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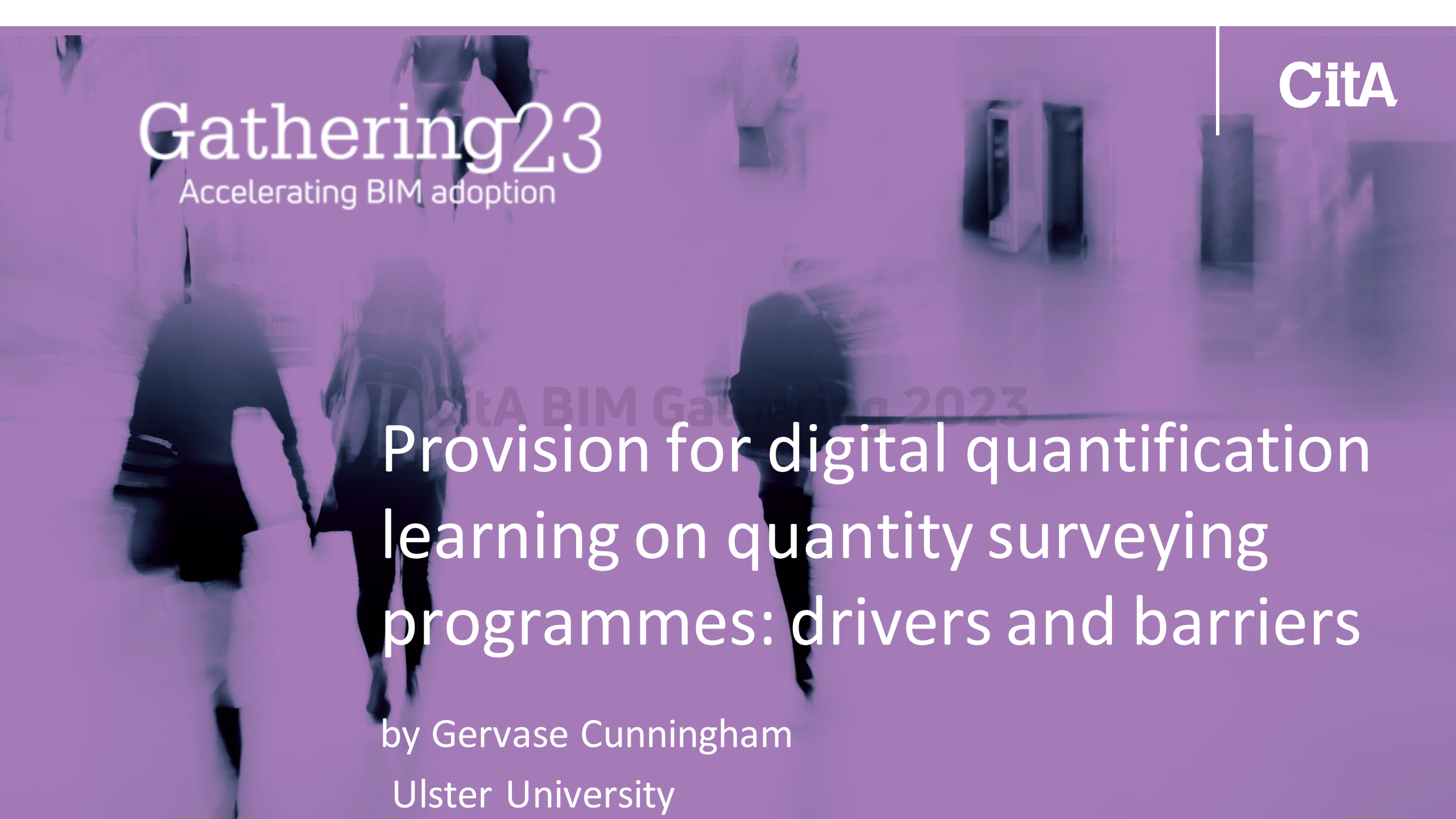

Provision for digital quantification learning on quantity surveying programmes: drivers and barriers

by Gervase Cunningham
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Provision for digital quantification learning on quantity surveying programmes: drivers and barriers

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Introduction

- The development of measurement skills of quantity surveying students is happening in a rapidly changing environment where they need to adapt quickly to advancing digital technologies including BIM.
- Advances in technology in industry have seen the demise of the traditional handwritten take-off and the labour-intensive transfer into a bill of quantities with the continued digitalisation of the process.

