening the infrastructure and resource base. It will ensure UCC is pre-eminent in internationalisation, external engagement and contribution to society. It will enhance UCC's position as a premier European university for research, innovation and commercialisation. And the new building will help deliver research-inspired teaching and learning with a world class student experience.

The proposed new building will include the following facilities:

- Teaching and learning space for CUBS students
- Laboratories
- Study areas and innovation space of collaboration and group working
- Office accommodation for faculty and professional staff
- Accommodation for existing and new research centres
- Conference and meeting room space
- Exhibition atrium
- Reception, café and catering facilities

The main advantages for a new stand-alone building for the business school is that it enables significant student growth particularly amongst post-graduate and research students. It offers world-class facilities to attract outstanding faculty, students and researchers, facilitates cross-discipline activities amongst faculty and students, creates a hub for engagement between businesses and students, supports an increase in post-graduate and international students and, finally, it eliminates the requirement to lease buildings off campus for the business school's various research centres.

It will be a strategic resource and facility for Cork and the region as well as for UCC. The proposal will also assist the country in meeting some of the key priorities identified by the National Planning Framework, The Department of Education Statement of Strategy 2015 – 2017 and the National Strategy for Higher Education to 2030. It would also help shape the physical environment of Cork, represent a significant investment in buildings and estates for UCC and further cement UCC's position amongst the region's business community.

As we have seen in Section 2 of this report, UCC has an ambitious €241 million **development plan**[45] over the coming 10 years (outside of the business school itself). In November 2016, UCC signed a European Investment Bank Loan Agreement to fund €100m of that development plan. Projects include:

- €64 million investment into student accommodation
- €37 million for a new Cork University Dental School
- €27 million to fund Western Campus Development including Cork Science and Innovation Park and additional sports facilities
- €90 million for a new student hub
- €23 million to fund Clinical Medical School for the Cork hospitals and associated research

This is the single largest capital investment plan being undertaken in Cork and it will have a real positive impact local fiscal environment: up to €446m in total economic output. It will also support up to 11,482 jobs throughout the lifetime of the development plan. Not only that but delivering on the plan will help transform the physical environment of UCC and the surrounding area by delivering crucial infrastructural projects to allow UCC to grow and expand to meet the increasing demand for the University.

UCC is also committed to **Cork Science and Innovation Park** at Curraheen in Bishopstown. This is a site for a 200-acre zoned science park in Curraheen, about 1.5 miles southwest of the main campus. Together with other partners, such as Cork Institute of Technology (CIT), local enterprise offices and private investors, the project has been in planning for the past ten years or so. It would mean that the location would become a cluster for innovation. It will enhance the extensive interface between UCC & CIT. The health innovation hub building is planned to be the first UCC building built on the site and it is also the proposed site for the new dental school. It will also include other related activities including increasing the space for campus companies.

From the analysis of national and international strategic publications, the development of the CSAIP is compatible both with government strategy and that of the European Commission. The three core zones – Information, Communications and Technology (ICT), Health and Wellbeing, and Energy and Environment – to be established in the CSAIP, can be complementary, are recognised internationally as a fertile ground for employment and hold a prominent place in the strategies underpinning formation of a 'smart economy' recognizing the importance of knowledge creation and research and development. Furthermore, the three core zones are central to the research strategies of both local third level institutions.

UCC also contributes to the attractiveness of Cork and the South-West Region. UCC provides physical spaces for discussion and creates connections between academia, students and companies that would not otherwise exist. UCC continues to shape the physical landscape and environment of Cork. The current building of the footbridge (the 9th over the River Lee) and entrance from Western Road is yet another example of UCC extending its hand into to the community, opening its doors and welcoming the people of Cork while at the same time providing necessary infrastructure to the betterment of the local area.

[45] UCC Capital Development Plan 2016 – 2026. 2016

6.4 UCC - Engagement with our community

From 'real' research engagement to that of teaching and learning via public lectures and workshops, through Cork University Press publications, through our conferences, open days and visitor days such as the wonderfully successful Cultural Night, through UCC's volunteers in the local community, through the impact of our alumni past and present, through UCC's engagement to widen third level participation, through sports, history and culture, UCC is very much a university in the community and for the community.

UCC has embraced the Irish University Association guidelines in respect of community engagement, and our Civic Engagement Plan 2017 – 2022 reflects the university's proactivity and commitment to real meaningful engagement with wider society. One excellent example of community-based teaching and learning is that of the **ENTRUST Project**. (Energy System transition through stakeholder activation, education and skills development). This three-year H2020-funded programme concluded at the end of April 2018 with a very successful exhibition of results in Brussels, entitled 'Exploring the lived experience of energy'. The project has its origins in work on sustainable production and consumption, carried out at UCC at the School of Engineering since the 1990s. UCC coordinated the project, which involved multiple partners including 6 different communities around Europe: Dunmanway, Co. Cork; a UCC student cohort; Gràcia in Barcelona; Le Trapèze in Paris; Stockbridge in Merseyside, UK as well as Secondigliano in Naples, Italy.

This truly interdisciplinary project examined the human aspect of energy systems. It looked at people's relationship with energy and what people in communities want from energy. It focused on changing practices and had its foundations in social practice theory and ideas around energy citizenship. Its results are having a real impact and look at the social contexts of decision-making. The project used ground-breaking, innovative methodologies, such as citizen juries and bespoke outreach approaches, through identified gatekeepers in each community. A key value is that it gives a voice to citizens capturing their viewpoint and legitimising citizens as stakeholders in society. UCC's lead role in the project has seen the University act as an enabler, develop a greater understanding of the communities and inform the climate change debate in the EU context from a bottom-up perspective. In doing so, it has given a voice to those previously unheard in this discourse.

A key tenet of IUA guidelines is that of 'engaged research' and 'public engagement and involvement'. **Community Academic Research Links (CARL)** is a really good example. It provides independent, participatory research support from skilled researchers in the University in response to community research questions and usually free of charge (or for a minimal cost). CARL is an initiative within UCC that supports community and voluntary groups to carry out research that is important to them.

The initial question is translated into a research project. The students are given an opportunity to develop skills and abilities, while being supervised by experienced researchers. Projects carried out through the university structures are seen as being scientifically impartial and thus can provide organisations with increased legitimacy in political debates or enhance their lobbying activities amongst other benefits. Community and voluntary organisations benefit in the following ways:

- Access to hands-on support and university expertise
- Students' energy, enthusiasm and ideas
- Low-cost help (the main cost is time spent working with students) and opportunities to tackle research tasks that could not otherwise be completed
- The chance to identify potential employees and possible staff development links

An additional benefit is that CARL gives an opportunity to the local community, for individuals and groups to gain a clearer idea of what a university is, and what it can provide for Cork and the surrounding area. In addition, over 70 community projects have been delivered by students through CARL.

A completely different method of community engagement and public outreach was evidenced in spectacular style through Cork University Press's publication of the award winning **'Atlas of the Irish Revolution'** in 2017. One of the biggest and most expansive books published in Ireland this year has turned out to be a huge success. Demand for the book is unprecedented and the initial 8,000 copies sold out immediately as did the 14,000 additional copies which arrived on the shelves on 15th of November, 2017. 'Atlas of the Irish Revolution' has nearly 1,000 pages and weighs 5kg. It has been described as mammoth and magnificent and was almost immediately short-listed for the Bord Gais Irish Book Awards in 2017.

Cork University Press (one of only two in Ireland) attributes the success of the book to its timing. It is extremely good value given its size – the atlas has 984 roughly A4-sized pages – and scope, as it covers not only the period between 1912 and 1923 but also the events that affected Irish history before and after independence. The atlas contains 364 original maps and 707 images, many never previously seen in public. It also lists the locations of all 1,900 IRA companies in the War of Independence.

A report on RTÉ News in September and a "cascade of positive reviews", including one in *The Irish Times*, were catalysts for the book's initial success. Although it is scholarly in tone, it is for a general audience. People recognise there is a lot in it. As the History Ireland (Nov 2017 issue) put it:

"'The Atlas of the Irish Revolution' represents a publishing milestone. It is a stunningly beautiful publication… and a gift to the Irish nation. It is essential that a copy be in every home in Ireland, because it is a book explaining how we came to be where we are. It is a book that should be in every Irish home throughout the world owing to its nuanced treatment of the complexity of these revolutionary years."

UCC prides itself on community engagement and this is something which UCC works proactively and diligently on year in and year out. For example, UCC's **junior conferring programme**, the only of its kind in Ireland, has seen **over 70,000 primary school students** visit and experience UCC first hand. While the extensive nature of community engagement and involvement could potentially suggest an ad-hoc approach to outward and inward reach, this is certainly not the case as UCC has taken a lead role in adopting guidelines suggested by the IUA in this regard. Indeed, civic and community engagement metrics are likely to be introduced via IUA in 2018 and UCC fully endorses this action.

In November 2017, UCC published its Civic Engagement Plan for the coming 5 years (2017-2022).[46] Entitled **'Together with and for the Community'**, this is UCC's first plan to cohere and advance UCC's commitment to civic and community engagement, towards establishing the University as a best practice community-engaged campus. The plan deepens our regional engagement, prioritising cultural links, the Irish language and a focus with intent on societal challenges such as social equality, environmental sustainability and public health and wellness.

[46] UCC Civic Engagement Plan (2017-2022) – 'Together with and for the Community'

6.5 UCC - The impact on the health of our citizens

UCC has an undoubted impact on the health and well-being of our citizens. Anchored in the world-renowned **UCC College of Medicine and Health** and world leading research centres, UCC's contribution to the health of our citizens is just as important as UCC's contribution to the financial well-being of the communities.

UCC's investment in creation and discovery, innovation and entrepreneurship creates value for the community, has a real societal impact and, in many cases, leaves a valuable and lasting legacy on the lives of the community and the nation.

Elsewhere in this report, the impact on our health is evidenced through case studies, including research centres and projects INFANT and SENATOR. One obvious, but often over-looked, way in which the health of the citizens is impacted is through UCCs academic partnership with the **South South West Hospital Group**.

UCC is the primary academic partner supporting nine hospitals in the South South West Hospital Group. UCC has a long-standing partnership with the Health Service Executive in the Cork, Kerry, South-Tipperary and Waterford areas. University clinical academics in many disciplines provide expert care in all the hospitals in the region. They also work closely with the local Primary, Continuing and Community Care staff to ensure that, together, they are not only meeting the needs of patients today but also looking forward to see how they can significantly improve patient care in the years to come.

The fact that **Health Innovation Hub Ireland (HIHI)** is located at UCC is hugely significant as UCC continues to take a lead role in health innovation in Ireland and in Europe. The hub, which has intimate working knowledge of the health system in Ireland, matches companies with the appropriate clinical setting. It was born out of the Action Plan for Jobs in 2012 and started off in 2013 with 6 projects from 21 applications. The next iteration of HIHL saw 40 applications made, put through a rigorous selection process, including desktop review, a review committee and, in some cases, presentations to government departments, the HSE, Enterprise Ireland and Science Foundation Ireland.

Coordinated from UCC's Erinville Hospital location, there are 3 main centres Cork, Galway and Dublin. Clinical research is happening across all locations as UCC and CIT team up with South Southwest Hospital Group, NUIG with the Western Hospital Group and TCD with the Dublin and Midland Hospital Group, including St James and Crumlin. It is a large associated community, a consortium of 23 hospitals plus community hospitals and primary care centres. Innovations such as **Viclarity**, which is a compliance monitoring tool, and **Lincor** patient bedside screens, have emerged via the hub. The key gain for HIHI from helping a company is the enhanced reputation. The hub is primarily funded by Enterprise Ireland and the HSE fund the provision of staff in the locations.

The fact that UCC bid for and won the location of HIHL is testament to its reputation for excellence in healthcare and its leading role with regard for innovation in health and wellbeing. Since its formation, HIHI has worked nationally to integrate academic, business and clinical networks, generating R&D to benefit population health and the economy.

The Republic of Ireland was the first country to introduce fully **smoke-free work places** in March 2004. The Irish workplace smoke-free law was introduced by UCC alumnus Micheal Martin and was introduced with the intention of protecting workers from second-hand smoke and to discourage smoking generally. This decisive action has made an immeasurable difference to the lives of Irish citizens. Based on research completed by the Brunel University in London in 2013, it is estimated that in the ten-year period immediately after the ban, that approximately 3,700 smoking related deaths were prevented.

Research conducted by UCC in 2017 found that **childhood obesity** will cost Ireland €7.2bn in its lifetime. With one in four children here overweight or obese, the research, which was funded by Safefood Ireland, concluded that almost 80% of these overall costs will be due to absenteeism, premature mortality and lifetime income losses. Furthermore, the risk of this trend tracking into adulthood can result in lifelong and inter-generational ill health. More than 85,000 children in Ireland could die prematurely because of childhood obesity and overweight issues. The study found that health care would account for 21% of the total cost of childhood obesity in the Republic of Ireland, including hospital and GP visits and drug costs. As well as impacting those affected, this is an unacceptable burden on society and obesity strategies are the way forward. Just a 1% reduction in childhood obesity would generate savings of €365m and a further 5% reduction would leave to savings of €1.5bn. The study shows the leading role UCC has taken in highlighting the need for effective and urgent public policy. As Prof Ivan Perry recently outlined, "Policy initiatives, such as the tax on sugar- sweetened drinks and measures designed to promote walking and cycling among children, have the potential to yield substantial savings in a relatively short time."

