The Knowledge Economy in NI

The whole story

2018
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Key findings
Key findings – some records set

The good

• Highest numbers on record for Knowledge Economy;
  1. Employment = 40,250 (4.7% of total employment)
  2. Business deaths (creative destruction) = 259
  3. Business stocks = 3,059 (previous high revised down)
  4. R&D employment = 7,000 R&D personnel
  5. Private equity and VC investments = 55
  6. No. of private equity and venture capital per 100k businesses = 94
  7. VC investments per 100k businesses = 92
  8. PLC’s Market capitalisation per head = £796
  9. Research grants and contracts per 1,000 population = 56
  10. Number of patent applications granted per 1mn population by UK IPO = 25
  11. Sales of £5.7bn
Key findings – some challenges

The less good

- Deterioration in some indicators including;
  - Wage premiums are being squeezed
  - Productivity premium now at its lowest level since 2009
  - PhD numbers and research grants remain low
  - Investment values remain relatively small, even with huge increases in activity

- In general – indicators are in growth mode in NI, but struggling to get ahead of other regions that are also growing.
NI Knowledge Economy GVA low relative to other UK regions

Knowledge Economy GVA as % of total regional GVA (nominal), UK regions, 2016

NI target - Knowledge Economy GVA (nominal, £Bn), 2009-2030

Source: Annual Business Survey (ABS)

NB: The ABS data refers to the non-financial business economy

- NI Knowledge Economy GVA (real) was £2.2bn in 2016.
- Knowledge Economy GVA accounted for 6% of GVA.
- Below the UK average (10%) and ranked 10th of the UK regions.
Impressive KE real GVA growth (6.3% annually)

• NI has the 4th fastest growing knowledge economy in the UK.

• Real KE GVA increased from £1.6bn in 2011 to £2.2bn in 2016.

• KE GVA in the East Midlands declined by 8.7% per annum over the period, from £7.4bn to £4.7bn.

Source: Annual Business Survey (ABS)

NB: The ABS data refers to the non-financial business economy
Knowledge economy real GVA, as a % of total

Rank = 10  Annual rank change = ~  Relative to UK = 62%

- KE GVA (real) increased from £1.6bn in 2011 to £2.2bn in 2016 – annual average increase of 6.3%.

- London experienced the fastest annual average growth over the 2011-2016 period at 6.8%, increasing from £26.6bn to £37.1bn over the period.

- East Midlands experienced a decline in real GVA from £7.4bn to £4.7bn over the 2011-2016 period, constituting the only region that declined.
High productivity, but premiums are squeezed

- Relatively higher KE productivity helps reducing the productivity gap between NI and the UK.
- The premium has narrowed in recent years.
- Developing sectors such as the Knowledge Economy which generate high levels of productivity and exports is vital for future economic growth.

Source: Annual Business Survey (ABS)

*NB: The ABS data refers to the non-financial business economy.
*NB: Productivity refers to GVA per employee*
Knowledge Productivity, £’s

Rank = 12  
Annual rank change = ~  
Relative to UK = 58%

• NI Knowledge Economy productivity (KE real GVA of non-financial sector/employees) averaged £52,500 over the 2011-2016 period.

Source: Annual Business Survey (ABS)
Note: This productivity data is based on real KE GVA of non-financial sectors/ total KE employees.
Productivity premium lowest in the UK

- The average Knowledge Economy productivity premium over the period 2011-2016 is 30%
- This is significantly lower than the other UK regions and the UK average, illustrating the potential for NI.

Source: Annual Business Survey (ABS)
Note: The ABS data refers to the non-financial business economy. Productivity refers to GVA per employee.
The average Knowledge Economy wage premium is 42%.

The most recent year of data (2018) saw Knowledge Economy wages grow by 3% whilst whole economy wages grew by 4%, in nominal terms.

In recent years, the premium has been continually squeezed from a high of 58% in 2013 to a low of 32% in 2018.

In order to attract and retain appropriately skilled employees, enterprises will need to be able to pay competitive wages.
Knowledge Economy sales remain steady

- KE sales increased by 6.3% per annum over the period 2011-2016 - a record high.

- However, KE sales as % of total NI sales declined marginally from 19.3% to 18.9% (so other sectors are growing more rapidly).

Source: Broad Economy Export measure, UUEPC
Note: The BEE is based on ABI data and therefore excludes the financial Services sector, including high tech financial services.
Knowledge Economy sales remain steady

- Knowledge Economy export sales reached a record high, accounting for over one third (35%) of export sales in NI.
- Knowledge Economy sales to GB as a proportion of the NI total increased to 16% (also a record high).
- Domestic sales within the Knowledge Economy average 2% of the NI market total over the period 2011-2016.

Source: Broad Economy Export measure, UUEPC
Note: The BEE is based on ABI data and therefore excludes the financial Services sector, including high tech financial services.
Generating wealth from outside NI

• The Knowledge Economy currently accounts for 35% of NI exports, 64% of which are outside EU where a strong North American market accounts for 63% of non-EU exports.

• In total £4 out of every £5 of Knowledge Economy sales was generated outside the EU26 in 2016.

• The composition of the Knowledge Economy export profile highlights potential for strong resilience to EU related uncertainty.

Knowledge Economy sales profile (£m), NI, 2016

Source: Broad Economy Export measure, UUEPC
Note: The BEE is based on ABI data and therefore excludes the Financial Services sector, including high tech financial services.
Knowledge Economy sub-sectoral drivers

- Aerospace remains the largest Knowledge Economy employment and GVA sub-sector.

- Medical devices, software and IT services are important subsectors, each contributing between 12% and 17% of employment and GVA.

- Communications has made an significant increase in productivity from £61,500 in 2015 to £138,000 in 2016 despite still employing a relatively low number of workers.

- High tech financial services and creative content are high productivity sectors, but with relatively low employment numbers.

Source: Annual Business Inquiry
Introduction
The Knowledge Economy Project

The Ulster University Economic Policy Centre (UUEPC) and Oxford Economics have been commissioned by Catalyst to update the Knowledge Economy Index report and consider the economic impact of achieving Knowledge Economy targets.

The NI Knowledge Economy indicator framework is based on the San Diego CONNECT model, which is entrepreneurial and private sector focussed. A total of twenty indicators make up the framework under the sub headings of core indicators, investment, R&D and innovation & patent activity.
What is the Knowledge Economy?

Knowledge economies comprise of individuals, companies and sectors that create, develop, hone and commercialise new and emerging ideas, technologies, processes and products and export them around the world. In order to maintain their competitive advantage these companies constantly strive to remain at the forefront of their industry by recruiting highly skilled individuals, investing in R&D, innovation, encouraging creativity, marketing and seeking out new markets.

The Knowledge Economy is a vital element of every developed economy around the world as it contributes to and enhances their global competitiveness, which in turn increases their level of economic growth.
What is the Knowledge Economy?

Components of the Knowledge Economy
The sectors that are included are both knowledge intensive and export oriented and therefore have the capacity to grow the NI economy through high value added exports. This year, for the first time, high-tech financial services are included in the definition.