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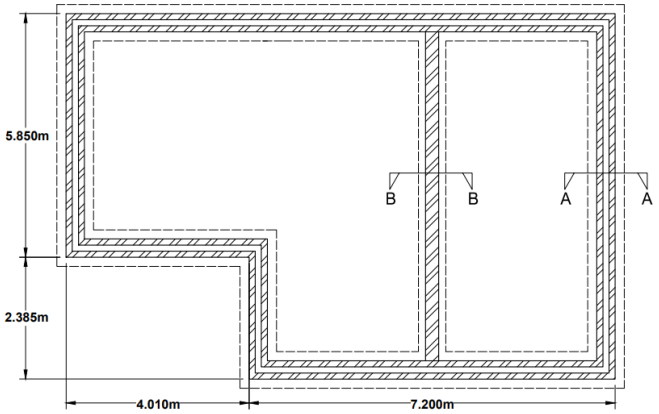
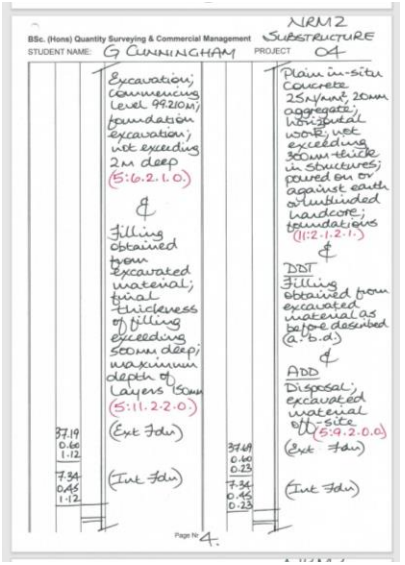
- This has now made the process of measurement and bill production predominantly automated.
- This has improved time efficiency and transparency as well as accuracy.
- However, research indicates that quantity surveyors have been slow to adopt advancing digital technologies.
- Generally, in academia the conventional approach to teaching construction measurement involves developing learning in construction technology to develop a student's knowledge and understanding to be able to read and interpret information on a drawing.
- Then developing manual quantification skills before progressing to some form of digital quantification.





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- Initially software packages required entering dimensions taken from 2-dimensional drawings which evolved to the automated abstraction of total quantities from 3-dimensional building information models (BIM).
- Dispensing with the requirement to wait for printed drawings and then use scale rulers to abstract dimensions to be recorded in a systematic manner on dimension paper.
- Replacing with drawings being emailed or shared on a cloud based common data environment and then quantified using on screen take-off software.
- In conjunction with this, it is necessary to explain the rules, namely a standard method of measurement such as the New Rules of Measurement – Detailed Measurement for Building Works second edition (NRM2) if based in the United Kingdom (UK) or the Agreed Rules of Measurement fourth edition (ARM4) if based in the Republic of Ireland.
- This is also done whilst showing or subsequent to showing the process of how-to take-off (measure) to quantify work (as outlined previously).
- Inevitably some students struggle to acquire this mix of skills and knowledge within a restricted academic timeframe.

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- Therefore, as industry has moved to predominantly using software for the quantification and billing process the practice of teaching traditional manual measurement must now be questioned.
- This has been reinforced by the observation that students with digital quantification skills and knowledge display a higher technical ability and are better prepared for work in industry.

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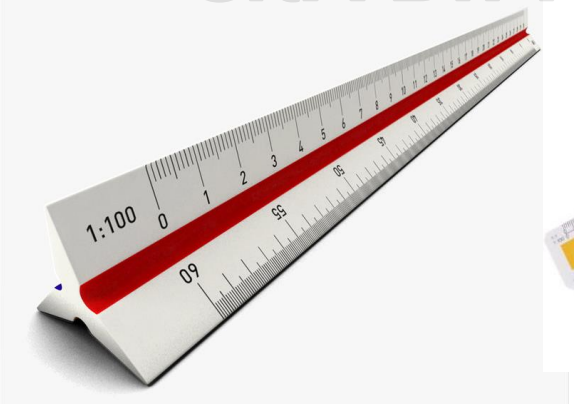

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Drivers

- The drivers put forward for the adoption of digital quantification in academia are common in many instances to those drivers for its adoption in industry.
- These include:

  - Increased productivity.
  - Better response times.
  - Improved accuracy.
  - Improved quality control.
  - More transparent working methods.
  - Improved communication.
  - Promotion of greater and more efficient collaboration.