UCC is the primary academic partner supporting nine hospitals in the South South West Hospital Group. In 2016, **UCC graduated more undergraduate health and welfare graduates** than any other Irish university at 1,097 out of a total of 4,608. This represents almost 24% and is a significant contribution to the health and welfare staffing our patient care facilities both home and abroad. It re-enforces UCC's reputation for medicine and health and the lead role UCC has taken in relation to health innovation in Ireland. UCC schools of Nursing & Midwifery and Pharmacy are in the Global Top 100 in the QS World University Rankings.

UCC was the first university in Ireland to be recognised as a health promoting university in 2015. UCC Health Matters is a student-staff collaborative group working to promote university-wide health and wellbeing.

UCC is at the hub of a unique innovation ecosystem of industries, health care facilities, academic and technological expertise. UCC is capitalising on this ecosystem through the development of the Cork Science and Innovation Park's anchor buildings, the Health Innovation Hub Ireland Building and the new Dental School, Hospital and Research Centre in Curraheen, Cork.

6.6 The impact of UCC on the environment and sustainability

We have seen from case studies such as the Environmental Research Institute (ERI), Marine and Renewable Energy Institute (MaREI) and others across the university, the leading role that UCC has taken nationally and internationally in relation to our environment and sustainability. These are issues are at the very core of UCC's strategic goal 2 in relation to societal impact and goal 3 in respect of engagement on local and global issues of UCC's strategic plan 2017 to 2022. Indeed, UCC published a concept paper in April 2017 in relation to environmental and sustainability impact.

UCC's lead role in relation to this crucial **national objective**, as detailed in the National Planning Framework Plan 2040, is evidenced by the following initiatives:

UCC is developing a specific **outreach programme** on green social enterprise and green entrepreneurship, climate action and sustainability for secondary schools with the aim of encouraging transition year students to consider the potential of green social enterprise, cooperatives and social business. UCC is placing an emphasis on undergraduate teaching of **green social entrepreneurship** across programmes, including business and the sciences (i.e. integrate science, business, organisational theory), and is preparing a future generation of green social entrepreneurs and future leaders in this sector. The University is exploring ways in which climate action and sustainability initiatives might elaborate their work/develop new collaborations with UCC Creative, through creative pedagogies, collaborations with creative practitioners, and other emergent creative strategies.

UCC, through participation with external groups, including An Taisce and others, in enhancing the educational and support programme for the **Green School Initiative**, and is linking this more explicitly with the Green Campus Initiative so as to ensure effective coordination between these two initiatives, wider society and the business community.

UCC is exploring the possibility of further collaboration with **some state companies** (e.g.: ESB, Eirgrid and Bord Gáis Networks) and **relevant private companies** that are interested in climate action and sustainability. These companies are often trying to support local, uncoordinated programmes so they may well be interested in working at a more strategic level to support a national initiative that still has strong local engagement.

Separately, the University is exploring the potential of collaborating with some private industry partners. Ideally, such partners would have a strong and trusted brand, already be involved in national initiatives, have community ties and have an interest in or be actively involved in the promotion of energy usage and efficiency and/or sustainability. UCC has international collaborations with universities such as University of Massachusetts Lowell, National University of Colombia (Universidad Nacional de Colombia) and other international agencies. UCC is exploring collaboration with interested parties nationally such as **The Cool Planet Experience, SEAI Community Networks, Irish Environmental Network** and others, which will only serve to enhance UCC's position nationally and internationally in this regard.

UCC is continuing to promote civic engagement activities through the **Campus Engage** platform, which aims to strengthen the relationship between higher education and the wider society, through the promotion of civic engagement activities in higher education and facilitating the sharing of knowledge and resources between academic and civic communities. This platform, along with UCC's CARL initiative, will be utilised for the sharing of climate action and sustainability research and knowledge.

6.7 Key findings - The impact of UCC on our society and in our community

- UCC helps shape and impact the physical landscape of Cork as much as it has impacted its heritage and culture. UCC's €241m development plan (2017 to 2022) is the largest planned by any organisation in Cork. Developments such as the new Cork University Business School are a further testament to UCC's commitment to the city and region.
- UCC significantly impacts on our society and in or community. UCC's impact on social responsibility and the promotion of responsible processes is noteworthy. UCC helps shape the minds, perspectives and futures of the 25,000 people on a daily basis including students, full-time and part-time staff. This is a population similar to the size of Kilkenny city. As influencers responsible processes garnered on campus by the patrons of UCC, reflecting the ethos of UCC, are promoted locally and globally.
- UCC was instrumental in Cork becoming part of UNESCO Global Network of Learning cities in 2015, one of only 119 in the world.
- UCC is a truly international university. Nearly 17% of the student population and 30% of the staff are now from overseas. This is equally true of UCC's 'Quercus' talented student programme, which currently has 3 global teen leaders, 2 outstanding young people of the world winners, and 3 of Time Magazine's most influential teenagers in the world.

  UCC invests approximately €600,000 per year on talented students across the spectrum, including sports, citizenship, entrepreneurship, academic and the performing arts.
- UCC has taken a lead role nationally, specifically in relation to widening participation and access to third level for all. Over 23% of UCC's undergraduate intake are mature students, students with disabilities or non-traditional college-goers.
- UCC has a tradition of promoting equality, diversity and inclusion for all. UCC was a leading Irish university in the admission of female students (1885), the first to appoint female professors (1910) and, in 2017, it maintained this heritage and established an equality, diversity and inclusion unit on campus. Moreover, UCC has become a designated sanctuary university and 2018 will see UCC awarding 7 scholarships to people from the refugee and asylum seeker community.
- UCC is the Irish university which impacts the community, for the community. From 'real' research engagement through interdisciplinary projects such as En-trust, to UCC's series of public lectures and seminars in 2017, UCC's CARL initiative, UCC open days, visitor days and the wonderfully successful cultural night, UCC is open to all.

  UCC is the only Irish university running a junior conferring programme for primary school students from all over the region. In June 2017 UCC graduated its 70,000th primary school student, a momentous milestone for this programme.

  UCC's community outreach was formalised in October 2017 through the publication of its first Civic Engagement Plan for the period 2017 to 2022.
- UCC was the first university in the world to be awarded a Green Flag from the Foundation of Environmental Education. Over ten years on, UCC continues to lead the way in relation to impact on the environment and sustainability and, through its actions and leading-edge work at the Environmental Research Institute (ERI) and Marine and Renewable Energy Institute (MaREI), UCC continues to champion action in relation to climate change.
- UCC is the primary academic partner supporting nine hospitals in the South South West Hospital Group. UCC impacts the health of our citizens. In 2016, UCC graduated more undergraduate health and welfare professionals (almost 24%) than any other Irish university, a hugely significant contribution to our health service.

- UCC was the first university in Ireland to be recognised as a health promoting university in 2015. UCC Health Matters is a student-staff collaborative group, working to promote university-wide health and well being. UCC schools of Nursing & Midwifery and Pharmacy are in the Global Top 100 in the QS World University Rankings.
- Beyond science and technology, other recent outstanding achievements of scholarship include the production of Atlas of the Irish Revolution, published by Cork University Press and edited by John Crowley, Donal Ó Drisceoil, Mike Murphy and John Borgonovo, which was awarded the Irish Book of the Year 2017. Incidentally, UCC is one of only two Irish universities with its own publishing house.
- The creative voices of the UCC community are internationally known – Seán O Ríada, Seán Ó Faolain, Frank O'Connor, Aloys Fleischmann, John Montague, Seán Ó Tuama, amongst others. UCC academics frequently participate in national documentary series, as well as working as consultant academic advisors on major films.
- UCC has a very proud sporting tradition and the first university club founded was the Rugby club back in 1872 with the famous skull and crossbones being introduced in 1880. Today, UCC has 58 sports clubs with local, regional, national and international athletes operating from its renowned Mardyke Arena base. In addition, UCC has 103 different student-led interest societies which run an average of 40 events per week.

SECTION 7:

CONCLUSION

The outputs of this report are clear evidence of how UCC serves as a national and international engine of economic growth and underlines its strategic importance for Cork City and the South-West Region of Ireland.

We have analysed the University in a manner similar to that of a conventional industry, emphasising major economic characteristics. We have quantified the fiscal impact of UCC in the context of its position as a leading employer, world class research institution, and first choice destination of students.

At a granular level, we have systematically examined sources of revenue, employment created, output generated, and export earnings attracted. Additional analysis has been undertaken in respect of the workforce development impact of UCC, the business and FDI of UCC as well as the creation and discovery impact of our University.

Finally, we have reviewed UCC's pivotal role in relation to impact on our society and in our community. *The key messages are highlighted as follows:*

The economic impact of UCC is extensive

- Overall, **the total economic impact (Gross Value Added) of UCC is €853m per annum**. That impact means that UCC generates **€2.3m per day for the Irish economy**. The impact generated by expenditure is €727m annually and the fiscal contribution **including taxes and social insurance contributions amounts to a further €125m each year**.
- Taking 2016 as a representative year, UCC produced €853m in output for a €151m state investment. That is a return of **€5.68 to the Irish economy for every €1 of state investment** in UCC.

  This compares favourably with the Leading European Research Universities (LERU Group)[47], where their return is estimated at €5 for every €1 invested.
- **UCC's turnover is €350m** per annum, of which 43% (€151m) is invested by the state. UCC secures the remaining 57% of the investment from non-Exchequer sources. In 2016, **for every €1 invested by the state in UCC**, the state directly received **approximately €0.83 cent in return** in the form of VAT and payroll taxes, including employee contributions.
- Furthermore, **UCC supports 14,708 jobs on an annual basis**, which equates to approximately **1 in every 15 jobs in Cork city and county**.

  In addition, an estimated further **11,482 (Full Time Equivalent) FTE jobs** will be supported over the lifetime of **UCC's €241 million capital development plan (2016-2026)**. The approved development plan alone (which excludes key strategic projects such as the new Cork University Business School), is the largest planned by any organisation in Cork and will **impact positively on the South-West economy to the tune of €446m** including all direct, indirect and induced effects.

UCC graduates play a key role in the development of the Irish workforce

- Graduates of UCC who remain and work in Ireland, **create extra economic value** for the economy of up to **€24.8 million in the first year after graduation** when compared to non-university graduates.
- In 2016, **UCC graduated more undergraduates (4,097) than any other University in Ireland**. Furthermore, and crucially for the economy, UCC is developing graduates in the **sectors that have an economic need** and which are 'hot' in terms of graduate intake. Per 'Grad Ireland' research published in 2017, the greatest availability of jobs was in banking and financial services (32%), accounting related (16%), IT and telecoms (14%). At undergraduate level, UCC leads the way in terms of graduate numbers for business administration and law, science mathematics and computing, addressing this economic need.
- UCC's impressive 1st year retention rate of 93.4% for the academic years 2016/17 to 2017/18 puts it on a par with some of America's elite third level institutions and ahead of prestigious universities such as Boston University, George Washington University and Syracuse University.
- **Employment rates** of UCC graduates (which include those in further study) are at **historic high levels at 94%** for undergraduate level and 95% at postgraduate level.
- In pure financial terms, **the additional earning potential** (output) from being a graduate of UCC as opposed to being a non-graduate is **10.2 times the cost** (input) to that undergraduate degree.

  We have calculated that the UCC graduate premium (UCC graduate versus non-graduate) is circa €10,794 per annum. The input is the cost of the degree (€3,000 annual student contribution plus living costs of €8,018 per annum) which equates to €44,072 and the output is the additional earning potential over the lifetime of a professional career of 40 years, €431,760[48] (€10,794 x 40). Thus the additional benefit is 10.2 times the cost.

[47] Leading European Research Universities (LERU). The Economic Contribution of LERU universities 2016, published December 2017

UCC is an innovative university, and contributes significantly to business and industry needs

- UCC acts as an **attractor of foreign direct investment** (FDI) and domestic investment into the South-West Region. The growth of FDI employment in the region is highly correlated with that of UCC. The growing reputation of UCC's creation and discovery environment has helped to facilitate world leading clusters such as pharmaceuticals where **7 of the top 10 pharma companies in the world are located in the environs of UCC**, where there is a highly skilled graduate population readily available.
- UCC's research and development capabilities contribute greatly to the overall impact that the University has on the region. Through proactive collaboration, UCC has forged partnerships with many global names including Dell EMC, Intel, Pfizer, and Lilly; these partnerships have remained strong through various economic climates. **UCC facilitates the industry sector in expanding their R&D capabilities in the region**, with resulting economic impact through enhanced importance, expanded roles, and anchoring employment in Ireland.
- UCC has a huge impact on local business through the expenditure of the University itself, its staff, Irish students, recent graduates, international students and visitors alike. These expenditures impact right across the economy and right throughout the entire region.

  For example **UCC's international students** support total expenditures (direct & indirect and induced) in the Cork region of **€52.5m per annum**. This expenditure supports an estimated **1,421 jobs** in the Irish economy each year.

  Similarly, UCC's **Irish students** have direct expenditure of **€135m** in the local economy and this expenditure supports an estimated **3,675 jobs** in the Irish economy.
- The business innovation impact of UCC is plain to see. UCC has created a bespoke entrepreneurial ecosystem comprising **'Blackstone LaunchPad', 'IGNITE' and 'Gateway' as business incubators, often providing the bridge between education and business**.
- UCC provides world-class training for business people. Business talent is nurtured and developed at UCC and this commitment to the business community is reflected in UCC's plans for the **new Cork University Business School in the centre of the city**.
- The UCC owned **Irish Management Institute (IMI), significantly enhances the University's resources for its delivery of executive education in Ireland**.