The sectors included are:
- Pharmaceuticals and biotechnology;
- Medical devices;
- Software & digital content;
- IT services;
- Telecommunications;
- Computing and advanced electronics;
- Creative content and digital media;
- Other technical services;
- Aerospace and other transport equipment; and
- High-tech financial services.

A full list of Standard Industrial Classification (SIC) sectors used to define the Knowledge Economy is included in Annex A.
Why the Knowledge Economy is important?

Generating wealth and employment

• The KE creates highly paid, high productivity, sustainable jobs

• It also is export intensive and generates income from outside NI

• The graph shows the strong positive correlation between the size of a region’s KE and average wealth

Source: ONS, UUEPC
Why the Knowledge Economy is important?

**R&D and Economic growth**

- Innovation is widely recognised as a key driver of economic growth. This is fuelled by strong research and development activity.
- This activity allows for technological advancements, meaning firms and business can produce more with the same amount of resource and so, increasing productivity and ultimately generating economic growth.
- R&D is one pillar within the Knowledge Economy Index and for NI has generally performed well against other UK regions, since 2009. However, it must remain a strong focus as recent figures suggest a slow down in performance.

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Sources: OECD, Eurostat, UUEPC
Note: UK:NI GDP ratio calculated from Regional Accounts for GDP per capita and applied to OECD data. UK:NI R&D expenditure ratio calculated from Regional Accounts for GDP per capita and ONS data for R&D as a % of GVA
Why the Knowledge Economy is important?

Addressing economic challenges

• The Knowledge Economy can play a key role in growing the private sector. A larger Knowledge Economy will help to rebalance the NI economy towards higher productivity sectors that generate wealth from outside NI and sustain highly paid jobs.
• These companies have relatively large downstream effects as they make purchases in NI through their supply chain and employees will spend wages on a range of goods and services. Therefore, the Knowledge Economy can also benefit a range of other sectors.
• Increased levels of economic activity will result in a broader tax base, which can then be used to fund public services.
• It is also more difficult for many emerging nations to compete on the basis of Knowledge in the way that they can with cost and therefore NI has a comparative advantage. New ideas and knowledge can also be responsible for creating new opportunities, products and firms as well as wealth, which can improve economic wellbeing in its broadest sense and increase quality of life.
Northern Ireland economic context and outlook

- The UK and Northern Ireland economies are both **heavily reliant on consumer spending** to drive their economic growth (66% and 70% of total GDP respectively).
- Workers in NI have experienced **no growth in real wages** (i.e. after inflation) in the last decade meaning consumer spending has been fuelled by borrowing and increasing levels of employment.
- UUEPC forecasts the **labour market may stall, or indeed regress** in the coming years highlighting an inherit risk of an economic structure which relies on consumer spending.
- On the upside, the relatively more competitive **exchange rate will continue to support exporters** and **interest rates** are forecast to remain low which **should support business investment** in the long term.
- Furthermore, the UK Government’s fiscal position is a little stronger than previously forecast and there may be scope to increase spending which should support economic growth.
Northern Ireland economic context and outlook

The outlook is highly uncertain, all forecasts are conditional on the assumptions they are making about tariffs, migration policy etc. The UUEPC forecasts already projected a slow down, though weaker post Brexit they do not suggest a recession.

The outcome of the ongoing negotiations between Britain and the EU surrounding Northern Ireland’s position post-Brexit and whether Northern Ireland is able to re-establish an Executive will be important in engendering certainty and will aim to provide an environment and stability that is conducive to maintaining positive economic growth.

Key economic indicators, 2018-2022 (UUEPC forecasts)

<table>
<thead>
<tr>
<th>Key indicators</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>GVA</td>
<td>0.6%</td>
<td>0.4%</td>
<td>0.2%</td>
<td>0.4%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Employment growth rate</td>
<td>1.1%</td>
<td>0.3%</td>
<td>-0.7%</td>
<td>-0.6%</td>
<td>0.1%</td>
</tr>
<tr>
<td>ILO Unemployment rate (% labour force)</td>
<td>3.9%</td>
<td>3.7%</td>
<td>3.9%</td>
<td>4.2%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Source: UUEPC Economic Outlook, Autumn 2018
The key economic challenge remains... boost productivity

- NI has consistently remained below UK average levels of wealth despite various economic strategies aimed at boosting productivity.

- This is driven by lower relative employment rates and lower productivity (both workers producing less output per hour and a higher concentration of lower productivity sectors).

- These issues have been persistent for many decades and have dominated economic policy debates.
Economic impact of the Knowledge Economy in NI
Wider impact of the Knowledge Economy (GVA)

The wider economic impacts of the Knowledge Economy are quantified through economic modelling.

A sum of direct, indirect and induced GVA impacts associated with the Knowledge Economy was £3.8bn, in 2016.

This translates to 10% of NI total GVA in 2016.

Overall the Knowledge Economy GVA multiplier is 1.64.

Source: Annual Business Survey, NI Input Output tables, UUEPC
Looking to employment the Knowledge Economy supported 91,000 direct, indirect and induced jobs in 2016.

This accounts for 10.4% of total NI employment.

The Knowledge Economy employment multiplier is 2.32
Knowledge Economy indicator framework
Core indicators
Knowledge economy employment, as proportion of total employment

Rank = 10  Annual rank change = +1  Relative to UK = 79%

- NI’s KE employment has grown steadily at an annual average of 2% from 2009 to 2017. This is the third fastest growth rate in the regions, behind London and Wales.

- Wales moved from 8th to 3rd in the UK rankings between 2016 and 2017 as their proportion of knowledge economy employment grew from 4.9% to 6.4% over the period.

- The South East had the largest share of KE employment and London the fastest rate of growth, consolidating the relative strength of the South Eastern corner of England.
Knowledge economy businesses, as a proportion of total business stock

Rank = 12  
Annual change = ~  
Relative to UK = 50%

NI was home to over 3000 Knowledge Economy businesses in 2017 – an increase of 3.2% per annum since 2009. The rate of growth per annum in NI must continue to rise if it is to converge and/or surpass the region with the next highest proportion of Knowledge Economy businesses (Wales).

London has experienced the highest rate of annual growth in Knowledge Economy businesses since 2009 (6.6% p.a) followed by Scotland (6.1% p.a).
Knowledge economy business starts as proportion of total business stock

Rank = 12  Annual change = ~  Relative to UK = 50%

- NI maintained 400 Knowledge Economy business starts in 2017 with average annual growth of 5.5% since 2009, second only to London (6.8%).
- The proportion of Knowledge Economy business starts has declined across GB regions and slowed within NI over the past 3 years.
- Knowledge Economy business starts remain concentrated within the South East corner of England, as one in three start-ups are within London and almost 2 out of every 5 within South East.
Knowledge Economy business deaths as a proportion of total business stock

Rank = 12  Annual change = ~  Relative to UK = 44%

The number of business deaths (259) in NI is slightly over half the number of business starts (400), resulting in an increase in the stock.

The proportion of Knowledge Economy business deaths have marginally increased in the last year across UK regions, however the majority of regions remain far from peak 2009 levels.