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- Other drivers put forward include:
  - Enhanced visualisation of data and project information in a 3-deimensional BIM environment.
  - Provision of greater flexibility and adaptability to managing changing project requirements.
- However, the main driver in academia is ensuring that students have the necessary adaptable digital skills in a rapidly changing industry as research has identified that many academic institutions do not offer specific modules in digital learning or if they do it is inadequate to meet industry's needs.
- This then puts the onus on companies to train their recently employed graduates.
- However, it is also worth noting that quantity surveying graduates will be future influencers of the construction industry and its implementation of digital technology, and third level institutions will need to embed digital skills.

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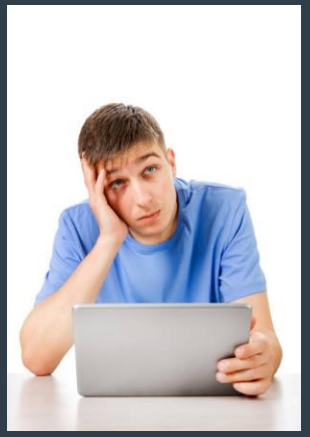
Barriers

- The integration of digital quantification on quantity surveying programmes throughout Ireland and the UK has had numerous challenges and barriers again similar in many instances to those encountered in industry.
- These include:
  - Lack of digital literacy among not only students but academics.
  - Lack of industry support and cooperation as consultancies and companies may be tentative about partnering with academic institutions to provide real-life projects and case studies for students to gain relevant knowledge.
  - Accessibility and affordability of digital technologies or particularly lack of awareness of what software is accessible and affordable.
  - Lack of investment in computer hardware, poor managerial leadership and attitude towards incorporating digital technologies



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- Other barriers identified include:
  - Software not being user-friendly.
  - Software compatibility issues.
  - Intellectual property , privacy and copyright issues particularly where industry information may be used.
  - General resistance or fear of change by academics.
- Therefore, barriers like those in industry can be categorised as technological, financial, organisational or psychological.

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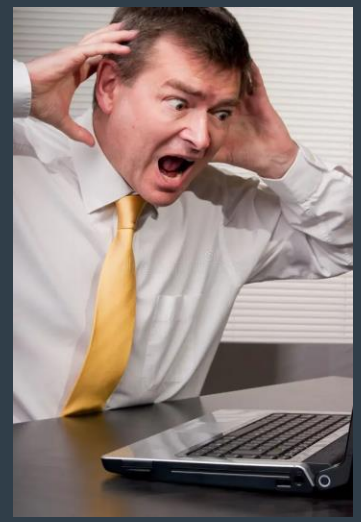

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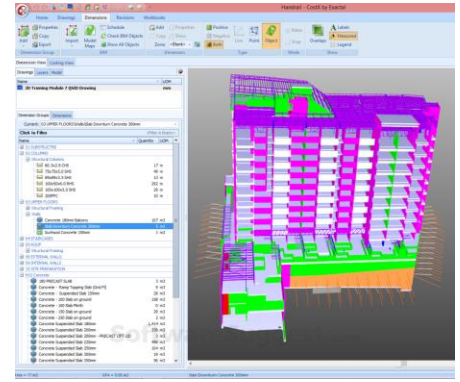
Primary Research



- A survey was conducted of current provision and approach to delivery of digital quantification learning at both undergraduate level and on postgraduate "conversion" programmes across Ireland and the UK.
- Data was collected using an online questionnaire that was developed through JISC Online Surveys.
- The questionnaire was designed and drafted to collect data on staff members' perceptions and experiences related to the teaching and learning of digital quantification on quantity surveying programmes, as well as the challenges and benefits related with its integration.
- A total of 91 prospective participants were identified in over 30 academic institutions across Ireland and the UK via university websites and RICS/SCSI databases.
- These academics were then contacted via email to complete the survey.
- Out of these, disappointingly only 31 recipients completed the survey, representing a response rate of 34.07%.
- However, the responses to the survey did produce some interesting data.