UCC is driving the creation and discovery agenda in Ireland

- **UCC's €96m investment (Financial Year end 2016)** in creation and discovery means that it is the **leading Irish University** with regard to actively seeking and securing investment in research and development. Similarly, the **€10m** secured and invested by UCC's industry partners makes it **the leading Irish university by a distance** with regard to research and development investment collaborations with **Industry**.
- UCC hosts several of Ireland's elite research centres including the Alimentary Pharmabiotic Centre (APC) now known as **APC Microbiome Ireland**, recognised as world leaders in the area of food and health. Such centres are home to brilliant scientists and their inter-disciplinary work impacts the lives of millions of people around the globe. Four of UCC's top most cited researchers include Paul Ross in Food and Health Science, Elke Arendt in Food and Nutritional Sciences, John Cryan in Anatomy and Neuroscience, and Catherine Stanton in the area of Food, Health and Nutrition. In relation to **how often APC's ground-breaking work is cited**, APC has a normalised citation score of 1.83 which is **almost twice the world average**.

  APC is ranked number one globally for research in antimicrobials and probiotics (CWTS bibliometric, Leiden)

[48] The Present Value of additional UCC graduate earning potential €431,760 discounted by 3% over a 40 year period is €132,359. This compares favourably to the UK Russell Group average of £88,000 (€101,149 at 0.87 exchange rate) for the 2015/2016 period. – The Economic Impact of the Russell Group Universities. October 2017.

- **Tyndall National Institute (TNI)** through its **€30m+ turnover** each year, 250 staff and 200+ PhD researchers is the only institute of this scale nationally. It contributes to the impact of the nation at a level which is unmatched in smaller scale research and innovation centres. TNI **represents 30% of UCC's annual investment in creation and discovery**; and its international reputation is renowned. Indeed TNI's investment in research and development each year is **in itself greater than that of two of the seven Irish universities**.
- Beyond science and technology other recent outstanding achievements of scholarship include the production of **Atlas of the Irish Revolution**, published by Cork University Press and edited by John Crowley, Donal Ó Drisceoil, Mike Murphy and John Borgonovo, which was awarded the Irish Book of the Year 2017. Incidentally, UCC is one of only two Irish universities with its own publishing house.
- The creative voices of the UCC community are internationally known – Seán Ó Ríada, Seán Ó Faolain, Frank O'Connor, Aloys Fleischmann, John Montague, Seán Ó Tuama, amongst others. UCC academics frequently participate in national documentary series, as well as working as consultant academic advisors on major films.

The societal impact of UCC is as wide as the economic impact is deep

- UCC **shapes and impacts the physical landscape of Cork as much as it's' heritage and culture**. UCC's €241m development plan (2017 to 2022) is the largest planned by any organisation in Cork. Developments such as the new Cork University Business School are a further testament to UCC's commitment to the city and region.
- UCC significantly impacts on our society and in our community. **UCC's impact on social responsibility and the promotion of responsible processes** is noteworthy. UCC helps shape the minds, perspectives and futures of the 25,000 people on a daily basis including students, full-time and part-time staff. This is a population equivalent to the size of Kilkenny City. As influencers, responsible processes garnered on campus by the patrons of UCC, reflecting the ethos of UCC, are promoted locally and globally.
- UCC is a **truly international university**. Circa 17% of the student population and 30% of the staff originate from overseas. This is equally true of UCC's 'Quercus' talented student programme, which currently has three global teen leaders, two outstanding young people of the world winners, and three of Times Magazine's most influential teenagers in the world. UCC invests approximately €600,000 a year on talented students right across the spectrum including sports, citizenship, entrepreneurship, academic and the performing arts.
- UCC has a very **proud sporting tradition** and the first university club founded was the Rugby club back in 1872 with the famous skull and crossbones being introduced in 1880. Today UCC has 58 sports clubs with local, regional, national and international athletes operating from its renowned Mardyke Arena base.

  In addition UCC has 103 different student-led interest societies which run an average of 40 events per week.
- UCC is the primary academic partner supporting nine hospitals in the South South-West Hospital Group. UCC impacts positively on the health of Ireland's citizens. In 2016, **UCC graduated more primary degree health and welfare professionals** (almost 24%), than any other Irish university, a hugely significant contribution to our health service.
- UCC has taken a lead role nationally in relation to **widening participation** and access to third level education for all. Over 23% of UCC's undergraduate intake is mature students, students with disabilities or non-traditional college-goers.
- UCC has a **tradition of promoting equality, diversity and inclusion for all**. UCC was a leading Irish university in the admission of female students (1885), the first to appoint female professors (1910); in 2017 it built on this heritage and established an **Equality, Diversity and Inclusion Unit** on campus. Moreover, UCC has become a designated Sanctuary University; 2018 will see UCC awarding seven scholarships to people from the refugee and asylum seeker community.

- UCC considers itself to be in the **community and for the community**. From 'real' research engagement through interdisciplinary projects such as **Entrust**, to UCC's series of public lectures and seminars, **UCC's CARL initiative**, UCC open days, visitor days and the wonderfully successful cultural night, UCC is open to all.

  UCC is the only **Irish university running a junior conferring programme** for primary school students from all over the region. In June 2017 UCC graduated its 70,000th primary school student, a significant milestone for this programme.

  UCC's community outreach was formalised in October 2017 through the publication of **it's first Civic Engagement Plan** for the period 2017 to 2022.

- The University has in its care collections, artefacts and archival material which are of national and international significance, including the Seán Ó Riada Collection; the George Boole Archive; the Bantry House Archive; a collection of Gaelic manuscripts (including the Torna Collection) and the Great Book of Ireland.

- UCC was the **first university in the world** to be awarded a Green Flag from the Foundation of Environmental Education. Over ten years on, UCC continues to lead the way in relation to impact on the environment and sustainability and through its actions and leading-edge work at the Environmental Research Institute (ERI) and Marine and Renewable Energy Institute (MaREI), UCC continues to champion action in relation to climate change and sustainability.

In its totality, this report delivers a detailed understanding of the broad scope of the economic value added by UCC and takes a granular look at UCC in order to provide the college stakeholders with an accurate sense of the University's impact on the region and wider economy. It is hoped that this study may become a template for Irish universities and might inform the national cost benefit debate in favour of additional investment for higher education. The recommendation is that a national report be prepared in relation to the combined impact of the Irish universities. Finally, the outputs of our study support the business case for continued inward investment into UCC by both public and private stakeholders alike.

7.2 Final word on impact

Universities transform lives and shape society. They are also a major driver of growth and economic well-being of the citizens. In line with a recent LERU (Leading European Research Universities) report, the evidence demonstrates how UCC constitutes a powerhouse within the Irish economy.

At the most fundamental level, UCC is a major organisation with a significant role to play in Cork and the South-West economy. It anchors institutions in the region, acts as a major employer to thousands of people across many occupational areas, purchases enormous quantities of goods and services and is a major contributor to cultural life and the built environment. Indeed, the investment in the infrastructure of UCC to support its core business has its own important regional economic impact.

UCC also plays an important leadership role, regionally, nationally and internationally through its involvement in the advisory boards of private, public and non-profit organisations. UCC acts as a repository of best practice, bringing global thinking to bear locally. Volunteerism is commonplace among UCC's stakeholders. Staff and student bodies undoubtedly contribute to the vibrancy of Cork and the surrounding area. UCC also contributes to the attractiveness of the South-West Region as knowledge centre and this is evidenced by the correlated growth of IDA companies in the South-West.
UCC's impactful role in the region was highlighted in a recent HEA Report in relation to the destination of Irish graduates. Approximately 42% of all Irish third level graduates now move to Dublin to take employment, of which 17% were in employment in the South-West but, primarily, in Cork. This compares very favourably with the South-East, the Midlands and the Border regions, where there are no universities and where the employment rates for graduates are 4%, 2% and 3%, respectively.

UCC provides a space for discussion and creates connections between academia, students and companies that would not otherwise exist. This fosters an environment for innovation. It creates clusters of people, which lead to the creation of entire university ecosystems, which in turn draw more people to Cork. The South-West Region, because of UCC and its university ecosystem, has become an attractive place to invest.

A research-led university like UCC is of crucial importance with regard to driving innovation. It contributes to improved productivity, entrepreneurialism and the generation of "knowledge spill-overs", where information and knowledge collected generate new ideas and new applications. UCC is a vital source of technological innovation through commercialisation activities such as spin-out companies and intellectual property licensing, and UCC is adept at commercialising their research licensing. UCC also enables businesses to access academic specialists, creating opportunities to transfer knowledge into new areas.

Summing up its core contribution to the economy, UCC contributes directly by generating income and employment, but also by spending on supplies and services, by providing income to their staff, and through capital spending. UCC also contributes via students' spending, working, volunteering and undertaking placements, by knowledge transfer, entrepreneurial and innovation activity, via tourism activity of visitors to staff and students and events held at the universities and by lifetime productivity gains from teaching and learning delivered by UCC – the 'graduate premium'. One cannot overlook the role of UCC as a talent attractor to the region especially at PhD and post-doctoral level, many of whom impact significantly on industry as well as within the University.

The fiscal report primarily looks at UCC in 2016, as an isolated year. However, the long-term dynamic economic and social impact is much more significant. Talented graduates and professionals transform the organisations within which they work, and with UCC, act as a local as well as global hub for knowledge production and exchange.

[49] Leading European Research Universities (LERU). The Economic Contribution of LERU universities 2016, published December 2017

[50] HEA – The Class of 2016. January 2018.

7.3 Closing word from international reviewer

The analysis in this report demonstrates the significant and important impact which University College Cork contributes to the economy of Cork and the South West and the national economy of Ireland.

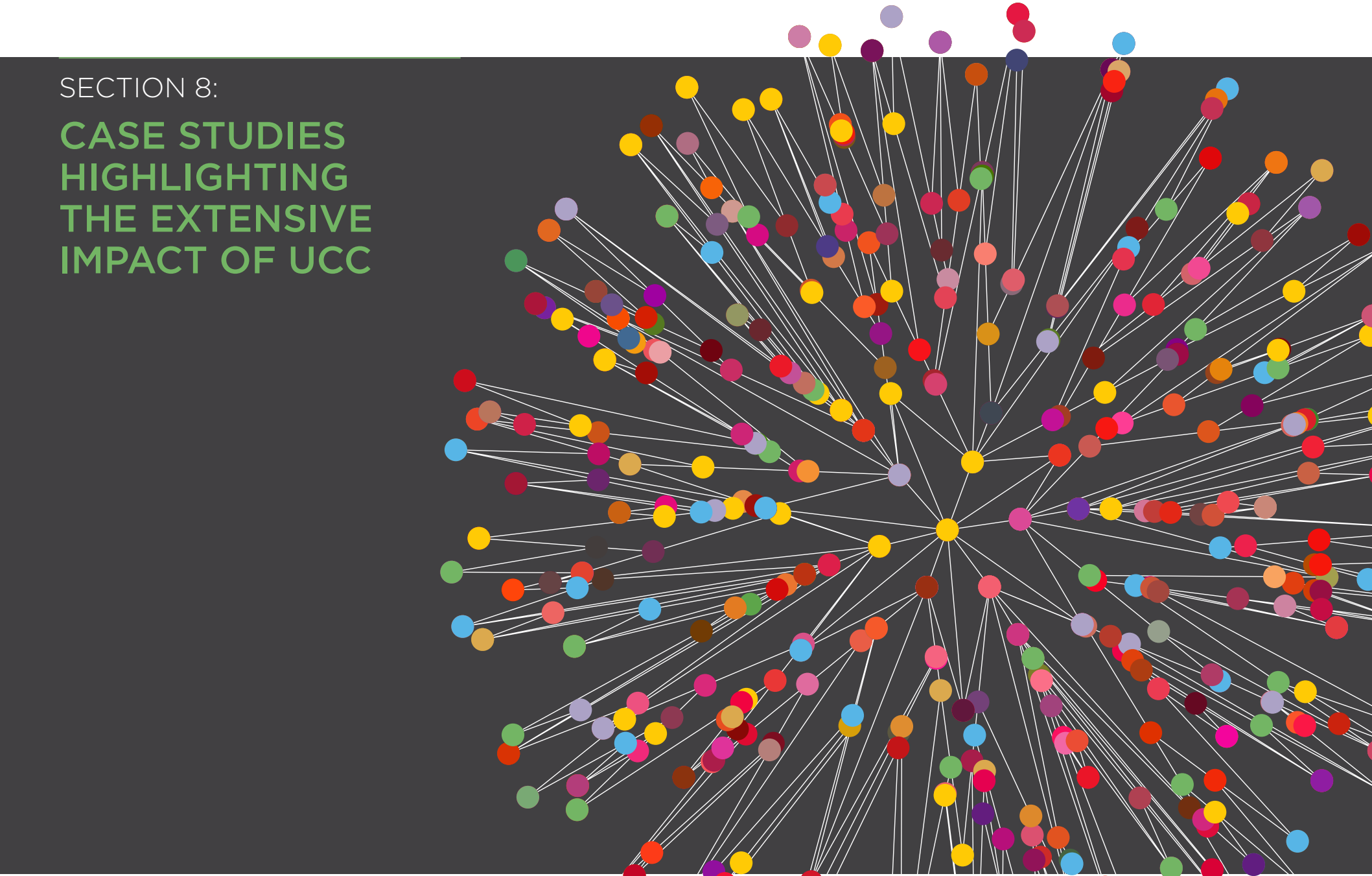
This is an excellent report. The economic impact analysis on which the report is based is of very high quality, drawing on best practice in similar studies in Ireland, the United Kingdom and the rest of Europe. Unlike many such reports on the impact of higher education institutions, the authors have been able to calculate both economic and wider social impacts. The report covers all of the direct, indirect and induced impacts of the research and teaching at UCC, and also the University's significant impact on the business environment in Ireland, and on society and the local community.