- Although London has the highest proportion of Knowledge Economy starts, almost one third (31%) of total Knowledge Economy business deaths are also in London.
The business churn rate of the Knowledge Economy in NI has averaged 20% since 2009.

NI has experienced a significant improvement in the regional rankings from 10th to joint 6th between 2016 and 2017.

- NI ranked marginally below the UK average Knowledge Economy business churn rate in 2017, 22% and 23% respectively. Since 2009 the NI Knowledge Economy business churn rate has ranged from 18% to 23%.

- London has consistently reported the highest business churn rate since 2009 suggesting a relatively higher level of creative destruction.
Knowledge Economy gross annual average earnings

Rank = 12  
Annual change = ~  
Relative to UK = 79%

NI Knowledge Economy employees earn on average £28,000 per annum. Average wages in the sector remain lower in 2017 than in previous year, perhaps reflecting a change in composition of employment or slackening demand for labour.

London remains as the highest paying Knowledge Economy region with average wages of £45,400, which is on average 32% higher than the annual gross pay for all employees.

The West Midlands continues to experience the highest rate of growth in wages (3.1% per annum since 2009).
Summary of core indicators

<table>
<thead>
<tr>
<th>Knowledge Economy- Core characteristics (CONNECT definition)</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE GVA, as a % of total</td>
<td>10/12</td>
<td>=</td>
<td>6.0%</td>
<td>5.9%</td>
<td>2016</td>
<td>Annual Business Survey</td>
</tr>
<tr>
<td>KE employment, as % of total employment</td>
<td>10/12</td>
<td>+1</td>
<td>4.6%</td>
<td>4.7%</td>
<td>2017</td>
<td>COE (NI), BRES (GB)</td>
</tr>
<tr>
<td>KE business stock, as a % of active enterprises</td>
<td>12/12</td>
<td>=</td>
<td>5.0%</td>
<td>5.2%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE business start ups as a % of active enterprises</td>
<td>12/12</td>
<td>=</td>
<td>0.7%</td>
<td>0.7%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE business deaths, as a % of active enterprises</td>
<td>12/12</td>
<td>=</td>
<td>0.4%</td>
<td>0.4%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE business churn rate, %</td>
<td>6/12</td>
<td>+4</td>
<td>21.4%</td>
<td>21.5%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE median wage level, £</td>
<td>12/12</td>
<td>=</td>
<td>£28,778</td>
<td>£28,079</td>
<td>2017</td>
<td>ASHE</td>
</tr>
</tbody>
</table>

- Improvement in two rankings, but limited change overall
- NI ranked, on average, 11th of the UK regions
Investment activity
Venture capital and private equity activity in NI increased to 75 investments (63 in 2016).

In 2017 NI accounted for 6.1% of total UK private equity and venture capital activity.

- Ireland increased the number of venture capital and private equity investments by 23 companies to 198 from 2016 to 2017. This is second only to London (431) and in line with investment trends in the South East (122).

- NI has experienced the fastest rate of growth of the UK regions since 2009 with an average annual growth rate of 14.7%. This rate of growth is reflected in improvements in NI’s regional ranking year on year from 2013, moving from 12th to 6th.
No. of private equity inv’ per 100,000 VAT registered businesses

Rank = 3  Annual change = ~  Relative to UK = 127%

- NI has remained as the 3rd ranked region in the UK across 2016 and 2017 for private equity investments per 100,000 businesses.
- NI had the fastest rate of growth across UK regions since 2009 at 5% per annum. However, this still remains below Republic of Ireland’s average annual growth rate of 8% over the same period.
- Ireland has the highest number of private equity investments per 100,000 VAT registered businesses (79) relative to other UK regions.

Source: British Venture Capital Association (BVCA), Invest NI, Irish Venture Capital Association (IVCA)
NI is the fastest growing of the UK regions, averaging 22% per annum since 2009. In 2017 NI hit a record high number of VC investments within at 55.

NI now tops the regional rankings in this indicator for the fourth year in a row and significantly outperforms the UK and Irish economy averages.

The proportion of venture capital investments in Ireland per 100,000 businesses (8) is low relative to the UK regions and below the UK average (14).
The value of VC investments in NI increased from £15m in 2016 to £16m in 2017. However, this increase was outstripped by other parts of the UK and NI’s regional ranking fell from 4th to 7th.

The value of venture capital in Ireland consistently outstrips the South East of England, which is the prime location for VC investment.
No. of M&A and ECM deals per 100,000 VAT registered businesses

Rank = 2  Annual change = -1  Relative to UK = 144%

• In 2017 NI had 295 merger and acquisition deals, a marginal fall on 2016 (333) moving NI from 1st rank to 2nd rank across UK regions.
• Over time NI has significantly improved in this indicator, moving from 12th ranked region in 2011 to 2nd ranked in 2017.
• The number of deals taking place has decreased from 2016 to 2017, but the value of those deals increased from £1.1bn to £1.3bn.

Ireland performs significantly below the UK average in the number of mergers and acquisitions per 100,000 businesses, 112 and 205 respectively.

Source: Experian Corpfin
In 2018 the number of PLC’s in NI remained at 4, whereas most other UK regions experienced a marginal decline.

The significantly low PLC’s base within NI has meant NI has consistently ranked 12th across UK regions since 2009.

The UKs overall position is driven by London, where more than 50% of UK PLCs are registered.

Ireland performs significantly below the UK average number of PLC’s (124) with 55 PLC’s. The number of PLC’s in Ireland compares with that of West Midlands (58).
NI has consistently ranked 12th of the UK regions since 2009, with an average market capitalisation of listed companies £280 per head over the period 2009-2018.

- Market capitalisation per head in NI (£795) is significantly below the UK average (£36,000), which is driven by London (£136,140) as it accounts for over half of UK PLC’s.
- The standardised market capitalisation in NI has increased over the period 2009 to 2018, £65 and £795 respectively. This indicator will need to continue to experience high growth if NI is to surpass the region with the next highest market capitalisation per head (Wales, £2,070).

Ireland performs above the UK average in market capitalisation per head, £50,400 and £36,000 respectively. Ireland’s performance remains in line with Scotland (£53,106).
Investment data can be challenging to gather for NI as some VC’s report data to the BVCA, others to the ICVA and some to neither. In addition, Invest NI funds some VC activity.

The data in the report are from the IVCA, BVCA and Invest NI. By identifying which deals are reported to which organisation, UUEPC calculate investment activity in NI.

Recent research by Catalyst will help to bridge the data gap by providing a more comprehensive source of data across the UK regions. The current sources BVCA (UK) and IVCA (RoI) omit any investment activity between firms that are not members of the respective association, therefore investment activity is underreported across each of the UK regions.

The Investment Benchmarking Analysis report by Catalyst will become the preferred data source once a reasonable time series is constructed. At this stage, the quarterly data are available for just over one year. The data from Catalyst report will replace two investment indicators;

• Number of venture capital and private equity investments; and
• Amount of venture capital invested.