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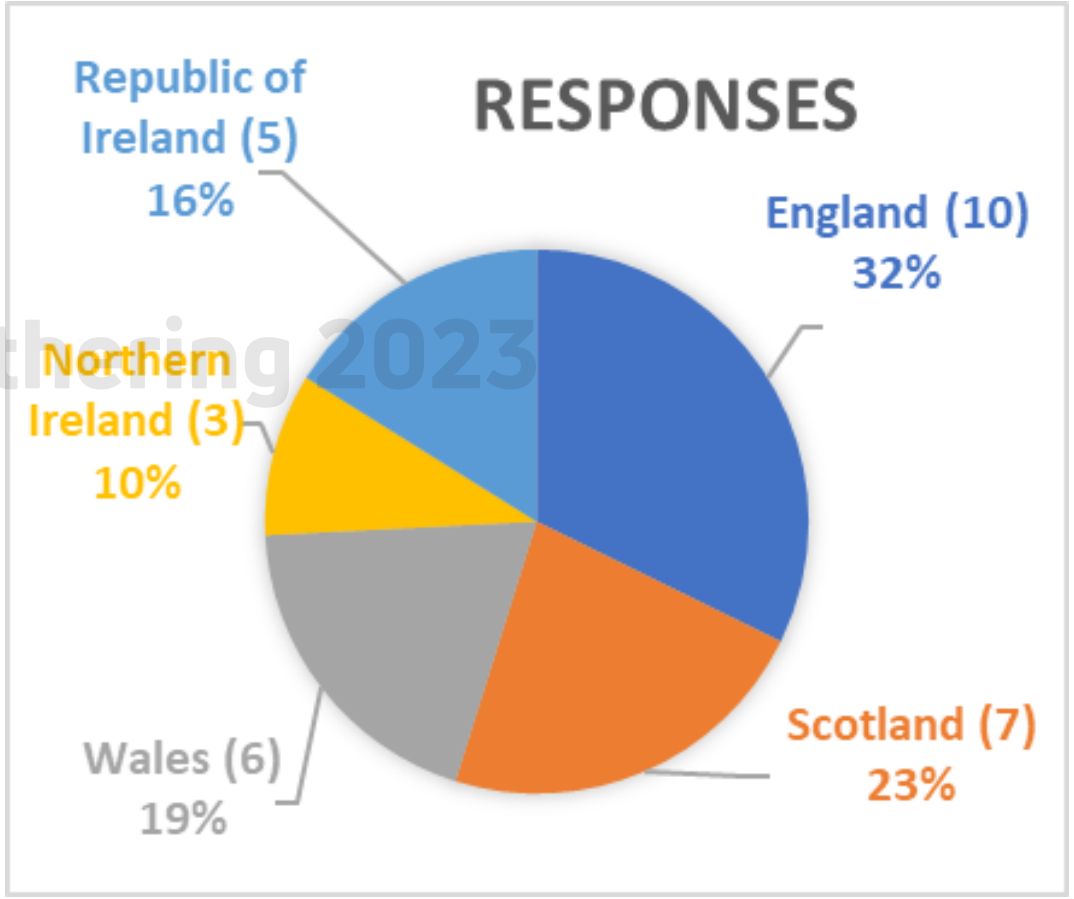
Data Analysis & Results

- The demography of the responses detailing the numeric and percentage breakdown are illustrated in the pie chart.
- All respondents indicated that learning and assessment in measurement/quantification at their institution was a mixture of traditional manual "taking-off" and the application of some form of digital method.



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- The responses indicated that 18 institutions deliver learning and assessment in digital quantification in first year at undergraduate level.
- Moving on to second year, responses recorded that this was the most popular stage for embedding digital quantification learning and assessment in the curriculum with 29 of the 31 respondents indicating that their institutions had provision at this stage.
- With regard to third year, 11 institutions provided learning and assessment in digital quantification.
- These were institutions in either the Republic of Ireland or Scotland who predominantly deliver a 4-year full-time programme as opposed to the 4-year sandwich undergraduate degrees offered at institutions in England, Wales and Northern Ireland where the third year is spent on industrial placement.
- In final year at undergraduate level 19 institutions provided for learning and assessment of digital quantification.
- At postgraduate level all 7 institutions offering such programmes had provision for digital quantification learning and assessment.