UCC has grown rapidly in recent years to become an engine of growth for the Irish economy, and it has combined this with a major contribution to the public good in its locality. Given this, it's not surprising that UCC has a growing reputation across Europe.

Professor Sir Anton Muscatelli (External Reviewer)
Economist, Principal and Vice Chancellor of the University of Glasgow
Chair of the Russell Group of Universities

SECTION 8:

CASE STUDIES HIGHLIGHTING THE EXTENSIVE IMPACT OF UCC



SECTION 8.1: Case Studies highlighting the excellence of UCC's R & D capabilities

CASE STUDY 8.1: Health, including chronic and infectious diseases – INFANT

The Irish Centre for Fetal and Neonatal Translational Research (INFANT) as it is appropriately referred to, is a great example of a UCC research centre which is having a global impact. Funded by SFI, this is a world leading research centre in the critical area of maternal and child health.

Of the approximately 130 million babies born worldwide each year, 300,000 mothers die, 2.6 million babies are stillborn, and another 2.8 million babies die in the neonatal period. These are frightening real life numbers and highlight the magnitude of this global issue. Added to that is the fact that perinatal disease accounts for 10% of the global health burden, and we can begin to understand why INFANT was established in 2013.

Founded by Prof Geraldine Boylan, a professor of Neonatal Physiology, Paediatrics and Child Health and Prof Louise Kenny from the Department of Obstetrics and Gynaecology the Centre has a dual approach. It uses a unique blend of bio-medical scientific and engineering research with clinical insights and application to tackle problems during pregnancy and after birth. INFANT is Ireland's first and only perinatal research centre. It is the only Irish institution with documented commitments to the United Nations Global Strategy for women's, children's and adolescent's health. It is an active member of the World Health Organisation's partnership for maternal, new-born and child health.

Located on-site at Cork University Maternity Hospital, INFANT's infrastructure revolves around laboratory facilities, a 1.5m bio specimen biobank, physiology data banks, HRB mother and baby clinical trial network as well as access to 9,000 births per year at the hospital. The physical spaces are state-of-the-art, from clinical settings to assessment rooms and reflect the investment and commitment made by the Centre's many funders. It is that investment which has allowed the Centre to grow, develop and transition organically in its first 5 years and establish itself as a world-leading perinatal and translational research centre with an ambition to become a world-leading maternal and child health research institute. This transition is reflected in INFANT's research agenda, which is now not only based on pregnancy, birth and infant health but also encompasses child health and maternal health as well. The agenda spans biomarkers (predictive diagnostic tests for mothers and babies), biomedical engineering (tools for monitoring, diagnosis and treatment), connected health (use of technology to promote healthcare remotely), nutrition (promoting the best for mother and child) and therapeutics (developing and testing treatments and care interventions for women & children).

Some of INFANT's ground-breaking work include the development, licensing, and leading of a multicentre clinical trial for the world's first automated neonatal seizure detection algorithm, a similar role in the world's first early pregnancy screening test for preeclampsia as well as discovery and validation of the first early blood biomarkers of brain injury in new-born babies.

INFANT's impact is much more than the pure positive impact on maternal and child health and the wider society. It has developed companies, created employment and helped deliver crucial products to the marketplace. It consistently engages internationally and is keen to continue attracting the world's top research talent to Cork. Its fantastic public engagement, in the form of school programmes, public programmes and initiatives, helps build a bridge between the ground-breaking work and the public. INFANT continues to advance, advocate and influence national and international healthcare policy. In doing so, it is developing its staff and creating leaders and future champions in maternal care for the betterment of society and the healthcare industries. It is without doubt a major global force for innovation in maternal and child health.

CASE STUDY 8.2: Culture, society, rights and identities – Institute for Social Sciences (ISS21)

Twenty-first century Ireland has witnessed a series of social, cultural and economic transformations, which pose significant questions about how to create a more just, equal and liveable society. From the impacts of austerity on local community organisations, to young people's mobility and employment trajectories and exploring how we might better listen to the voices of marginalised groups in policy-making processes, ISS21 seeks to develop, sustain and promote impactful social science research in Ireland that addresses the social, economic and political challenges that affect everyday life in 21st century Ireland. With members from 14 Schools and Departments across the University, the Institute's interdisciplinary research clusters focus research activities around key thematic specialisms, including children and young people, ageing, caring, disability and mental health, migration and integration, gender and sexuality, and civil society.

The Institute's economic impact has been felt through the €4.6 million secured in external research funding since 2008 from sources including PRTLI4, EU 7th Framework, Horizon2020, National Disability Authority, Cork City Council, CARDI and the Irish Research Council. Through this funding, ISS21 research is contributing in a critically informed way to addressing some of the key social and political questions facing Irish society today.

Current and recently completed projects examine issues of key societal significance, including gender in/equality in higher education (GENOVATE), energy citizenship and the social dimensions of moving to a low carbon economy (ENTRUST), youth mobility in Europe (Y-MOBILITY), disabled people's geographies of fear of hostility, violence and (un)safety (SAFE(R) SPACE), tenant precarity in the context of Ireland's housing crisis, and the lives and experiences of carers after they finish caring roles (POSTCARE). The varied outputs from these and other projects include international peer-reviewed scientific articles, books, research reports, and media aimed at different audiences, including research summaries, short films and newspaper articles.

Through its success in winning networking grants, and the work of its research clusters, ISS21 has had significant capacity-building impacts in terms of developing engaged research landscapes with external bodies and organisations. Forging collaborations with community and voluntary sector groups, and public bodies, Institute members have raised issues of policy concern for communities in the areas of housing, ageing, caring, disability rights and mental distress, and children's rights. Collaborating organisations have included Respond! Housing Association, Threshold, Carers Alliance, West Cork Carers' Support Group, Headway (Brain Injury Services and Support), Critical Voices Network, and Wallaroo Playschool. The Institute hosts an extensive series of workshops and conferences, many of which bring academics together with community and advocacy groups, and policymakers. In the past two years, it has hosted some 13 events, including symposiums on Looking Ahead: Brexit, Borders and Belongings (Migration and Integration Cluster), Eldercare Consumption, Service Provision and Cultures of Care: International and Interdisciplinary Perspectives (Ageing Cluster) and Interdisciplinary encounters: neuroscience, social science and the politics of research (Children and Young People Cluster, and Disability and Mental Health Cluster). Through these events, Institute members are shaping debates of public and policy concern in Ireland.

ISS21 projects and events have had recognisable policy impacts at a local and national scale. Findings from the GENOVATE project, for example, contributed to the HEA's (2016) *National Review of Gender Equality in Irish Higher Education Institutions*. Meanwhile, members of the Children and Young People cluster have conducted extensive work for the Department of Children and Youth Affairs in the area of children's participation, the sexualisation of childhood, and children's involvement in urban regeneration. This work has brought innovative and creative research methodologies into the children's policy arena in Ireland, and directly informed the writing of the *National Children and Young People's Participation Strategy.*

CASE STUDY 8.3: Financial and business services – FinTech at UCC

University College Cork is a global leader in FinTech (Financial Technology) research. This reputation is due to the scientific excellence and world impact of the research being conducted here. With this expertise, the University plays a leading role in positioning Ireland as an international destination of choice for IFS foreign direct investment, supporting the governments IFS2020 strategy to grow IFSC employment from by 100,000 nationally by 2020. In the last 5 years, there has been a €10 million investment in FinTech research and development. UCC has been chosen as one of only two global centres of excellence for FinTech research by international bank State Street and the location for the first international Centre for research into Governance Risk and Compliance Technology, by the IDA and Enterprise Ireland. The research investment has led directly to over 100 highly skilled jobs and over €30m in total economic impact.

The basis of the success of UCC in FinTech research is the unwavering focus on delivering world leading international undergraduate and graduate programmes in Finance and Information Systems, with over 1,000 students in programmes in these domains each year. These finance programmes are accredited by Chartered Financial Analyst (CFA) Institute, the gold standard international accreditation for International Financial Services, the Chartered Alternative Investments Analyst (CAIA) association and the Chartered Institute for Securities and Investment (CISI), while the Information Systems programme has the largest internship into US based IFS companies of any programme in Europe. This long history of success in training and education has led to the development of strong partnerships with global leading IFS firms, including Fidelity and State Street.

Building on this history, in 2007, UCC launched the first two centres in Ireland focused on IFS, the Centre for Investment Research (CIR) and the Financial Services Innovation Centre (FSIC). The CIR is focused on scientific excellence with strong research collaborations at world leading international business schools including Warwick, CASS, Cambridge Judge and the University of Miami. In 2013, Investanalitix, an institutional investment research and consulting company specialising in fund manager search and selection, spun out of the centre's scientific research. The focus of the FSIC is the application of technology and innovation to the financial services industry, including policy making. One project to come from the centre is Boole Business Labs, which works closely with industry partners with strong collaboration with Dell/EMC, including a joint research programme. The FSIC has also had a role in international policy making, in 2016 publishing a commissioned report for the European Commission's Directorate General for Financial Stability, Finance Services and Capital Markets Union.

In 2012, UCC was chosen by the IDA and Enterprise Ireland for the first technology centre in Europe to be focused on Governance Risk and Compliance technology. Following the financial crisis in 2008, there has been rapid growth in regulation, with over 50,000 regulations published across the G20 since 2009, while in the period 2007-16, $321 billion in fines were incurred by IFS companies. Since the Centre's inception, it has had significant research impact. Critically, the GRCTC shapes the policy of leading international organisations including the Enterprise Data Management Council, UK Financial Conduct Authority, Bank of England, and RegTech Council. Its industry membership has grown from 12 founding FinTech/RegTech companies to over 40, investing over €6.8m in research and development, and delivering 12 core projects, 12 invention disclosures and 4 licences and over 54 international academic and industry publications and presentations.

In December 2015, State Street, UCC and Zhejiang University in China announced a collaboration to launch a technology centre at UCC. Zhejiang University, which is ranked in the top 100 universities in the World, has been partnering with State Street for 14 years on research and development and hosts a State Street Zhejiang University Technology Centre, with over 1,500 staff. The UCC centre builds upon these activities and is the only other centre of this nature globally. The research and development partnership is focused on fundamental and applied research and development, balancing scientific excellence with industry impact.

One project, which involved collaboration with State Street's Dublin office and Chief Scientist in the US, is a joint research and development project with UCC, which is both creating new knowledge and developing open industry standards for the benefit of all stakeholders in the financial services ecosystem. UCC has developed a proof of concept which takes a data set (from multiple sources)

used in quarterly reporting and leverages semantic modelling to aggregate that information. In total, it is estimated that 200 person-hours per quarter would normally be spent preparing this report. Some of the aggregations that used to take 3-4 hours individually can now be accomplished in 3-4 seconds and the quality of the reporting is dramatically improved. This new technology has the potential to have tremendous benefits for society at large, and not just the financial services industry.

CASE STUDY 8.4: Food and health – Dairy science at UCC

UCC has been involved in producing the leaders of the national and global food sector for almost a century. Today, just as the food industry continues to go from strength to strength, so too education in food science and demand for UCC graduates has never been as high. Effectively, there is full employment for graduates, the majority of which will go on to serve the food sector within Ireland. Others, as we will see, will go on to central roles in the global food market. Key to the education principles in UCC food science has been research-led and informed teaching and the close links to the food industry. The latter reflects the long-standing linkages created by generations of graduates as well as the inherently applied nature of food science research.

University College Cork has enjoyed a long, successful and ever-expanding, strategically important role in educating and training high calibre graduates as well as providing upskilling and continued educational courses for those already in the workforce. Nowhere is the strategic importance of UCC more prevalent than in the area of Dairy Science, where UCC enjoys a rich tradition, by far the most established of any of the Irish universities. The first PhD for research in food was awarded at UCC in 1928. Professor Pyne's work in relation to milk salts continues to be cited 60 years on from that ground-breaking work and, indeed, another UCC professor, Patrick Fox, has impacted the global dairy sector in a profound manner such that UCC is now at the centre of the **largest dairy research cluster in the world**.

Central to the impact of UCC on dairy science in Ireland has been the expanded research and development capabilities in the region because of UCC's close industry links. Global food companies such as the Kerry Group and Glanbia have established relationships with UCC and have on-going collaborations and inward R&D investments with UCC. For example, both, together with Carbery, Dairygold, Tipperary and several of the other regional co-ops have strong active engagement with UCC through the **Dairy Processing Technology Centre (DPTC)**. Such R&D impact has been particularly strong over the past 20 years or so. In addition, the impact of the knowledge transfer to industry by UCC is noteworthy. For example, most of the current 60 or so PhD students in the area of food may be viewed as being high calibre apprenticeships for industry. Similarly, the Food Industry Training Unit (FITU), which has been in operation

for over 26 years, makes UCC a leader in terms of continued professional development for those already employed in the food sector. This industry-led unit provides flexible part-time certificate and diploma qualifications in Food Science and Technology, management development programmes and a host of short courses and workshops for the wider food industry. FITU also deliver speciality and artisan food programmes customised to assist with growth and development of the SME sector of the food industry.