It is expected to increase the number and value of investments for each of the UK regions, although in absolute terms current figures suggest NI will continue to lag behind the UK average.
### Summary of investment activity

<table>
<thead>
<tr>
<th>Investment Activity</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of private equity and VC investments (no. of companies)</td>
<td>6/12</td>
<td>+1</td>
<td>63</td>
<td>75</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>No. of private equity inv' per 100,000 VAT registered businesses</td>
<td>3/12</td>
<td>=</td>
<td>34</td>
<td>36</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>No. of venture capital inv' per 100,000 VAT registered businesses</td>
<td>1/12</td>
<td>=</td>
<td>74</td>
<td>92</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>Amount of VC investment, £m</td>
<td>7/12</td>
<td>-3</td>
<td>£15</td>
<td>£16</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>No. of M&amp;A and ECM deals per 100,000 VAT registered businesses</td>
<td>2/12</td>
<td>-1</td>
<td>333</td>
<td>295</td>
<td>2017</td>
<td>Experian Corpfin</td>
</tr>
<tr>
<td>Public listed companies: Market capitalisation per head</td>
<td>12/12</td>
<td>=</td>
<td>£509.0</td>
<td>£796.3</td>
<td>2018</td>
<td>London Stock Exchange</td>
</tr>
</tbody>
</table>

- NI ranked, on average, 5th of the UK regions
- Performance is stable but maintaining these rankings is the challenge for NI.
R&D activity
NI R&D expenditure remained constant at 1.9% of workplace GVA during 2017. This was on track with the UK average which also remained at 1.9% over 2015 and 2016.

NI’s R&D performance is still relatively strong, outpacing Ireland and ranking 5th out of the UK regions.

The East of England remains the strongest performing region at 3.8% of workplace GVA.

The West Midlands has continued to experience a rapid growth trend, with R&D GVA increasing from 1.2% in 2009 to 2.2% in 2016.
• Business Expenditure on R&D in NI has remained constant across 2016 and 2017 at 1.4%. This is above the UK average and Ireland which are 1.3% and 0.8% respectively.

• NI’s R&D base has was supported by an increase in R&D expenditure by both indigenous businesses and SME’s.
Business R&D personnel as % of total employment

Rank = 4  Annual change = ~  Relative to UK = 122%

- The number of R&D personnel in NI remained constant at 0.8% across 2016 and 2017, retaining NI’s 4th place rank.
- Interestingly, Ireland has the largest proportion of R&D personnel (1.4%), despite both R&D expenditure as a proportion of GVA and BERD as a proportion of GVA being lower than the UK and NI averages. However, Ireland has experienced a decline from 1.8% of total workforce to 1.4% over the 2016 to 2017 period.
The number of PHD’s awarded in NI increased from 450 in 2015/16 to 480 in 2016/2017, moving NI from 12th to 10th position across UK regions. However, NI still remains significantly below peak levels of 575 in 2012/13.

London continues to lead the way with 555 PHDs awarded per million inhabitants, followed by Scotland (498).
The absolute value of HEI research grants and contracts increased in 2016/17, moving NI from 10\textsuperscript{th} to 9\textsuperscript{th} ranked region across the UK.

London and Scotland continue to lead the way with 166 and 143 research grants and contracts per 1,000 population respectively. However, it should be noted these have both marginally decreased in the last year.
No. of science and technology graduates (NVQ Level 4+) as % of workforce

Rank = 12  
Annual change = ~  
Relative to UK = 79%

Northern Ireland has consistently ranked 12th among UK regions since 2013. However, the proportion of the total workforce with science and technology degrees has risen from 5.8% to 6.7% over the same period.

Although the recent increase is welcomed, NI still has the lowest proportion of science and technology graduates in the workforce relative to other UK regions.

LFS data are based on small sample sizes and are subject to a larger deviation than other indicators in the report.
The proportion of graduates from STEM subjects in NI has increased 5 percentage points since 2009, from 18% to 23%.

Although NI is ranked 11th of the UK regions, the proportion of STEM graduates is less than 1 percentage lower than South East and West Midlands, the regions ranked 10th and 9th.

- Welsh higher education institutions produced the largest proportion of STEM graduates in 2016/17, moving from 3rd in the regional rankings in 2015/16 to 1st in 2016/17.
- London is consistently at the opposite end of the spectrum, also with a strong university base, but less focussed on STEM related subjects. However, research by the Centre for Cities in 2016 indicates that London can attract 25% of the UK’s graduates.
## Summary of R&D activity

<table>
<thead>
<tr>
<th>Research and Development Activity</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D as % of workplace based GVA</td>
<td>5/12</td>
<td>=</td>
<td>1.9%</td>
<td>1.9%</td>
<td>2017</td>
<td>UK R&amp;D survey</td>
</tr>
<tr>
<td>Business Expenditure on R&amp;D as % of workplace GVA</td>
<td>6/12</td>
<td>+1</td>
<td>1.4%</td>
<td>1.4%</td>
<td>2017</td>
<td>UK R&amp;D survey</td>
</tr>
<tr>
<td>Business R&amp;D personnel as % of total employment</td>
<td>4/12</td>
<td>=</td>
<td>0.8%</td>
<td>0.8%</td>
<td>2017</td>
<td>UK R&amp;D survey</td>
</tr>
<tr>
<td>No. of PhDs per million inhabitants</td>
<td>10/12</td>
<td>+2</td>
<td>242</td>
<td>257</td>
<td>2016/17</td>
<td>HEIDI</td>
</tr>
<tr>
<td>HEI Research grants and contracts per 1,000 population</td>
<td>9/12</td>
<td>+1</td>
<td>52</td>
<td>56</td>
<td>2016/17</td>
<td>HEIDI</td>
</tr>
<tr>
<td>No. of science and tech’ graduates (NVQ Level 4+) as % of</td>
<td>12/12</td>
<td>=</td>
<td>6.0%</td>
<td>6.7%</td>
<td>2017</td>
<td>LFS</td>
</tr>
<tr>
<td>STEM Higher Education qualifiers (% total regional graduates)</td>
<td>11/12</td>
<td>=</td>
<td>22.8%</td>
<td>23.1%</td>
<td>2016/17</td>
<td>HEIDI</td>
</tr>
</tbody>
</table>

- NI ranked, on average, 8th of the UK regions
- Performance is stable and has improved in university related indicators
Innovation and patent activity
NI remains ranked 12th across UK regions experiencing a marginal decline in the proportion of firms stating they are innovation active in 2017, from 43% to 40%.

Although the majority of UK regions experienced a decline in 2017, Yorkshire and Humber has experienced the most significant. The decline from 58% in 2016 to 51% in 2017 has moved the region from the most innovation active region to the 6th most innovative region.
The number of patent applications to the EPO from NI marginally declined in absolute terms from 66 to 63 over the 2016 to 2017 period. Other declines were experienced in Yorkshire and Humber, South West and South East.

Standardising the number of EPO applications against population, NI experienced a fall from 35 patents per million population to 34.
No. of patent applications filed per million inhabitant (to UK IPO)

Rank = 12  Annual change = ~  Relative to UK = 42%

The number of patent applications filed to the UK IPO from NI, per million inhabitants remained the same in 2017, 84. This is significantly below the peak in 2012, 138.