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- The table appended provides a further analysis of responses detailing different approaches to provision for digital quantification and learning.
- As can be seen on the table all respondents with the exception of one indicated that digital quantification learning and assessment was delivered over at least 2 years on their undergraduate programme, with 8 respondents indicating that it was delivered over 3 years and 4 respondents indicating delivery over all 4 academic years of a full-time programme.

Provision for digital quantification learning and assessment	Programme format	Number of institutions
1st year only	4-year sandwich programmes	1
1st and 2nd year	4-year sandwich programmes	6
1st and final year	4-year sandwich programme	1
2nd and final year	4-year sandwich programme	8
1st, 2nd and final year	4-year sandwich programme	4
2nd and 3rd year	4-year full-time programme	3
1st, 2nd and 3rd year	4-year full-time programme	2
2nd, 3rd and final year	4-year full-time programme	2
1st, 2nd, 3rd and final year	4-year full-time programme	4

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- With regard to the software platforms used by third level institutions for digital quantification the appended table provides a detailed breakdown of results from the survey.
- As can be seen Microsoft Excel and CostX are the most popular software platforms for digital quantification learning in academia followed by Buildsoft Cubit and Bluebeam.

Software Used	Northern Ireland	Republic of Ireland	England	Scotland	Wales	Total
Autodesk Quantity Take-off	0	1	3	1	2	7
Bluebeam Revu	3	4	1	0	2	10
Buildsoft Cubit	3	2	3	1	3	12
Causeway CATO	0	1	0	0	1	2
CostX	3	4	7	5	3	22
Microsoft Excel	3	5	8	5	6	27
Planswift	0	0	2	0	0	2
QS Pro	0	0	1	0	0	1
Revit	3	1	0	0	0	4

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- It is interesting to note that the survey has identified that the vast majority of institutions use two or more software platforms to deliver digital quantification learning.
- This is detailed on the table appended.
- It can be seen also that Microsoft Excel is extensively used across the institutions in conjunction with bespoke software platforms.

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Combination of software used at institution	Northern Ireland	Republic of Ireland	England	Scotland	Wales	Total
Microsoft Excel only			2	1		3
Buildsoft Cubit only				1		1
Microsoft Excel & CostX			3	4		7
CostX & Autodesk Quantity Take-off				1		1
CostX & Buildsoft Cubit		1				1
Microsoft Excel & Causeway CATO					1	1
Microsoft Excel & Bluebeam Revu		1				1
Microsoft Excel & Autodesk Quantity Take-off					1	1
Buildsoft Cubit & Autodesk Quantity Take-off			1			1
Microsoft Excel, CostX & Buildsoft Cubit					1	1
Microsoft Excel, CostX & Causeway CATO		1				1
Microsoft Excel, Buildsoft Cubit & Autodesk Quantity Take-off					1	1
Microsoft Excel, CostX & Bluebeam Revu					1	1
Microsoft Excel, Autodesk Quantity Take-off & Bluebeam Revu		1				1
Microsoft Excel, CostX & QS Pro			1			1
Microsoft Excel, CostX & Planswift			1			1
Microsoft Excel, CostX, Autodesk Quantity Take-off & Planswift			1			1
Microsoft Excel, CostX, Buildsoft Cubit & Bluebeam Revu					1	1
Microsoft Excel, CostX, Buildsoft Cubit & Autodesk Quantity Take-off			1			1
Microsoft Excel, CostX, Buildsoft Cubit, Bluebeam Revu & Revit	3	1				4

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- In terms of the design information used in the delivery of digital quantification modules:
  - 11 respondents indicated that their institutions used design information solely in a PDF format.
  - 10 respondents indicated use of design information in either a PDF or DWG format.
  - 5 respondents indicating that their institution used BIM models in addition to design information in a PDF and DWG format.
  - 2 respondents indicating that their institutions used BIM models as well as design information in a PDF format.
  - 2 respondents indicating that their institution only used BIM models.
  - 1 respondent indicating using design information solely in a DWG format at their institution.

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- The main drivers identified by respondents were:
  - Better preparation of students for a career in a rapidly changing industry.
  - Improving efficiency and transparency of the quantification process.
  - Embedding the importance of better collaboration and communication in a digital environment.
  - Improving speed and accuracy of data processing and analysis – attributes employers are increasingly looking for in quantity surveying graduates.
  - Enhanced visualisation of data and project information in a digital 3-D environment improving understanding and development of construction technology learning and application to the quantification process.
  - Improved accessibility to digital quantification software and support and its evolvement in terms of being “user friendly”.