The interconnectedness of food research and development across the University, with areas such as food business, nutrition and health, engineering and microbiology means that UCC has unrivalled, wide-ranging, food expertise (e.g., dairy science inter-disciplinary research with UCC's APC Microbiome Institute). Collaborations with Beijing Technology and Business University and the ability to attract top class talent to the region further enhances UCC's food reputation worldwide. Similarly, UCC's unique relationship with Teagasc in the form of a strategic alliance means that UCC has a unique food proposition to industry and helps maintain UCC's position at the very forefront of dairy science research, globally.

According to Dr Seamus O'Mahony, "Research and teaching at UCC in strategic areas such as ingredient, formulation, material science and processing technology are fundamental to maintaining and developing those standards and attracting continued investment in the sector by value-added food ingredient companies and food formulators."

An example is the infant formula industry; Ireland currently produces approximately 10-15% of the total global supply of infant formula, with the industry consuming large quantities of Irish-produced skim milk, whey protein and lactose ingredients. UCC has a unique, proven ability to meet the research needs of such an industry by combining internal resources across food science and technology, nutrition, microbiology/biotechnology, material science, process engineering. UCC has strong links with several of the major infant nutritional companies (e.g., Wyeth/Nestle, Abbott and Danone) globally.

Infant Milk Formula sits at the interface of the dairy and pharmaceutical industry sectors. Irish milk is safe, nutritious and of the highest quality. An outward looking policy stretching back to the 1970s, the availability of talented graduates and indeed an oversupply of milk-related products (Ireland produces enough milk-related products to feed 36 million people) has placed Ireland and UCC at the core of this importantmarket. It is a highly sensitive marketplace too, as IMF is the sole source of food and nutrition for new-born infants and formulated milk products can be used up to 7 or 8 years of age in certain markets internationally.

If we consider some of the inward investment to this marketplace in recent times, we can see the impact that it is having on the region. Dairygold, the **largest farmer-owned co-op in Ireland**, has invested €86m in Mallow recently in the development of its new Nutritional Campus.. Kerry Group in Charleville manufacture and package infant formula, mainly for the export market (e.g., China), which has an even greater impact on the region because of the ancillary jobs in quality, marketing, administration etc. Danone in Macroom manufacture infant milk formula. Several of these companies have established R&D centres which are populated to a large degree with UCC graduates. Furthermore, there is significant business to business benefit in that infant milk formula represents a major market opportunity for ingredients for the dairy co-ops such as Carbery Group. and Dairygold Co-operative, as they supply ingredients such as skim milk powder, lactose and whey powder for the manufacture of infant formula.

The future of this '**white gold**' product type/market for Ireland is most definitely based on an R&D focused structure supported by the state. UCC's nutritional sciences research supports development of this segment It is also informing state agencies and regulatory agencies as well as leading-edge research in collaboration with the maternity hospital with regard to the properties of human milk. Collaborations with food science, APC Microbiome Institute and Cork University Maternity Hospital again highlights the world-leading inter-disciplinary nature of the R&D capabilities at UCC. UCC's engagement with the market goes beyond direct R&D supports, as each year, UCC students go to companies on work placements, work on various research projects while in industry as part of their studies and many are employed by these companies on graduation. This is in addition toconstant stakeholder engagement in the form of site visits and training (Continuing Professional Development) via UCC's Food Industry Training Unit.

In recent years, national strategy and demand from industry have resulted in a considerable increase in the numbers of students progressing to further study (at MSc and PhD levels). The very successful initiative – the Department of Agriculture, Fisheries and Food-funded Agri Food Graduate Development Programme – is at the cutting edge of graduate training and development, ensuring that MSc and PhD graduates have the skills necessary to hit the ground running in the food industry. UCC has been central to the success of this initiative building on its tradition in dairy science. Is it any wonder that **UCC alumni are at the head of some of the world's largest dairy research centres in for example, the USA, New Zealand and the Netherlands**, all headed by UCC graduates, indeed, **all former PhD students of UCC's Professor Patrick Fox**.

The future of dairy science is bright at UCC. Later in 2018, UCC will launch its **Food Institute**, which will provide a single, overarching, outward-looking and industry facing structure to food engagement at UCC. In addition, UCC is expanding its suite of top quality food-related programmes. In addition to the BSc degree in Food Science, there are three other BSc degree offerings in the area of food at UCC: BSc in Nutritional Sciences, BSc in Food Marketing and Entrepreneurship and BSc in International Development and Food Policy with the use of subject matter experts being central to these programmes. For the first time, UCC will also be offering an **Agri-Science Degree** in the very near future.

CASE STUDY 8.5: Future and emerging technologies – Tyndall National Institute

The primary role of Tyndall National Institute is to provide a national focal point for excellence in research, development and graduate training in information and communication technology (ICT). It is recognised as an international leader in materials, devices and systems research particularly as applied to the fields of Communications, Energy, Healthcare and the Environment with the underlying objective of having a significant impact on economic development in Ireland. This is detailed in the Institute's Strategic Plan 2013 to 2018 – Impact from Excellence.

Tyndall National Institute was established in 2004 from what was previously the National Microelectronics Research Centre (NMRC), itself founded in 1982. Tyndall was established to undertake research and development and graduate training in support of nascent electronics industry; the Institute is now a powerhouse of research activity and a leading European research centre in integrated ICT hardware and systems. Specialising in both electronics and photonics – materials, devices, circuits and systems – it is globally leading in its core creation and discovery areas of:

- Smart sensors and systems
- Optical communication systems
- Mixed signal and analog circuit design
- Microelectronic and photonic integration
- Semiconductor wafer fabrication
- Nano materials and device processing

Central to the Institute's mission is delivering economic impact through research excellence. It works on the cusp of industry and academia to transform research into products in its core application areas. With an annual turnover of nearly €36m, the Institute has almost 450 researchers, engineers, support staff, postgraduate students, interns and industry researchers-in-residence at its Cork City centre campus.

The headcount at Tyndall National Institute has grown phenomenally over the past 15 years, from 133 in 2002 to 445 in 2017. Spin-off companies include high potential start-ups of the calibre of Farran Technology, Firecomms (since acquired by a Chinese company), SensL as well as InfiniLED, the story of which features in Section 5 of this report. Another excellent example is that of of PixAPP, it is the world's first open access Photonics Integrated Circuits Assembly & Packaging Pilot Line. It is a significant EU-wide initiative coordinated by Tyndall and it is highly likely that there will be spin-off potential from the activity in the future.

Tyndall is a stand-alone national institute established and governed by an agreement between the Irish Minister for Business Enterprise and Innovation and University College Cork. It operates as a discrete business entity subject to the appropriate and over-riding financial and governance framework within UCC. It provides the highest quality facilities and support for both academia and industry, educating PhD students and training post-doctoral staff, in partnership with the relevant academic schools and departments in UCC, Cork Institute of Technology as well as other Irish third level institutions. Straddling the boundary between fundamental and applied research and industrial development,

Tyndall aims to develop its technologies and inventions into useful applications to provide significant contribution to economic development and employment nationally. A by-product of its work is that it generates over 230 peer-reviewed publications annually. It collaborates with around 200 industrial organisations world-wide each year and has an impressive track record in strategically important EU programmes.

The Tyndall National Institute also hosts a number of agency-funded research and technology centres, with a focus on industry-led, impact driven research in the areas of:

- Photonics integration and bio-photonics (IPIC)
- Analog mixed signal circuits (MCCI)
- Integrated sustainable energy systems (IERC)
- Future networks and communications (CONNECT)

Other centres with significant activities based at TNI include 'Confirm' (smart manufacturing) and 'Future Milk' (smart dairying). Similarly, the institute is home to the European Space Agency's Space Solutions Centre Ireland, a collaborative business incubation centre that seeks entrepreneurs with innovative ideas for using space technology to develop new products and services in a non-space environment.

Tyndall National Institute is a unique model in Ireland and within Europe, bridging the gap between excellent fundamental research and practical industrial development. In particular, the co-location on a single campus of fundamental industrial driven work and the staff undertaking same provides an especially stimulating environment within which innovation can be fostered, ultimately to the benefit of the regional and Irish economy. The Tyndall National Institute undoubtedly plays a key role in expanding the R&D capabilities in ICT of Ireland. IDA and Enterprise Ireland delegations are regularly on campus as Tyndall National Institute acts as an attractor of FDI for Ireland and for Cork, given its status on the international stage.

Tyndall has relationships with global leaders such as Intel, which stretches back as far as 1989 when Intel's first manufacturing plant was established in Ireland. The relationship has matured over time and is now firmly built on collaboration and productive partnership. In 2010, Intel commenced a major research programme with Tyndall, which was renewed in 2012 when Intel announced further commitment to invest $1.5m in research to be carried out on site over the following 3 years.

Overall, Tyndall has a €200m capital infrastructure base and an income of €36m, of which 85% comes from competitively-won contracts. Its researchers and graduate students reflect Tyndall's international reach and over 44 different nationalities are represented on campus at Tyndall.

Tyndall is an international leader in integrated ICT research and is striving to raise the technological base in Ireland. It is synonymous with the delivery of disruptive technology solutions. We have seen first-hand how it has acts as a catalyst for the generation of high tech business, jobs and growth in the economy. It is a national and global partner of choice facilitating an enabling R&D and innovation in Ireland to help delivery of national objectives.

It is a primary source of highly skilled people and its alumni have gone to senior positions, such as Denis Doyle, VP of Analog Devices and Anne Kelleher, Corporate VP at Intel. Finally, the strategic national asset that is Tyndall National Institute acts as a gateway to industry from academia and has a crucial role to play in relation to technology transfer. A truly international success story on our doorstep.

CASE STUDY 8.6: Gender, equality and diversity – GENOVATE

Funded under the European Union's 7th Framework Programme, the GENOVATE project at UCC was part of the cross-European GENOVATE Consortium project that ran from 2013 to 2017. The other partners were the University of Bradford, Lulea University of Technology, Ankara University, Università degli Studi di Napoli, Trnava University in Trnava and Complutense University of Madrid. GENOVATE sought to ensure equal opportunities for women and men by addressing gender inequalities in research, innovation and scientific decision-making bodies, with a particular focus on universities. A key objective of this action-research project was not solely to investigate, but to actively change gender equality policies and practices within and beyond its member institutions.

GENOVATE within UCC has been an exemplar of an action research process, and its achievements are clear to see. Developing nine gender equality actions for the University based on rigorous research and analysis, GENOVATE contributed to a heightened awareness of gender inequalities at all levels within the University, including securing commitments from senior management to implementation of all of its actions. Its participatory approach, which involved engaging staff and other stakeholders in identifying gender equality issues and solutions through GENOVATE Cafes and other events, was a key element of the project. The multiple resources generated from the project remain available at GENOVATE's online hub, which was launched in September 2016. These resources provide tools for individuals and other organisations to use in working to address gender inequalities in higher education and research. The project's achievements are reflected in the UCC project team's receipt of the award of UCC Research Team of the Year 2017.

The GENOVATE project has made a significant contribution to national and international policy debates and synergies around these issues through its events and outputs. The project's impact can be seen nationally in the clear influence that GENOVATE had on the Higher Education Authority's (2016) National Review of Gender Equality in Irish Higher Education Institutions, a review in which GENOVATE is extensively cited. It is expected to have a significant impact on the higher education sector into the future, as reflected, for example, in government's recent announcement of plans to establish a

Gender Equality Taskforce for Higher Education. Internationally, the project at UCC provided support and training to their GENOVATE partner at University of Naples Federico II in establishing the first ever female-only academic mentoring programme in an Italian university. The GENOVATE team also led the production of the GENOVATE consortium's Contextualised Guidelines for universities and research organisations, and contributed, in conjunction with cross-European GENOVATE partners, to the production of multiple resources, including the innovative GENOVATE Model, aimed at promoting gender equality in higher education across Europe and beyond.

CASE STUDY 8.7: Human health, activity and social wellbeing across the lifespan – APC Microbiome Ireland

APC Microbiome Ireland links Irish Science with industry and society through excellence in research, education and outreach in the crucial area of gastrointestinal health. This SFI Research Centre is built on the premise of people working together across the boundaries of traditional research sectors. It has created a lively, trans-disciplinary environment with clinicians, clinician-scientists and other scientists from diverse backgrounds working in teams, sharing ideas and resources. Although focused on the magic and mysteries of the gastrointestinal bacterial community (the microbiota), the scale and scope of the work has become one of the fastest moving areas of biology, of relevance to all branches of human medicine and veterinary science and is of growing importance to the economic welfare of society.

APC Microbiome Ireland began life in 2003 as the Alimentary Pharmabiotic Centre, with a focus on the role of the microbiome in host health. While it was predicted that the microbiome would become an important research topic, the Institute could not have foreseen the explosion of interest in the field. The Institute has grown and evolved in the last 13 years, bringing it to a point where it is the single largest centre globally devoted to microbiome research. It has been expanded from an initial single industrial partner (Alimentary Health Ltd) in 2003 to now having a portfolio of 39 industry projects with companies which are engaged in collaborative research with the Institute.

The key achievements of the APC since its foundation in 2003, and in particular since 2013, remain firmly aligned and consistent with the mission of the Irish Government and SFI, whose mission statement embodies three areas: scientific excellence, impact and educational outreach. SFI will progress Ireland's society and economy by supporting the best scientific and engineering research while building an awareness of the role, impact and opportunities science creates.