The rate of patent applications across UK regions has generally declined in recent years. In particular, South East has experienced a continual decline since 2012, from 328 to 227 in 2017. The reason is that patents can take a number of years to be registered and recorded.

Despite declines, London remains the UK region with the highest rate of patent applications per million inhabitants.

Source: UK Intellectual Property Office

Ulster University
The number of patent applications granted by UK IPO per million inhabitants hit a record high in 2017 of 25, moving NI from $12^{th}$ position across UK regions to $11^{th}$.

NI must continue to hit record highs in the coming years if it is to converge or surpass with Scotland (the $10^{th}$ ranked region).

Although there has been a decline in the trend of patent filings to the UK IPO the success rate has increased as the trend in patent applications granted by UK IPO is generally improving across UK regions.

The East of England remains the number one ranked UK region (75 granted patent applications by UK IPO), followed by West Midlands (61) and London (60).
## Summary of innovation and patent activity

<table>
<thead>
<tr>
<th>Innovation and Patent Activity</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of firms stating that they are innovation active</td>
<td>12/12</td>
<td>=</td>
<td>42.5%</td>
<td>40.0%</td>
<td>2017</td>
<td>UK Innovation Survey</td>
</tr>
<tr>
<td>No. of patent applications per million inhabitants (to EPO)</td>
<td>10/12</td>
<td>=</td>
<td>35.4</td>
<td>33.7</td>
<td>2017</td>
<td>EPO</td>
</tr>
<tr>
<td>No. of patent applications filed per million inhabitants (to UK IPO)</td>
<td>12/12</td>
<td>=</td>
<td>83.8</td>
<td>84.5</td>
<td>2017</td>
<td>UK IPO</td>
</tr>
<tr>
<td>No. of patents granted per million inhabitants (to UK IPO)</td>
<td>11/12</td>
<td>+1</td>
<td>18.3</td>
<td>24.6</td>
<td>2017</td>
<td>UK IPO</td>
</tr>
</tbody>
</table>

- NI ranked, on average, 11\(^{th}\) of the UK regions
- Performance is stable with a single indicator improving its ranking
What would meeting our aspirations mean for NI?
Achieving our Knowledge Economy aspirations

- Could make a huge difference to the NI economy
  - £3bn of additional GVA
  - 80,000 additional jobs
  - Roughly half of these jobs in the supply chain and consumer economy (restaurants, hotels, retail, wholesale etc.)
  - Reducing unemployment and economic inactivity
  - Requirement for migrants to meet the demand for labour, boosting the population

- What of the Brexit immigration policy - £30,000 earnings threshold?
  - 12 month consultation on the level – Hammond is demanding £21,000

- Most NI Knowledge Economy employees earn less (average is £28,000) and therefore, we need to respond robustly to the UK Government consultation
Achieving Catalyst’s Knowledge Economy aspirations could add £3bn of GVA to the NI Economy by 2030, over the baseline forecast.
Significant employment benefits
More than 80,000 jobs could be added

- More than 80,000 jobs could be added to the NI Economy, when supply chain and downstream wage effects are included, significantly boosting the employment rate.
- Almost one percentage point could be added to the employment rate.
Decreasing the inactivity rate

Through downstream impacts

• Additional KE activity will have the welcome effect of reducing the inactivity rate (mostly through the wage effects, creating jobs for those with level 1, 2 & 3 skills).
Decreasing the unemployment rate
By creating additional employment opportunities

- Additional KE activity will have the welcome effect of reducing the unemployment rate in NI.
- This is through direct employment in the knowledge economy and in the supply chain and through additional consumer spending.
Migration boost to meet demand

Immigration will be required to meet demand from additional employee opportunities.

In order to meet employment demand from the Knowledge Economy, it is estimated that net immigration of c2,500 people will be required annually, to 2030.
Resulting in more rapid population growth….

- In order to meet employment demand from the Knowledge Economy, it is estimated that net immigration of c2,500 people will be required annually, to 2030.
…..and more rapid working age population growth

7,000 additional dependents

- In order to meet employment demand from the Knowledge Economy, it is estimated that net immigration of 2,500 people will be required annually, to 2030.
However, GVA per capita remains largely unchanged

- Real GVA per capita is interesting. Due to the impact of
  (a) increasing the population through net positive migration, and
  (b) large employment multipliers and lower GVA multipliers in the
  supply chain and wage impacts (lower productivity jobs
  in retail, hospitality, arts and entertainment), GVA per capita is
  largely unchanged over the next decade.
Summary of indicators
## Knowledge Economy activity indicators

<table>
<thead>
<tr>
<th>Knowledge Economy- Core characteristics (CONNECT definition)</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE GVA, as a % of total</td>
<td>10/12</td>
<td>=</td>
<td>6.0%</td>
<td>5.9%</td>
<td>2016</td>
<td>Annual Business Survey</td>
</tr>
<tr>
<td>KE employment, as % of total employment</td>
<td>10/12</td>
<td>+1</td>
<td>4.6%</td>
<td>4.7%</td>
<td>2017</td>
<td>COE (NI), BRES (GB)</td>
</tr>
<tr>
<td>KE business stock, as a % of active enterprises</td>
<td>12/12</td>
<td>=</td>
<td>5.0%</td>
<td>5.2%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE business start ups as a % of active enterprises</td>
<td>12/12</td>
<td>=</td>
<td>0.7%</td>
<td>0.7%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE business deaths, as a % of active enterprises</td>
<td>12/12</td>
<td>=</td>
<td>0.4%</td>
<td>0.4%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE business churn rate, %</td>
<td>6/12</td>
<td>+4</td>
<td>21.4%</td>
<td>21.5%</td>
<td>2017</td>
<td>IDBR</td>
</tr>
<tr>
<td>KE median wage level, £</td>
<td>12/12</td>
<td>=</td>
<td>£28,778</td>
<td>£28,079</td>
<td>2017</td>
<td>ASHE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investment Activity</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of private equity and VC investments (no. of companies)</td>
<td>6/12</td>
<td>+1</td>
<td>63</td>
<td>75</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>No. of private equity inv' per 100,000 VAT registered businesses</td>
<td>3/12</td>
<td>=</td>
<td>34</td>
<td>36</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>No. of venture capital inv' per 100,000 VAT registered businesses</td>
<td>1/12</td>
<td>=</td>
<td>74</td>
<td>92</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>Amount of VC investment, £m</td>
<td>7/12</td>
<td>-3</td>
<td>£14.8</td>
<td>£16.0</td>
<td>2017</td>
<td>BVCA, IVCA, INI</td>
</tr>
<tr>
<td>No. of M&amp;A and ECM deals per 100,000 VAT registered businesses</td>
<td>2/12</td>
<td>-1</td>
<td>333</td>
<td>295</td>
<td>2017</td>
<td>Experian Corpfin</td>
</tr>
<tr>
<td>Public listed companies: Market capitalisation per head</td>
<td>12/12</td>
<td>=</td>
<td>£509.0</td>
<td>£796.3</td>
<td>2018</td>
<td>London Stock Exchange</td>
</tr>
</tbody>
</table>
### Knowledge Economy activity indicators