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- The main barriers identified by respondents were:
  - Lack of understanding of digital technologies particularly with many first-year students not having basic skills in the use of Microsoft Excel for example being identified.
  - Lack of appropriate resources to support digital quantification learning.
  - Lack of digital literacy among academic staff delivering modules.
  - Limited training and support available for academics.
  - Difficulty in obtaining design information in the form of digital drawings.
  - Students being able to share information in a digital environment easily and creating problems when it came to assessment and ensuring academic integrity.
  - Lack of institutional support in terms of facilitating digital quantification in the curriculum.
  - Cost of implementing, maintaining and updating digital quantification software.
  - View among some pedagogists that an over reliance on technology may contribute to restricting the development of critical thinking and problem-solving skills.

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- The survey also asked if the Royal Institution of Chartered Surveyors (RICS)/Society of Chartered Surveyors of Ireland (SCSI) should incorporate a competency in digital quantification for the quantity surveying Assessment of Professional Competence (APC) as a further measure to advance the further embedding of digital quantification in quantity surveying programmes.
- 52% of respondents said yes, 29% of respondents were unsure, and 19% of respondents said no.
- The survey also questioned the suitability of the current method of measurement, either NRM2 or ARM4 for use in digital quantification 28 respondents indicated that the respective methods of measurement were suitable with the remaining 3 respondents indicating that they were not.
- However, it was identified that the building-up of descriptions is still a time-consuming process and qualitative responses argued that possibly the methods of measurement need to be updated to recognise the restrictions of quantifying in a digital platform.

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Conclusion

- There does appear to be a variety of approaches to delivering digital quantification therefore, recommendations are as follows.
- As all degree programmes are accredited by either the RICS or SCSI and embed their respective learning framework the development of a digital quantification APC competency would set out clear criteria and provide the basis for developing a uniform and consistent approach for embedding learning outcomes for digital quantification on QS programmes across institutions.
- Lack of digital literacy among some students should be addressed by embedding learning in the first year of undergraduate programmes to develop competency in the use of Microsoft Excel and computer aided design software such as Revit and Navis Works providing the basis for developing further digital quantification skills with bespoke quantification software from second year onwards.
- Greater collaboration with software providers and also between academic institutions in terms of developing best practice and developing and sharing resources particularly instructional videos, design information etc.

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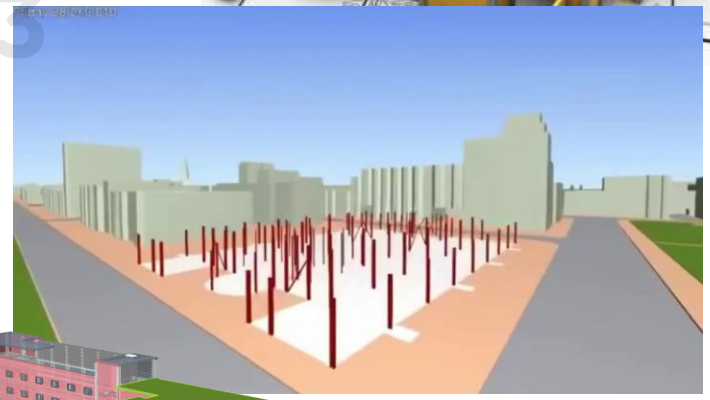
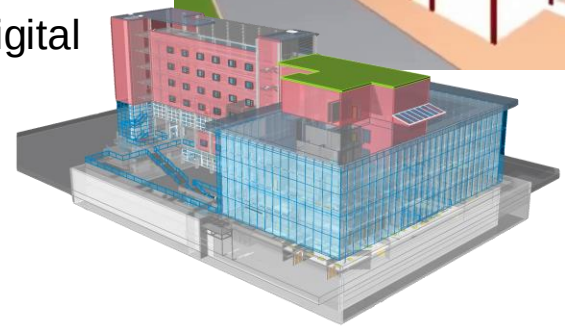
- That bespoke software providers in conjunction with academic institutions explore ways of enhancing licences issued for educational purposes to facilitate forensic checking by academic staff to establish if work has been completed by the student or students concerned over the time period allocated and not simply copied from another student just prior to submission.
- As technology and industry is rapidly moving forward with regard to digital quantification, course teams need to develop a strategic plan for adopting, embedding and advancing the use of digital quantification learning to avoid their programmes losing currency and relevance with industry – there simply cannot be an ad hoc approach.
- To conclude there is a significant opportunity for quantity surveyors to improve efficiency and accuracy of construction cost management and competence in digital quantification technology can facilitate this.