In broad terms APC Microbiome Ireland has impact across 5 key areas as follows:

Human Capital Impact: The Institute is extremely proud of its development and attraction of a highly skilled workforce which is in demand by industry and academia alike. In the period 2003 to 2017, the Institute developed an impactful body of 543 alumni, including 120 who have moved and transferred knowledge to industry, 181 who represent faculty and research staff and another 242 others, including consultants, general practitioners, nurses, teachers, librarians etc. In respect of creation and discovery, APC is home to numerous and frequent young investigator award winners as it continues to invest in its people through a number of developmental programmes. The institute is truly international as nearly 30% of all researchers are non-Irish. The Institute hosts 5 Horizon 2020 Marie Curie fellows, it facilitates international sabbaticals as well as international industry exchanges with the likes of Suntory, Caelus and Jansen.

Scientific Impact: With regard to science, the Institute has been ranked for citations in the top 5 microbiome centres worldwide and ranked number 1 in Europe. This is evidenced by the following APC normalized citation score of 1.83, which is almost twice the world average. 21% of APC papers are in the top 10% of the mostly frequently cited papers. 36% of publications are internationally co-authored, 9% industry are co-authored, and 10% publications are cited across 128 patent families. This scientific impact is hugely significant in the context where papers with industry co-authors have highest impact and indeed papers with international co-authors have a very high impact. Furthermore, APC professors Dr John Cryan (2014 report) and Dr Paul Ross (2015 report) were in the top 1% of highly cited researchers, which is fantastic for the global reputation of the Institute.

Economic Impact: APC directly supports over 270 highly skilled jobs, is responsible for €46.3m in leveraged funding, has 39 current industry projects. APC has a total industry investment in creation and discovery of €22m to date, with another €15m or so committed funding as well as nearly €5.5m pending to October 2017.

The Institute is hugely active across the R&D pipeline, from discovery to pre-clinical and clinical to product, and this activity includes collaborations with some of the top global pharmacy and health companies. The Institute not only helps to underpin thousands of jobs in the food and pharmaceutical sectors in the south of Ireland, but also is directly responsible for attracting nine companies to invest in Ireland that would otherwise not have a foot-print in this country.

Spin out companies include Atlantia Food Clinical Trials, Tucana Health and Artugen therapeutics, each of which are established companies in their own right now and who employ 40 highly skilled people, a lasting legacy for the local economy. Including inter-disciplinary work at UCC to which APC has been associated with, the institute has been involved in 41 invention disclosures, 17 patents and 21 licence, option and assignment agreements.

Societal Impact: The societal impact of APC Microbiome Ireland centres on health, wellness, education and public engagement. In relation to health practice, the Institute has been responsible for the introduction of, among others, FMT to Ireland, a reduction in CT radiation and the introduction of probiotics into neonatal intensive care at Cork University Maternity Hospital.

In relation to health and wellness policy, the Institute has influenced innovative medicines, regulatory policy, Probiotics and Prebiotics Consensus, National Dementia Strategy, Arthritis UK, microbiome and Food Wise 2025, among others.

With regard to bringing an awareness of science to society, SFI has commented that, *"APC has developed an energetic expansive programme of education and outreach that would be the envy of many larger and even national organisations."*.

Miscellaneous Impacts: APC's ambition, passion and conviction in relation to gastrointestinal health has had other related impacts in relation to enhancing the international reputation of UCC, the region and Ireland on the global stage. It has proved itself to be a stimulus for indigenous industry. It has fostered open innovation, has aided the pharma industry to kill off drugs that are destined to fail early. It has acted as an attractor of top global talent to the Cork region for the betterment of the local economy and it has developed an impressive global alumni network, while continuing to be a leading advocate and agent for change in area of food and health.

The APC is a national institute and resource that continues to serve as an agent of change, creating an environment conducive to innovation and challenging obstacles and outdated concepts in education. It is outward looking with an international reputation as a leading global microbiome institute, with a broad range of academic and commercial partnerships. The APC Microbiome Institute builds on many success stories of its earlier years and looks to the future with energy, enthusiasm and confidence.

CASE STUDY 8.8: Innovation in teaching and learning – Quercus, UCC's Talented Students' Programme

Inherent in the ethos of University College Cork is the desire to create an environment in which academic excellence can be combined with opportunities for personal development. As we have seen, UCC is committed to the intellectual growth, social formation and welfare of its students, and recognises the strength that is derived from student diversity. Excellence underpins UCC, and the University recognises exceptional students when they join as well as those who develop their talents while studying.

UCC acknowledges that, while attainment in the Leaving Certificate may be used to recognise academic talent, many students are prevented from performing to the maximum of their academic ability in this examination due to social and cultural factors outside of their control, through disability or through their commitment to the pursuit of excellence in their personal extra-curricular talent or skill. UCC also acknowledges that some students do not realise their potential until they have commenced their university studies and will often achieve outstanding academic and personal accomplishments post-entry.

To this end, UCC introduced the Quercus Talented Students' Programme, which is aimed at supporting and promoting excellence in academia, sport, creative and performing arts, active citizenship and innovation/entrepreneurship for both prospective undergraduate students as well as for students already registered in UCC. In addition to the scholarships in these areas, the University also offers three types of Quercus academic scholarship.

Quercus is the Latin for oak or Arabic for the cork that is derived from the cork oak in Iberia. At UCC, the symbolism of the mighty oak growing from the little acorn is used to represent the growth that arises from nurturing talent through support, challenge and mentoring, both academically and in other areas of talent.

The Quercus banner, embossed with a beautifully crafted new logo, and kindly sponsored by the Ford Motor Company, was unveiled in the Grand Parade in Cork city on 19th September 2017. Just the previous day, Joanne O'Riordan, Active Citizenship Quercus Scholar, followed on from previous key note speeches at the United Nations and the like, and was one of the key speakers

at the third International Conference on Learning Cities. Joanne spoke with eloquence and humour in front of 500 delegates from across the globe at the opening ceremony of the conference in her home city of Cork.

UCC invests approximately €600,000 per year on talented students across the spectrum of the programme, including sports, citizenship, entrepreneurship, academic and the performing arts. Currently the programme has 3 global teen leaders, 2 outstanding young people of the world winners, and 3 of Time Magazine's most influential teenagers in the world. Combining talent with hard work, these outstanding students of UCC act as role models within the University and, just like the oak, are developing into strong and independent individuals who will have positive influence on society and in their communities for years to come.

CASE STUDY 8.9: Sustainability and climate action – Environmental Research Institute (ERI)

The Environmental Research Institute is a flagship research institute at University College Cork that carries out research in the broad environmental area. The mission of the ERI is to generate new research knowledge for the understanding and protection of our natural environment and to develop technologies, tools, services and policy knowledge to facilitate a transformation to a zero carbon, resource efficient and sustainable society.

The Institute was established in 2000 under the HEA Programme for Research at Third Level Institutes 2 (PRTLI2) national research infrastructure investment programme. The Institute constitutes an important part of UCC's strategy to develop inter-disciplinary research institutes that have a critical mass of world-class researchers in prioritised research areas. The integration of environmental research within the ERI has enabled UCC to adopt a more strategic approach to a key research area within the University, create an interdisciplinary research environment, develop economies of scale and engage more coherently with industry and society.

The Institute brings together 350 environmental researchers from 17 UCC Schools and Departments and incorporates a number of research centres including MaREI Centre for Marine and Renewable Energy, Centre for Research on Atmospheric Chemistry (CRAC), Aquaculture and Fisheries Development Centre (AFDC), UN Environment GEMS/Water CDC (UN GEMS), Cleaner Production and Promotion Unit (CPPU) and Centre for Law and the Environment (CLE).

- MaREI is coordinated by the ERI and is Ireland's SFI Centre for marine and renewable energy research, development and innovation working across 6 Irish academic institutions and collaborating with over 50 industry partners.
- CRAC is a leading national centre for atmospheric chemistry research carrying out laboratory, field and modelling studies to support clean air quality.
- The AFDC is a centre of excellence for aquaculture and fisheries research focusing on fisheries and fish population genetics, health of aquaculture species, and marine mammal research.

- The UN Environment GEMS/Water Capacity Development Centre provides global capacity development in water quality monitoring and assessment working on a programme of activities to support the Water Sustainable Development Goals.
- The CPPU conducts multi-disciplinary research on the sustainability of socio-technical systems; sustainable consumption; governance for sustainability; and the broader human aspects of sustainable development.
- The CLE carries out high-impact research within the field of environmental, marine, climate, energy and natural resources law providing a platform for broad legal and interdisciplinary collaboration within and beyond UCC.

ERI RESEARCH CASE STUDY A: CRAC – Centre for Research on Atmospheric Chemistry

Air pollution is directly linked to over 1,500 premature deaths every year in Ireland and new strategies are urgently needed to control emissions. Under the direction of Principal Investigator Prof John Wenger in CRAC, the EPA-funded SAPPHIRE project showed that the burning of solid fuels (coal, peat and wood) for home heating is by far the largest source of air pollution in winter months. Pollution levels in small towns across Ireland were higher than in the major cities and up to ten times higher at night, thus posing a significant health risk. Importantly, these results have been used to help shape new policies in air quality control such as the extension of the smoky coal ban to cover all parts of the country by September 2018. This measure introduced by Minister for Communications, Climate Action and the Environment, Denis Naughton, is a major step forward for Ireland in its efforts to achieve the more stringent pollution levels set down by the World Health Organisation.

ERI RESEARCH CASE STUDY B: Energy and Climate policy

Another example of the work being completed at ERI is in relation to Energy and Climate Policy under Principal Investigator Prof. Brian Ó Gallachóir. The context for this work is the EU target of reducing greenhouse gases by 40% by 2030 and the 2015 Paris Agreement on Climate Change to limit global warming to well below 2°C above pre-industrial levels. A further context is that Ireland is not on track to meet the mandatory EU 2020 renewable energy and climate targets. We are facing a bill in the range of €230M - €630M for the year 2020 alone to purchase credits. When these targets were being agreed (in 2007) Ireland's capacity to negotiate was weakened by not having a strong energy modelling capacity in the country. This has now been addressed, through the establishment of an Energy Policy and Modelling team at UCC's ERI.

This capacity was effectively drawn on by the Government in negotiations with the European Commission relating to the 2030 targets that are being finalised in 2018. In addition to supporting the Government negotiate with Brussels, Brian and his team have also strongly supported the development of national policy, including preparation of Ireland's first Low Carbon Energy Roadmap in 2013, commissioned by the then Department for Environment, Community and Local Government. This energy systems modelling scenario analysis provided insights into the technical and economic implications of Ireland's transition to a low carbon economy and facilitated the enactment of the Climate Action and Low Carbon Development Act in 2015, a significant milestone in the legal articulation of Ireland's climate policy.

In 2015, MaREI's Energy Policy and Modelling team at UCC's ERI again supported the development of national policy, undertaking analysis at the request of the Department of Communications, Energy and Natural Resources to inform the Government White Paper on Energy Ireland's Transition to a Low Carbon Energy Future. In July 2017, Ireland's first National Mitigation Plan was published by the Department of Communications, Climate Action and Environment. Brian's team again provided critical underpinning energy scenario analysis for the national mitigation plan.

The "National Mitigation Plan Scenario" developed by the group demonstrated that there is a need for significant reductions in non-ETS emissions from 23Mt CO2 in 2020 to 17Mt CO2 in 2030. In addition, Ireland's first National Adaptation Framework, which was also launched 2017, acknowledges the role that MaREI had in developing

the framework, and the Climate Ireland Portal (coordinated by Dr Barry O'Dwyer and Jeremy Gault, MaREI, ERI).

The ERI has a unique and outstanding physical space for conducting environmental research at a national level. The Institute has substantial research facilities at its two dedicated buildings on Lee Road, Cork and the Beaufort Building, Ringaskiddy along with environmental research facilities across UCC campus. The ERI Buildings have 7,000 square meters of office space, laboratories and workshops and incubation suites for industry. The Beaufort Building houses Ireland's National Ocean Test Facility (LIR-NOTF) which has a suite of state-of-the-art wave tanks and electrical rigs that allow for scaled testing in a controlled environment across the offshore renewable energy sector.

The ERI now has 350 researchers working on 156 live projects. The following points highlight the impact the ERI is having on a nationally and internationally:

- In the 2012 to 2016 strategic planning period, peer-reviewed publications by ERI Principal Investigators (PIs) have more than doubled. From 2012 to 2016, ERI researchers have published 1,234 peer-reviewed research papers and a total of 215 PhD and MSc students have graduated under the supervision of ERI PIs.
- The research income generated by Institute PIs and Centres in the 2012 to 2016 period was €47m. Decreases in available Exchequer funding were compensated by success in increasing non-Exchequer (particularly EU funding) with non-Exchequer funding making up 30% of research income. In 2016, the value of active research grants for the Institute was €44.2m.

In 2010, ten years after the initial establishment of the Institute, the ERI was significantly enlarged with a €15.2 M investment to create a new building for marine and renewable energy research in Ringaskiddy (the Beaufort Building).

- The funding for the Beaufort Building was followed in 2012 by SFI funding for the MaREI Centre for Marine and Renewable Energy which provided the opportunity to integrate the Hydraulics and Maritime Research Centre, the Coastal and Marine Research Centre, and the Sustainable Energy Research Group together generating increased capacity for marine and energy research in UCC. The MaREI Centre represents a total investment across its partner institutions of €55m from a number of funding sources.
- An independent assessment of research quality at University College Cork in 2015 found that the Institute's level of societal impact is excellent by international standards. The review also commended the ERI "as a successful manifestation of a multi-disciplinary, applied research centre that allows the University to lead in this area, to an extent that would have been very difficult within a purely School-driven structure. Of particular note is the engagement with industry and policy formers."
- In 2015, the ERI established UCC Climate Lab to strategically build on the existing substantial base of existing climate change research at UCC, develop deeper collaboration between UCC climate change researchers and support a clear branding for UCC climate change research.
- An independent national report commissioned by the Higher Education Authority into the commercial and economic impact of research investment in Ireland (PRTLI programme) found that the ERI had a high impact in all six evaluation categories (commercial, human capital, capability, reputation, national policy, wider impacts).