#### Research and Development activity

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D as % of workplace based GVA</td>
<td>5/12</td>
<td>=</td>
<td>1.9%</td>
<td>1.9%</td>
<td>2017</td>
<td>UK R&amp;D survey</td>
</tr>
<tr>
<td>Business Expenditure on R&amp;D as % of workplace GVA</td>
<td>6/12</td>
<td>+1</td>
<td>1.4%</td>
<td>1.4%</td>
<td>2017</td>
<td>UK R&amp;D survey</td>
</tr>
<tr>
<td>Business R&amp;D personnel as % of total employment</td>
<td>4/12</td>
<td>=</td>
<td>0.8%</td>
<td>0.8%</td>
<td>2017</td>
<td>UK R&amp;D survey</td>
</tr>
<tr>
<td>No. of PhDs per million inhabitants</td>
<td>10/12</td>
<td>+2</td>
<td>242</td>
<td>257</td>
<td>2016/17</td>
<td>HEIDI</td>
</tr>
<tr>
<td>HEI Research grants and contracts per 1,000 population</td>
<td>9/12</td>
<td>+1</td>
<td>£52</td>
<td>£56</td>
<td>2016/17</td>
<td>HEIDI</td>
</tr>
<tr>
<td>No. of science and tech' graduates (NVQ Level 4+) as % of workforce</td>
<td>12/12</td>
<td>=</td>
<td>6.0%</td>
<td>6.7%</td>
<td>2017</td>
<td>LFS</td>
</tr>
<tr>
<td>STEM Higher Education qualifiers (% total regional graduates)</td>
<td>11/12</td>
<td>=</td>
<td>22.8%</td>
<td>23.1%</td>
<td>2016/17</td>
<td>HEIDI</td>
</tr>
</tbody>
</table>

#### Innovation and Patent Activity

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Regional ranking</th>
<th>Annual change in rank</th>
<th>Previous data</th>
<th>Latest data</th>
<th>Latest year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of firms stating that they are innovation active</td>
<td>12/12</td>
<td>=</td>
<td>42.5%</td>
<td>40.0%</td>
<td>2017</td>
<td>UK Innovation Survey</td>
</tr>
<tr>
<td>No. of patent applications per million inhabitants (to EPO)</td>
<td>10/12</td>
<td>=</td>
<td>35.4</td>
<td>33.7</td>
<td>2017</td>
<td>EPO</td>
</tr>
<tr>
<td>No. of patent applications filed per million inhabitants (to UK IPO)</td>
<td>12/12</td>
<td>=</td>
<td>83.8</td>
<td>84.5</td>
<td>2017</td>
<td>UK IPO</td>
</tr>
<tr>
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<td>11/12</td>
<td>+1</td>
<td>18.3</td>
<td>24.6</td>
<td>2017</td>
<td>UK IPO</td>
</tr>
</tbody>
</table>
Knowledge Economy activity indicators

Overview

• NI reported an improvement in almost two thirds of the indicators over the most recent year.

• One third of the indicators declined over the year.

• Despite the improvement in most indicators, other regions are improving too resulting in nearly 60% of the regional rankings remaining the same.

• The regional rankings improved in seven indicators (compared to six last year) and declined in two (in the investment pillar).

<table>
<thead>
<tr>
<th>Data</th>
<th>Change</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>=</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UK regional ranking</th>
<th>Change</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>=</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Total 24

Source: UUEPC
## Summary of indicators relevant to Ireland

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Ireland</th>
<th>Northern Ireland</th>
<th>UK average</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of private equity and VC investments (no. of companies)</td>
<td>198</td>
<td>75</td>
<td>103</td>
</tr>
<tr>
<td>No. of venture capital inv' per 100,000 VAT registered businesses</td>
<td>79</td>
<td>36</td>
<td>28</td>
</tr>
<tr>
<td>No. of venture capital inv' per 100,000 VAT registered</td>
<td>8</td>
<td>92</td>
<td>14</td>
</tr>
<tr>
<td>Amount of VC investment, £m</td>
<td>£878</td>
<td>£16</td>
<td>£463</td>
</tr>
<tr>
<td>No. of M&amp;A and ECM deals per 100,000 VAT registered</td>
<td>112</td>
<td>295</td>
<td>205</td>
</tr>
<tr>
<td>Number of Public Limited Companies</td>
<td>55</td>
<td>4</td>
<td>124</td>
</tr>
<tr>
<td>Public listed companies: Market capitalisation per head</td>
<td>£50,400</td>
<td>£796</td>
<td>£36,000</td>
</tr>
<tr>
<td>R&amp;D as % of workplace based GVA</td>
<td>1.1%</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Business Expenditure on R&amp;D as % of workplace GVA</td>
<td>0.8%</td>
<td>1.4%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Business R&amp;D personnel as % of total employment</td>
<td>1.4%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>
Knowledge Economy
Activity Index
Knowledge Economy Activity Index so far...

- Solid activity growth
- Driven by increasing R&D activity in the early years and then investment activity in later years (just be aware of low absolute values).
- Need action to rejuvenate activity and continue NI’s catch up to UK levels

Source: UUEPC
Knowledge Economy Activity Index so far…

Growth in the Knowledge Economy Activity Index highlights there is significant activity within Northern Ireland’s KE sector.

NI is ranked 2nd in terms of growth in the Knowledge Economy Index.

North West is the fastest growing UK region and Scotland ranks closely behind NI in 3rd place.

Source: UUEPC
Knowledge Economy Activity Index

• KE activity in NI has moved from 10th to 8th in terms of relativity to the UK average.

• The NI KE is approximately 85% of the UK average KE, followed closely by East Midlands and Wales at 82%.

• The South East corner of England is a Knowledge Economy Activity hub as with London, South East and East of England taking the top ranking positions.

Source: UUEPC
The question to ask…. Does KE activity translate into tangible economic outcomes?

- KE activity growth = 60%
- KE GVA growth = 22%
- 57% correlation on right hand chart.
Targeting success
Progress towards targets slowing

- Previous Knowledge Economy reports found that NI was on target to exceed 7 targets, meet 6 and was below the trajectory to meet 8.

- NI is on track to;
  - Exceed 7 targets;
  - Meet 2 targets; and
  - Is below the required trajectory to meet 11 targets.

- This is a concerning trend, as the rate of progress towards targets has slowed over the year. Action is required to reinvigorate the Knowledge Economy sector in NI and get back on track to meet the targets.