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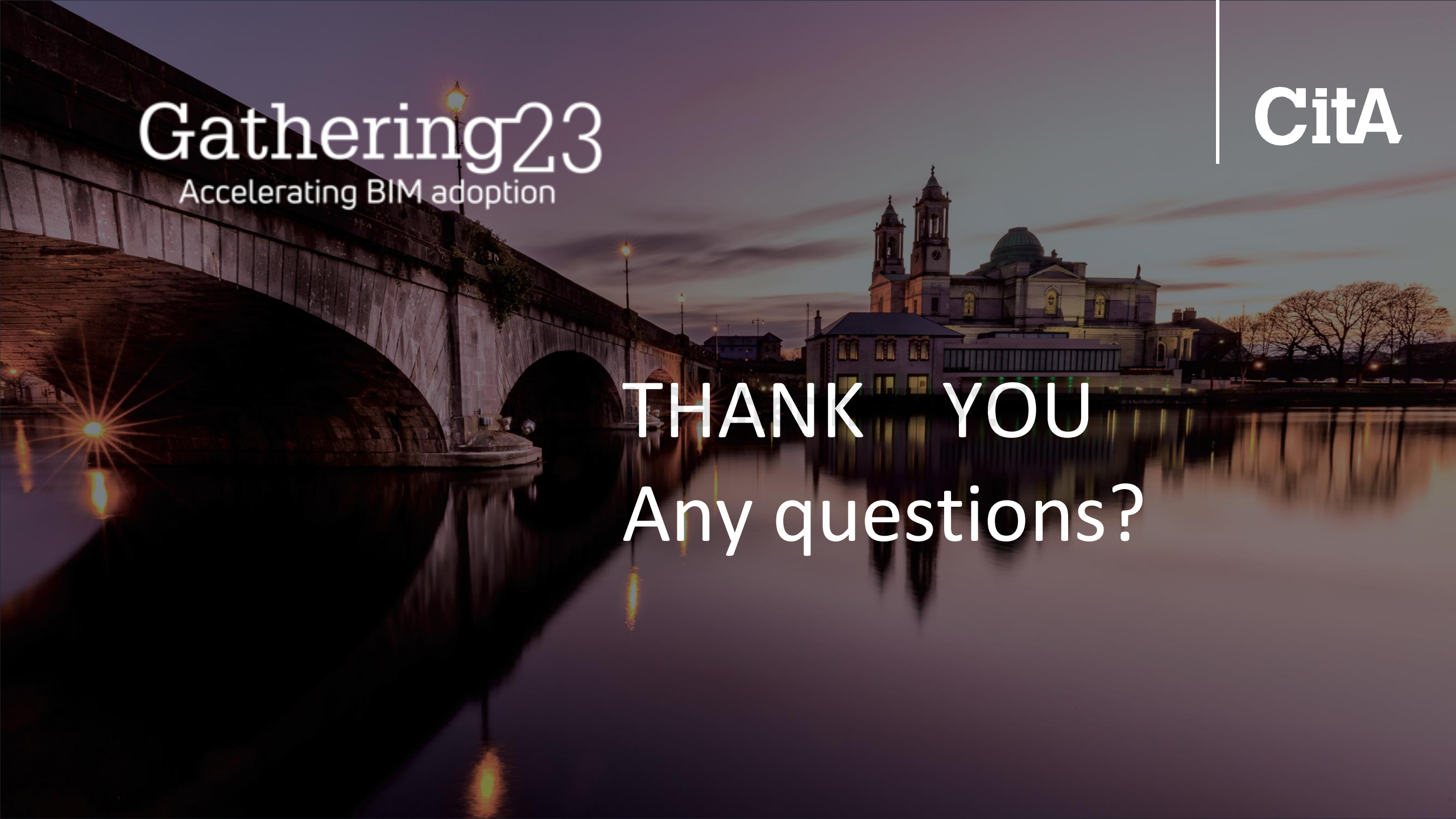
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