ERI has a multidisciplinary approach to research. It works in al trans-disciplinary approach with stakeholders at UCC, but also public, NGO, local authorities and private corporations. It is unique in that it is wholly owned by UCC, brings experts and world leaders together across disciplines so that it can add value.

The ERI has recently launched its ambitious strategic plan for the period 2018 to 2022, the key elements being capacity building, impact and it's inter-disciplinary nature. The ERI 2018-2022 Strategic Plan will provide the necessary research and knowledge base to support a transition to a sustainable society with a focus on 3 global environmental challenges (i) addressing climate change, (ii) supporting the development of a circular economy,and (iii) ensuring a healthy environment for ecosystems and society. The Strategic Plan will harness the considerable wealth of knowledge across UCC to address these challenges drawing on the University's expertise in environmental, sustainable energy, sustainable food, marine and sustainable materials research. The Institute has set out 5 strategic objectives based on human capital, its resource base, research clusters, impact through excellence and international profile in order to deliver on this plan.

CASE STUDY 8.10: Sustainability and climate action - Marine and Renewable Energy Institute (MaREI)

MaREI is a research, development and innovation centre, supported by Science Foundation Ireland, that operates across the fields of marine research, marine renewable energy, and renewable energy. With a cumulative budget exceeding €50m, the Centre's activities are motivated by the need to address global challenges such as blue growth, climate action, and the energy transition, resulting in the development of a dynamic research ecosystem that is responsive to the needs of academia, industry, government and society.

MaREI's strengths lie in the multi-disciplinary nature of its research teams, allowing it to combine insights across areas such as Marine Renewable Energy Technologies, Materials & Structures, Observation & Operations, Coastal & Marine Systems, Bioenergy, Energy Policy & Modelling, and Renewable Energy Management. As a driver of collaboration, the Centre comprises over 200 world-class researchers who are collaborating with stakeholders located across more than 36 countries, and who have a proven track-record in academic excellence, consistently publishing in high-impact journals and participating in major EU and international initiatives.

In addition to fundamental scientific research, the Centre provides targeted research and novel consulting services to a wide range of companies, including over 48 active industry partners, which has established it as a preferred research and development partner for both academia and industry worldwide. In doing so, MaREI seeks to maintain the forward momentum of the marine and renewable energy sectors through the development of technologies, tools and processes that will accelerate them towards commercialisation. MaREI also offers unique world-class infrastructure and testing facilities that allow the systematic identification and reduction of development risks through a structured 'Technology Readiness Level' (TRL) development cycle. These include: the Lir National Ocean Test Facility (Lir-NOTF); Limerick Docks tidal tow-testing facility; Structural Research Laboratory; Coastal Observing Radar System; and Mace Head Atmospheric Research Station, amongst others.

MaREI comprises internationally recognised experts from across its six partner institutions, comprising UCC, NUIG, UL, MU, UCD, and CIT, and is headquartered in UCC's ERI Beaufort Building in Ringaskiddy, Co. Cork, which also houses the Lir National Ocean Test Facility (Lir NOTF). Lir NOTF comprises a custom-designed facility for small to medium-scale laboratory testing of ocean and maritime systems. It comprises state-of-the-art test tanks for wave and current emulation, along with electrical test rig facilities.

MaREI delivers impact across a diverse range of categories, including economic, public policy & regulation, human capacity, environmental, societal, international, and research excellence. In terms of economic impact, MaREI helps to grow businesses in the marine and renewable energy sectors through the fostering of innovation, creation of new business models, and creation of EU funding opportunities. Furthermore, the Centre assists existing companies in improving their performance through the provision of critical data to support decision making, new product development and increased market share. MaREI also facilitates the incubation of start-up companies through the nurturing of an entrepreneurial environment, which includes the EntrepreneurShip incubator, with examples including EXCEEDENCE and WaveVenture.

In terms of public policy and regulation impact, MaREI continually seeks to improve the scientific evidence base to inform policy development in the energy, marine and climate spaces, and has underpinned the development of the National Energy Research Strategy, White Paper on Energy, National Mitigation Plan, and National Adaptation Framework, amongst others. MaREI's human capacity impact is demonstrated by the fact that approximately 40% of MaREI's departees have gone on to work in industry as a first destination, emphasising the Centre's importance as a conduit for highly skilled graduates. In this regard, MaREI promotes innovation in its people, and maximises the transfer of knowledge between academia and industry, simultaneously attracting leading talent to Ireland and providing the next generation of industry leaders in the marine and renewable energy sectors.

MaREI delivers environmental and societal impact by supporting the development of policy, regulations, standards and best practice, demonstrated through initiatives such as the development of the Climate Ireland Platform, and engagement with communities on issues such as marine litter. MaREI's public engagement strategy aims to foster a better understanding of the impact of the Centre's research on society. Through research and outreach activities, MaREI researchers are actively engaging with stakeholders from all sectors, including policy makers, industry bodies, NGOs, community groups, schools and the

public. On an international level, MaREI is enhancing the profile and reputation of the country through strategic and high-profile engagements, such as the ongoing collaboration with Zhejiang University in China.

MaREI's strategy is aligned with that of the Irish Marine Development Office (IMDO), which has set a target of €7bn in output from marine activity, where the current output is approximately €1bn. Norway and the Netherlands have led the way in this regard. Professor Mark Ferguson, Director General of Science Foundation Ireland and Chief Scientific Adviser to the Government of Ireland, noted that "Research and innovation matter for our future, and are at the heart of delivering tangible improvements to our quality of life. Climate change is one of the critical global challenges we face, and research led by the world-leading SFI Research Centre MaREI will be core to developing energy solutions that can positively impact the lives of Irish citizens."

During 2017, MaREI appointed two new directors, Professors Jerry Murphy & Brian Ó Gallachóir. On appointment, Professor Murphy commented, "MaREI research involves world-class scientists and engineers working with industry to facilitate Ireland's energy transition to a low carbon future. This is exemplified by our collaborative research with companies involved in wave and tidal energy, including ESB, OpenHydro, GKinetic and DP Energy…."In addition, our collaboration with Gas Networks Ireland on greening the gas grid has led to the Causeway Project, which will involve grid injection of biogas, 13 service stations serving advanced gaseous biofuels and ultimately 20% substitution of natural gas with renewable gas."

Professor Ó Gallachóir leads MaREI's energy policy and modelling research, increasing the evidence base underpinning energy and climate action policy choices by exploring a range of future energy scenarios for Ireland. He is also Professor of Energy Engineering at UCC and Chair of the Executive Committee of the International Energy Agency Technology Collaboration Programme on energy systems modelling. According to Professor Ó Gallachóir, "MaREI's research has usefully informed the development of Ireland's energy and climate policy and the strategic plans of our industry partners over the past few years… Our ambition going forward is to focus much more on engaging with citizens and communities and developing future scenarios together, so that we not only have a sustainable energy system, we also co-develop a sustainable energy society."

CASE STUDY 8.11: Rights, policy and society at UCC – School of Law

The College of Business and Law has a long track record of shaping and impacting wider society through its research. Much of the College's research falls under the thematic areas of Rights, Policy and Society. The College has four centres and clusters which have been the vehicles for much of this impactful work: the Child Law Clinic, the Centre for Criminal Justice and Human Rights, the Centre for Policy Studies and the Centre for Co-operative Studies.

The College is very active in the field of child rights and human rights, both nationally and internationally, and provides litigation and advocacy at all levels in Irish courts and before international tribunals such as the European Court of Human Rights and the European Social Rights Committee. Current activities include the UCC-led IDEA project which builds the capacity of professionals in the child protection system for the advancement of children's rights across European countries, funded by the European Commission's Directorate General for Justice. Other on-going projects in the field of rights include two Irish Research Council funded projects which collaborate with NGOs. The "Advancing International Networks for Understanding, Researching and Implementing International Disaster Laws" collaborates with the Red Cross, while the "Unseen, Unheard: Advancing the Rights and Needs of Children with a Parent in Prison" is partnered with the Irish Penal Reform Trust and the Children's Rights Alliance.

Research in the College also greatly influences policy-making nationally and internationally. Current projects include the transnational H2020 ADVOCATE project. This project, a collaboration of six European universities, three health insurance companies and the National Health Service, UK, analyses health insurance data to influence dental healthcare policy transnationally and prevent dental health problems. Much of the College's research also greatly shapes policy on the agricultural and food sector including a recent project, funded by the all-island body SAFEFOOD, which examined the vulnerability of the Irish dairy food supply chain to climate change related shocks. Other research focuses on the co-operative sector, especially the interlinked topics of money lending, financial exclusion and financial capability. Collaborations have been undertaken with numerous bodies such as Combat Poverty Agency, MABs, while academics in the College sit on the statutory Credit Union Advisory Committee which advises the Minister for Finance on policy.

The College has been very successful in generating funding; the four centres have achieved €3.5m from national and international funding agencies such as the Irish Research Council, H2020, and European Commission's Directorate General for Justice.

The College's four centres in the thematic areas of Rights, Policy and Society are highly research active. Over 46 books and monographs, 266 journal articles and 117 book chapters have been published by academics in these Centres. Much of the research has had a genuine international impact. For example, the Child Law Clinic's activities led to the Grand Chamber of the European Court of Human Rights ruling that Ireland had failed to adequately protect children in primary schools from sexual abuse, while in another case the European Social Rights Committee held that Ireland's failure to prohibit corporal punishment of children violated the European Social Charter.

The Centres also play a key role in shaping wider debate on the rights of many in society. For example, the recent Irish Research Council funded "Unseen, Unheard" project led to a direct call on government to develop a national advocacy strategy for children with a parent in prison – this had much extensive media coverage.

The College's research shapes debate and informs much policy-making nationally and internationally. Recent research in the Centre for Co-operative Studies on the need for policy intervention to support the multifunctional nature of agriculture was presented in Brussels to an audience including the European Commissioner for Agriculture and provided direct input in the reform of the Common Agriculture Policy.

Health Research Board funded research in the Centre for Policy Studies has estimated that the costs of prescription medicine will rise from €1.29bn in 2012 to €2bn in 2026. These findings have shaped wider debate and policy on this issue.

The above are just a number of examples where the College's research in the thematic are of Rights, Society and Policy has had significant impact on wider society both nationally and internationally.

8.2: CREATION AND DISCOVERY EXCELLENCE IN 2017 - A BRIEF SNAPSHOT

(In line with 3 of UCC's thematic research areas)

CASE STUDY:Culture, society, rights and identities

have a rich tradition of being prioritised at UCC. One such inter-disciplinary research project at UCC is that of **Deep Maps**.

The Challenge –

Connecting cultural history and marine biological research, Deep Maps fosters ongoing stewardship of Cork's coast and Ireland's maritime heritage. The project visualises the coastline in innovative ways and offers a comprehensive approach to understanding place. Deep Maps engages community stakeholders to identify environmental priorities and share their knowledge. Past and present are interwoven as literature, history, science and culture provide new ways of thinking about our endangered marine environment. The project maps the cultural history of the coastline in order to communicate a deeper knowledge of places, history, people and stories.

The Research –

Both intensive and extensive, Deep Maps investigates the biological, cultural and historical contexts of the south west coast of Ireland from 1700 to 1920, exploring the maritime environment found along the arc of Cork's Roaring Water Bay, from Clonakilty to Bantry Bay. In bringing literary traditions together with environmental sciences and digital technologies, Deep Maps demonstrates how coastal sites are reservoirs of personal, cultural and biological data. Knowledge flows from and to community stakeholders, with the goal of increasing public awareness of the rich but intangible heritage of the region. This innovative model of mapping results in layered storytelling that effectively expresses complex accounts of space and time. As such, Deep Maps departs from literal cartography to bring history, culture and biology together in original visualisations that can be accessed digitally.

> *"By connecting specialised scientific understandings of the marine environment with the stories, ideas and feelings associated with our coasts, we can help to create a new future for our seas."*
>
> **Professor Claire Connolly, Principal Investigator**

The Impact –

Deep Maps responds to needs emerging from both humanities and STEM research. In the case of the former, the environmental humanities have posed urgent questions about the scope and scale of human interactions with the environment as represented in literature and other texts, while in the case of marine biology, scientists are increasingly aware of the need to deepen and enrich their understanding of coastal environments via a more nuanced sense of the histories and cultures of these storied places. This transdisciplinary approach draws upon a scientific literature review, workshops with community stakeholders, sketches, photographs, poems, newspapers, letters and other historical artefacts, and the collection and analysis of Geographic Information Systems (GIS) data.

The project uses digital media to visualise and connect different kinds of knowledge about the coastline and establishes dialogue with diverse audiences. This includes a weekly blog series which has reached audiences in Ireland, the United Kingdom, the United States, China, Russia, Canada, Germany, France and Italy, integrated social media campaigns via Facebook, Twitter, Storify and Instagram, an open access Deep Maps website, incorporating interactive story maps, timelines and apps, and an exhibition within the world-renowned Glucksman Gallery on the UCC campus, from August to November 2017, which garners public feedback by taking visitors on a journey from traditional cartography through objects of cultural value and scientific inquiry.