- The next slide reveals that NI is above trend mostly on a number of investment and R&D indicators. However, NI is below target on a range of education and skills indicators and most concerningly on a range of core indicators.
<table>
<thead>
<tr>
<th>Above target</th>
<th>On target</th>
<th>Below target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of M&amp;A and ECM activity (number of deals)</td>
<td>Knowledge Economy exports</td>
<td>Knowledge Economy GVA</td>
</tr>
<tr>
<td>Number of private equity investments (number of companies)</td>
<td>Total expenditure on R&amp;D, £million</td>
<td>Knowledge Economy employment</td>
</tr>
<tr>
<td>Number of venture capital investments (number of deals)</td>
<td>Knowledge Economy productivity</td>
<td>Knowledge Economy business stock</td>
</tr>
<tr>
<td>Knowledge Economy start-ups</td>
<td></td>
<td>Knowledge Economy average wage</td>
</tr>
<tr>
<td>Number of firms stating that they are innovation active</td>
<td></td>
<td>Number of public listed companies</td>
</tr>
<tr>
<td>R&amp;D personnel, number of employees</td>
<td></td>
<td>Number of PhDs per annum</td>
</tr>
<tr>
<td>Total expenditure on Business R&amp;D (BERD), £million</td>
<td></td>
<td>HEI Research grants and contracts</td>
</tr>
<tr>
<td>Number of science and technology graduates (NVQ Level 4+)</td>
<td></td>
<td>Number of patent applications per million inhabitant (to EPO)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VC investment, £million</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of science and technology graduates (NVQ Level 4+)</td>
</tr>
</tbody>
</table>

*Source: UUEPC*
More indicators below target than on or above

- Year on year – the Knowledge Economy is slipping in terms of progress towards target aspirations....

Source: UUEPC
Summary and policy suggestions
Summary

It’s a vital and growing sector of the NI economy

Inputs
- Research & Development
- Venture Capital
- Innovation
- Patent Applications
- Skills Investment

Activity
- Business Starts
- Exports
- Sales
- 2nd fastest increase in activity of all UK Regions

Outputs
- Employment
- Wages

Outcomes
- GVA
- 4th fastest growing region in the UK
Summary
It’s still significant

Eleven records set
• Sales, employment, KE business stocks, VC companies,

Knowledge economy in growth mode
• 4th fastest growing knowledge economy in the UK (GVA)
• 2/3 of indicators have grown
• Regional rankings improved on 7 indicators
• 2nd fastest rate of activity growth (the activity index)
• Aerospace, software development and IT are the largest sub-sectors

Significant economic contribution
• Very externally focussed, generating 80% of sales outside NI
• High wage, high skill and high productivity (NI perspective)
• Wage and productivity premiums are lower than other UK regions – why?
Outcome growth is just above mid-table

The rate of activity growth is tailing off, and

Progress towards aspirational targets is slipping
- More than half of the indicators are below the required trajectory
- Over a quarter are above the required trajectory
- Deterioration from previous reports

Summary
But needs to move into a higher gear.....
Policy conversations
Aspire to excellence

A decade ago, many would have found it difficult to believe that NI could equal the UK in terms of R&D intensity. NI has now caught up to the UK average level and many new, innovative products are sold from NI. This success has been possible due to the collective efforts of those in the sector, educators, policy makers, delivery agents and researchers and NI should aim to replicate this success in other Knowledge Economy Pillars.

Catching up to the UK average on R&D intensity could be viewed as one step on the journey to success. The target for NI could be set at 3%, aiming to catch up with countries like Sweden, Finland, the US and Japan. A resource plan for requirements from each of the stakeholders could then be developed, identifying actions for Business, Government, Higher Education R&D participants, their funders and customers.

The Irish Economy has grown rapidly in recent years, providing NI with a nearby model to consider – differential tax rates, skills investments, aggressive FDI seeking policy and setting up the IFSC to name a few…
More competitive. More attractive.

• A healthy Knowledge Economy boosts the competitiveness of NI, making it more attractive to inward investors.

• Competitiveness is to economics what physics is to gravity, and a vibrant knowledge economy can boost NI’s economic future.

• Action is required across all of the Knowledge Economy pillars, either to maintain performance in the case of investment, build on R&D strengths or kick-start innovation and patent activity.
Policy conversations

Translating activity into outcomes

• The NI Knowledge Economy is very successful in generating additional activity across a range of indicators – particularly in investment and R&D. However, the growth in activity has not yet fully translated into growth in economic outcomes in terms of productivity, wages and GVA. Translating activity into tangible economy outcomes that benefit society is the key challenge for the Knowledge Economy.

• The City deal will provide £350m over the next 15 years. We need to use this funding in the best way possible to boost competitiveness, some examples could include;
  – Ensure R&D&I investment continue to grow;
  – Grasp the opportunities arising from automation;
  – Support new innovative start-ups;
  – Attract and retain world class talent;
  – Scale the values of VC & PE investment; and
  – More investment in PhD’s and collaborative research.
Insulating against Brexit

- Potentially the most significant economic event of this decade, NI’s knowledge economy could be considered to be well placed as 80% of sales are outside the EU.

- However, the sector is dependent on highly skilled individuals, who are internationally mobile. Access to skilled labour is key to the sector achieving its aspirations and an earnings threshold, rather than a skills based assessment is concerning.

- Access to EU funding and students are hugely important for NI universities. How the UK and NI Government plan to deal with reductions in wither remains to be seen.
Policy conversations

Educating for the Knowledge Economy of the future
• NI’s education system must be aligned to the requirements of the increasingly knowledge intensive economy.

• The economy is changing. That is nothing new. New technologies replace the old, new occupations and jobs are created and others disappear.

• It is essential that NI considers the sort of education system required for the economy of 2030 when today’s primary school children are embarking on their careers. It will be important for the Government, the private sector and philanthropists to ensure that appropriate funding is available for education. Equipping our children and students with the skills that will help them in the future is one of the most important things we can do for them.
Policy conversations

Investing in evidence informed policy making – a Knowledge policy matrix

- A number of Departments and other Government bodies deliver policies that are relevant to the Knowledge Economy. Consideration should be given to developing a Knowledge Policy Matrix which maps out the programmes, owners, expenditure and impacts. This would allow Catalyst Connect to help assess which policies are most important to the sector on a holistic basis and inform the direction of future policy. It would also serve to help direct Knowledge Economy companies to appropriate sources of funding.

- The matrix could facilitate the prioritisation of funding and an open discussion on which expenditures generate most value. It may be that increasing the VC deal flow is a priority, or increasing the number of STEM graduates or PhD researchers. Subsidies for innovators or tax breaks may be the priority – but either way the most important investments must be identified and prioritised.
Annex 1 - Knowledge Economy sectoral definitions
## Knowledge Economy sectoral definitions

<table>
<thead>
<tr>
<th>Sector</th>
<th>SIC 2007 Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A - Medical Devices</strong></td>
<td>26511 MF of electronic instruments &amp; appliances for measuring, navigation, except industrial</td>
</tr>
<tr>
<td></td>
<td>26513 MF of non-elect’ instruments &amp; appliances for measuring, testing and navigation, except industrial</td>
</tr>
<tr>
<td></td>
<td>26600 MF of irradiation, electromedical and electrotherapeutic equipment</td>
</tr>
<tr>
<td></td>
<td>26701 MF of optical precision instruments</td>
</tr>
<tr>
<td></td>
<td>32500 MF of medical and dental instruments and supplies</td>
</tr>
<tr>
<td></td>
<td>72190 Other research and experimental development on natural sciences and engineering</td>
</tr>
<tr>
<td></td>
<td>74202 Other specialist photography</td>
</tr>
<tr>
<td><strong>B - Pharma / Biotechnology</strong></td>
<td>21100 MF of basic pharmaceutical products</td>
</tr>
<tr>
<td></td>
<td>21200 MF of pharmaceutical preparations</td>
</tr>
<tr>
<td></td>
<td>72110 Research and experimental development on biotechnology</td>
</tr>
<tr>
<td><strong>C - IT services</strong></td>
<td>62020 Computer programming, consultancy and related activities</td>
</tr>
<tr>
<td></td>
<td>62030 Computer facilities management</td>
</tr>
<tr>
<td></td>
<td>62090 Other information technology and computed service activities</td>
</tr>
<tr>
<td></td>
<td>63110 Data processing, hosting and related activities</td>
</tr>
<tr>
<td><strong>D - Communications</strong></td>
<td>26301 MF of telegraph and telephone apparatus and equipment</td>
</tr>
<tr>
<td></td>
<td>26309 Manu of communications equipment</td>
</tr>
<tr>
<td></td>
<td>61900 Other telecommunications activities</td>
</tr>
<tr>
<td><strong>E - Computing and advanced electronics</strong></td>
<td>26200 MF of computers and peripheral equipment</td>
</tr>
<tr>
<td></td>
<td>26110 MF of electronic components and boards</td>
</tr>
<tr>
<td></td>
<td>26400 MF of consumer electronics</td>
</tr>
<tr>
<td></td>
<td>26512 MF of electronic industrial process control equipment</td>
</tr>
<tr>
<td></td>
<td>27110 MF of electric motors, generators, transformers and electricity distribution and control apparatus</td>
</tr>
<tr>
<td></td>
<td>27200 MF of batteries and accumulators</td>
</tr>
<tr>
<td></td>
<td>27310 MF of fibre optic cables</td>
</tr>
<tr>
<td></td>
<td>27900 MF of other electrical equipment</td>
</tr>
<tr>
<td></td>
<td>28910 Manufacture of machinery for metallurgy</td>
</tr>
<tr>
<td>Knowledge Economy sectoral definitions</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| **F - Other technical consultancy services** | 71121 Engineering design activities for industrial process and production  
71122 Engineering related scientific and technical consulting activities  
71200 Technical testing and analysis  
74100 Specialised design activities  
74901 Environmental consulting activities |
| **G - Aerospace & Transport** | 28110 MF of engines and turbines, except aircraft, vehicle and cycle engines  
28120 MF of fluid power equipment  
28131 MF of pumps  
28132 MF compressors  
28150 MF of bearings, gears, gearing and driving elements  
29100 MF of motor vehicles  
29201 MF of bodies  
29202 MF of trailers and semi-trailers  
29310 MF of electrical and electronic equipment for motor vehicles  
29320 MF of other parts and accessories for motor vehicles  
30110 Building of ships and floating structures  
30120 Building of pleasure and sporting boats  
30200 MF of railway locos  
30300 MF of air and spacecraft and related machinery  
30400 MF of military fighting vehicles |
| **H - Creative Content** | 59111 Motion picture production activities  
59112 Video production activities  
59113 Television programme production activities  
59120 Motion picture, video and television post production activities  
59200 Sound recording and music publishing activities  
18201 Reproduction of sound recording  
18202 Reproduction of video recording  
18203 Reproduction of computer media |
# Knowledge Economy sectoral definitions

<table>
<thead>
<tr>
<th>I - Software</th>
<th>58210 Publishing of computer games</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>58290 Other software publishing</td>
</tr>
<tr>
<td></td>
<td>62011 Computer programming activities</td>
</tr>
<tr>
<td></td>
<td>62012 Business and domestic software development</td>
</tr>
<tr>
<td></td>
<td>63120 Web portals</td>
</tr>
<tr>
<td>J - High tech financial services</td>
<td>64301 Activities of investment trusts</td>
</tr>
<tr>
<td></td>
<td>64302 Activities of unit trusts</td>
</tr>
<tr>
<td></td>
<td>64303 Activities of venture and development capital companies</td>
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<tr>
<td></td>
<td>64304 Activities of open-ended investment companies</td>
</tr>
<tr>
<td></td>
<td>64305 Activities of property unit trusts</td>
</tr>
<tr>
<td></td>
<td>64306 Activities of real estate investment trusts</td>
</tr>
<tr>
<td></td>
<td>64921 Credit granting by non-deposit taking finance houses and other specialist consumer credit grantors</td>
</tr>
<tr>
<td></td>
<td>64992 Factoring</td>
</tr>
<tr>
<td></td>
<td>64999 Financial intermediation not elsewhere classified</td>
</tr>
<tr>
<td></td>
<td>65300 Pension funding</td>
</tr>
</tbody>
</table>
Annex 2 - Mapping the Knowledge Economy
Where are the Knowledge Economy enterprises?

- Knowledge Economy firms are mostly concentrated in urban areas, suburbs and motorway corridors.

- Much of the sector is based in and around Belfast which is to be expected with a readily available skills supply and infrastructure hub.

- The highest concentration of KE firms is found in the Titanic DEA, where the NI Science Park is located (12.9% of businesses).

- As expected, the lowest concentrations of KE firms are found in rural and western areas of NI.

Source: IDBR, UUEPC
Knowledge Economy employment hotspots

- Slieve Gullion = 24%
- Bannside = 24%
- Titanic = 20%
- Coast Road = 20%
- Foyleside = 17%

➢ Readily available skills supply and infrastructure hubs important.
➢ Employment concentrations can be driven by large firms (e.g. BAE) and lower “other” employment

- Mid Tyrone = 0.2%
- West Tyrone = 0.2%
- Sperrin = 0.3%
- Court = 0.3%
- Benbradagh = 0.4%

Source: BRES, UUEPC
Belfast City Council – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Interdepartmental Business Register (IDBR)

Source: Business Register and Employment Survey (BRES)
Ards and North Down – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Lisburn & Castlereagh – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Newry, Mourne and Down – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Antrim and Newtownabbey – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Mid and East Antrim – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Source: Interdepartmental Business Register (IDBR)

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Mid Ulster – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Interdepartmental Business Register (IDBR)

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Armagh City, Banbridge and Craigavon – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Causeway Coast and Glens – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Derry City and Strabane – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Interdepartmental Business Register (IDBR)

Source: Business Register and Employment Survey (BRES)

Source: Interdepartmental Business Register (IDBR)
Fermanagh and Omagh – Knowledge Economy

Knowledge Economy employment (% of total employment), 2016

Knowledge Economy businesses (% of total businesses), 2016

Source: Interdepartmental Business Register (IDBR)

Source: Business Register and Employment Survey (BRES)
Annex 3 – Other slides
Wider impact of the Knowledge Economy

• The wider impact of the Knowledge Economy is felt through the supply chain purchases made by these companies (the indirect effects) and through the expenditure of employees’ wages from Knowledge Economy companies and their supplier in NI (the induced effects).

• The calculation of Knowledge Economy multipliers was possible due to the provision of sectoral GVA, productivity and employment data from the Annual Business Inquiry (ABI) by NISRA and the use of experimental NI Input:Output tables.

Source: UUEPC