One of the risks associated with any digital project is the rapidly-changing digital environment. With longevity in mind, the Deep Maps team worked with UCC Library's Research and Digital Services to develop a records management strategy that draws upon best practice guidelines from the Digital Repository of Ireland. Deep Maps assets are provided in preservation-friendly formats so that the research remains readily accessible.

CASE STUDY: Gender, equality and diversity

UCC has a strong tradition in promoting gender, equality and diversity issues. One such creative practice project during 2017 was that of **Unveiled Horizons**. This art project was made using innovative transdisciplinary methodologies, engaged dynamically in community contexts, and worked with major local festivals. *Unveiled Horizons* was the inaugural project for UCC Creative. It focused on the hidden presence of women in port towns and cities, through a large scale outdoor installation of portrait photographs, digital presence, talks and walks. Made in collaboration with the French photographer Carl Cordonnier/ *Daily Life, Unveiled Horizons* developed the relationship between art, digital media and social context, and associated UCC with progressive and professional arts practice. It intertwined the theoretical/critical reach of academia (gender, migration, geography etc.), with the contemporary experience of citizens, and the physical architecture/place of the city itself.

Through interviews and photography workshops, UCC Creative collaborated with six women from Cork on the composition of their portraits. These images were then printed onto 6-metre-high flags, flown from the iconic Port of Cork sign and on the roof of the Port of Cork building (both on the Customs House Quay), as part of both the *Cork Harbour Festival and the Cork Midsummer Festival* in June 2017. An installation of photographs and audio (also on the quay) gave visitors an intimate space to reflect and further engage with these stories.

The project was also part of the Women's Studies conference *Women's Voices in Ireland*. *Unveiled Horizons* was political as well as poetic work which sought to empower its female participants, to make present, and articulate not just the horizons of the women from Cork, but to place them in a networked context of other iterations of the project – women from Dunkirk and Boulogne-sur-Mer in France, Tianjin in China, Tangier in Morocco, Glasgow in Scotland, and most recently in the Calais Jungle refugee encampment. Flags from two of these cities flew on the Custom House Quay alongside the women from Cork, and the Cork images/stories joined the international *Unveiled Horizons* website.

For a brief period, it also changed the Cork horizon, as these large striking images were visible along multiple approaches to Cork City. For a while, people in Cork looked up to these women, placed symbolically in the site that so often excluded them, or marked them as sexual other. This project had significant visual, digital and local and national impact – placed in an iconic location and shared through online contexts, featured on national and international news.

CASE STUDY: Human health, activity and social wellbeing across the lifespan

is at the core of the world leading research emanating from UCC as we have seen in section 6 of this report. One fantastic example of the work being done across the lifespan includes **the SENATOR project**, which is coordinated by UCC. This concerns the development and clinical trials of a new software engine for the assessment and optimisation of drug and non-drug therapy in older persons.

The number of older people with multi-morbidity in Europe is growing steadily. The trend is strongly linked to adverse consequences of polypharmacy, inappropriate prescribing and excessive healthcare costs. In tandem with drug therapy problems, there is an underuse of non-drug therapies in the treatment of chronic diseases.

Born out of the **STOPP/START prescription criteria** developed by UCC's Professor Denis O'Mahony in 2002, SENATOR is an international, multi-site randomised academic trial funded under FP 7 which was launched formally on 01/10/2012 and which is due to be completed by July 2018. In partnership with Clan-William Health Ltd, the STOPP/START criteria will be applied via the software to the 1800 participants and will look at drug-to-drug, drug-to-disease and proof-of-concept in relation to non-drug advice.
SENATOR is not seeking EC mark initially, but subject to results, it may seek to commercialise the software, and the potential benefits include reducing adverse drug reactions in the elderly, saving in relation to drug wastage, improving quality of life and reducing mortality.

Simultaneously, there is another study under H2020 coordinated out of Bern in Switzerland called **OPERAM** in which UCC is participating. It too is using the STOPP/START rules as well and it commenced in May 2015. It is looking at 2000 patients across 4 locations in Bern, Utrecht, Brussels and Cork. It is examining multimorbidities, polypharmacy and the concept is a screening technology to reduce inappropriate prescription in the elderly.

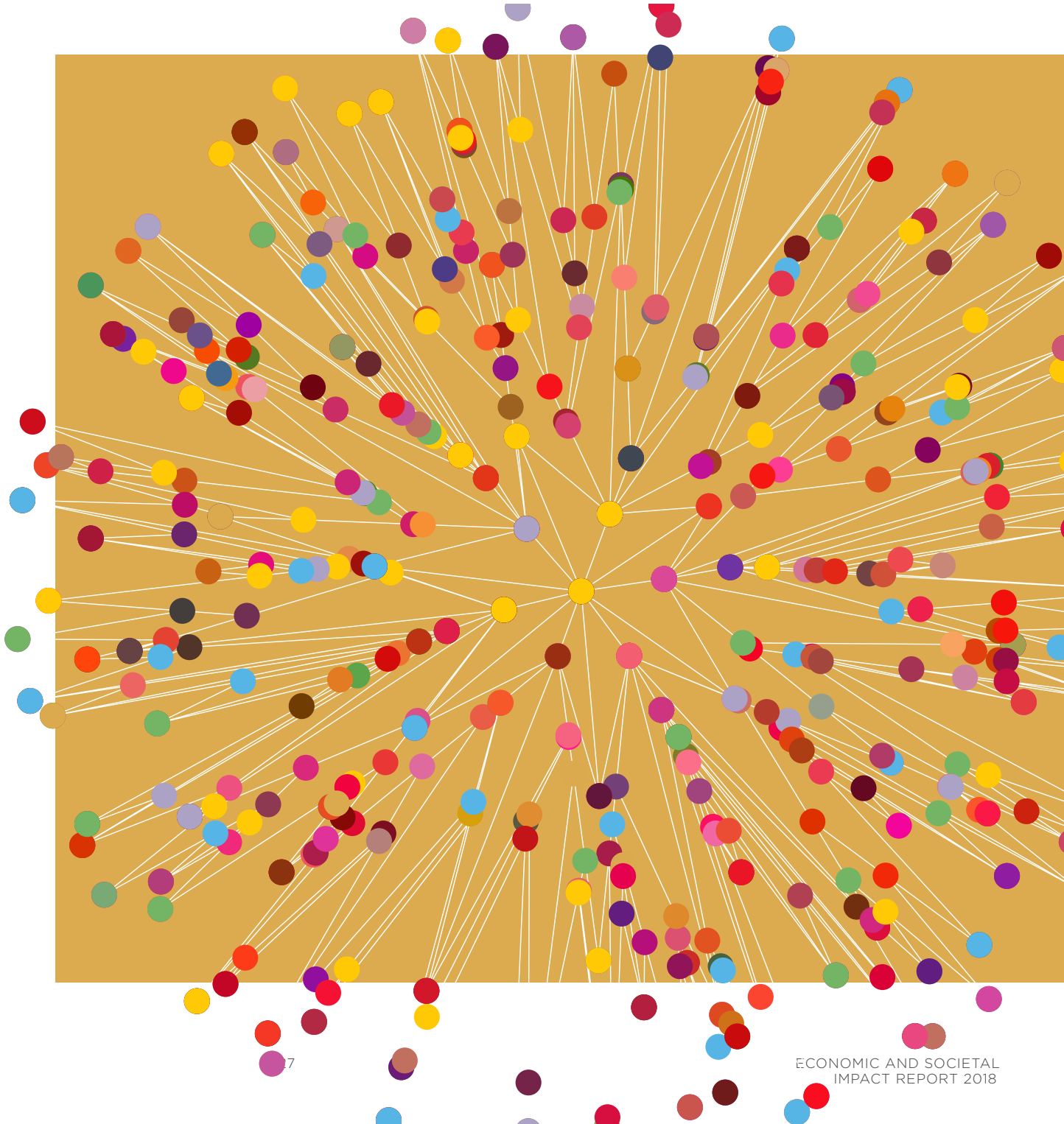
Concluding in spring 2019, the potential outcome will be to reduce drug-related admission to hospital, reduce adverse reaction to medicines, improve acute hospitalisation usage, improve quality of life, reduce mortality and reduce institutionalisation.

Between the two projects there has been an €11m investment in targeting improvements for Europe's aging population. Within a 1-year period, the results will be available from the two biggest software trials ever completed on this cohort.

UCC is well-positioned to be the lead healthcare software development institute in Europe. By taking a lead role with regard to the aging population, UCC is promoting getting it right first time in the world of medicine, endeavouring to eradicate omissions and ensuring best bang for our collective buck as it strives to get the most out of pharma with the least adversity.

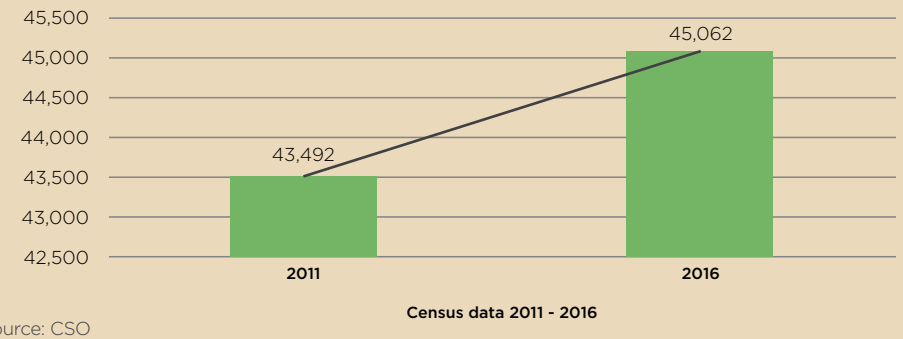
SECTION 9:

APPENDIX & REFERENCES



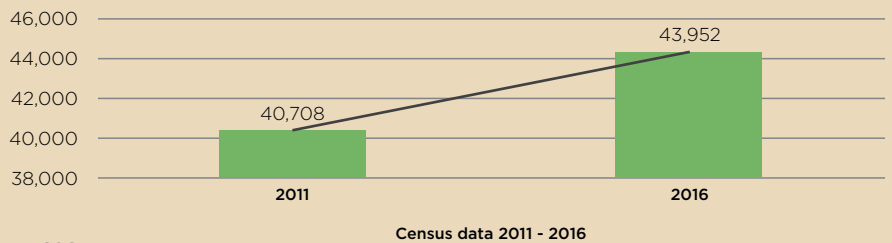
9.1: Appendix

EXHIBIT 1.4: Increases in the 10-14 age group, Cork and Kerry Region (in number of people)



Source: CSO

EXHIBIT 1.5: Increases in the 15-19 age group, Cork and Kerry Region (in number of people)



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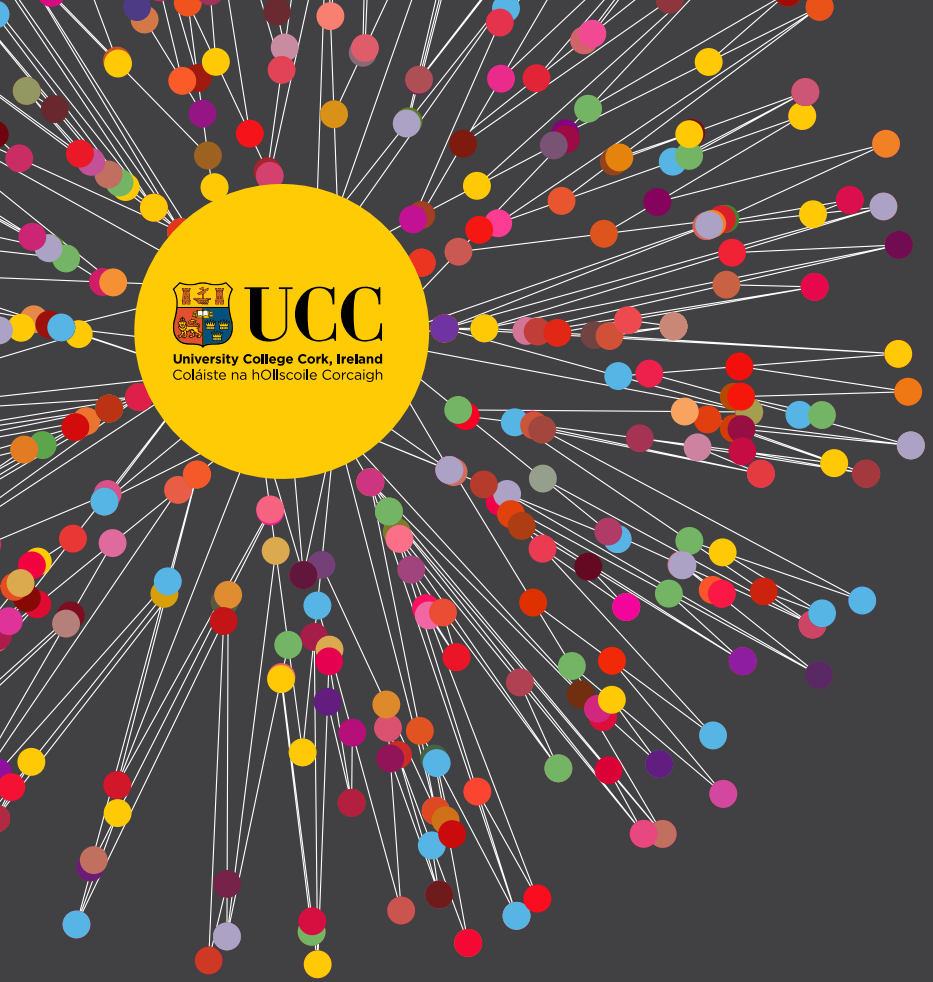

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