CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Report of Validation Panel
for a Special Purpose, Minor or Supplemental Award

Date of Meeting: 25th June, 2020

Named Award: Certificate

Programme Title: Certificate in Process Data Analytics

Award Type: Special Purpose Award

NFQ Level: 8

Intakes Commencing: Sept 2020

ECTS/ACCS Credits: 30

PANEL MEMBERS

Name / Function / External Institution OR CIT Academic Unit
Chair: Dr Breda Kenny, Head of School of Business, CIT
Aoife Brosnan, Janssen (Johnson & Johnson)
Dr David O'Sullivan, Univ. of Limerick

IN ATTENDANCE

Name / Function / External Institution OR CIT Academic Unit

PROPOSING TEAM MEMBERS

Name / Function / Academic Unit
Dr. David Goulding, Head of Dept. of Mathematics
Dr. David Hawe, Lecturer, Dept. of Mathematics
Sarah Murphy, Lecturer, Dept. of Mathematics
Dr. Catherine Palmer, Lecturer, Dept. of Mathematics

BACKGROUND TO THE PROPOSED PROGRAMME

Competitiveness is critical as manufacturing sites within networks globally compete to be selected to manufacture produce. With advancements in manufacturing process technologies and the drive towards Industry 4.0, companies increasingly seek to make data-driven decisions about both their operations and supply chains to achieve this competitiveness.

Process data analytics refers to a combination of tools and techniques that are used to make inferences and process decisions based on measured system data. The field of data analytics has become progressively

important due to the huge increases in the amount of data being collected, reductions in the cost of computer hardware, advances in data analytics algorithms, and the increased availability of powerful software tools.

This Certificate in Process Data Analytics has been designed, with significant industrial engagement, to provide learners with an opportunity to rapidly upskill in the ever-expanding field of data analytics. The programme will provide graduates with a theoretical underpinning of process data analytics, but more importantly, provide the practical skills required to meet the demands of the current and future data-driven industry. This course will enable learners to apply the transferable skills developed as part of their original degree to a specific expertise within data analytics.

This part-time blended learning programme will run over one academic year, for three evenings per week. The bulk of the course will be delivered online, providing a flexible learning environment for applicants.

The Certificate consists of 5 modules, 4 of these are new modules. The new modules have been externally reviewed and then internally moderated; the reviews are available in the Module Review spreadsheet.

FINDINGS OF THE PANEL

The work of the programme team, the panel members, the Curriculum Development Facilitator, and the Office of the Registrar and VP for Academic Affairs is acknowledged for the work and support for the validation process for the Certificate in Process Data Analysis.

On consideration of the documentation provided and discussion of the programme with the proposers, the Panel has arrived at the following Findings and Recommendations:

1. Validation Criteria

1.1 Is there a convincing need for the programme with a viable level of applications?

Overall Finding: Yes

Finding(s): A clear industry need, as initially identified by the regional skills forum, is addressed by this programme. This is further endorsed by support under the Springboard + programme.

Recommendation(s): The panel encourage the team to consider future programme development potential in terms of variation of different data settings and other CPD and workshop opportunities in R and other relevant content.

1.2 Are the level and type of the proposed award appropriate?

Overall Finding: Yes

Finding(s): The appended table below provides a mapping of the programme learning outcomes to CIT award standard – level 8 Science. The level and type of award are appropriate to the programme proposed, the graduate and the needs of industry.

1.3 Is the learning experience of an appropriate level, standard and quality?

Overall Finding: Yes

Finding(s): The proposed programme meets the needs of the overall learning experience with a fully online delivery for the first cohort of 20, with the opportunity to scale up in terms of numbers in subsequent delivery plans. The teaching, learning and assessment strategies are suited to learner needs overall.

Recommendation(s):

1.3.1 Update documentation to reference internal CIT/MTU supports such as the Technology Enhanced Learning and the Teaching and Learning Units.

1.3.2 Consider the use of R studio cloud to assist with uniform installation of software [https://rstudio.cloud/]

1.3.3 Consider mentioning other scripting language in lectures, as another scripting language, Python, was mentioned in the main text. The focus on a single scripting programming language in the offered modules is wholly appropriate as it will provide a solid ground in statistical

programming. It is also possible to hint at R's bindings and integrations for other languages, such as the libraries 'rccp' for C++ and 'reticulate' for Python.

1.3.3.1 https://cran.r-project.org/web/packages/reticulate/vignettes/calling_python.html

1.3.3.2 https://www.r-project.org/nosvn/pandoc/Rcpp.html

1.3.4 Consider the use of github classrooms when teaching version control through rstudio's integration of git. The majority of assessments across the programme are individual projects, the addition of group work in the assessment approach should be considered in future delivery notwithstanding the challenge of implementing group work in an online part time context.

1.3.5 As Communicating, story telling, presentation skills are key skill requirements, the inclusion of presentations where possible across modules is recommended.

1.3.6 Introduction to Data Analytics - foundational module for the programme with one hour lab contact time to facilitate access and exposure to trial and free license software.

1.3.7 Process Data with R – The inclusion of data cleaning and compliance in this module is to be commended here.

1.3.8 Regression Analysis – existing approved module. Students will use Excel and r only. SPSS not covered for this programme.

1.3.9 Data Mining and Visualisation – broad module covering a range of topics to provide a general overview of content with depth in specific areas where relevant.

1.3.10 Data Analytics Case Study – the industry specific focus of this module is to be commended. The self-directed nature of the student work allows a customised learning output based on work/industry specific context, needs, tools and software. Where industry projects and data are not available, alternative project scenarios and data sets will be made available at department level.

1.4 Is the programme structure logical and well designed (including procedures for access, transfer and progression)?

Overall Finding: Yes

Finding(s): Overall the programme structure is logical and well designed with a good balance between foundational and more advanced content and between theoretical and practical lab based activity. Entry, transfer and progression routes are clearly outlined with the potential to advance to the Higher Diploma in Science and Master of Science a distinct advantage.

1.5 Are the programme management structures adequate?

Overall Finding: Yes

Finding(s): The programme management arrangements are in place with a strong programme team with industry, research and academic experience. A wider team for project/case study supervision can also be drawn on. The programme also builds on the experience and learning from existing programmes with the department.

1.6 Are the resource requirements reasonable?

Overall Finding: Yes

Finding(s): The resource requirements of the programmes have been addressed and will meet the needs of the programme and its learners.

Recommendation(s):

1.6.1 While the resources are in place for the first cohort of 20, the programme team needs to consider the IT/remote support needs of learners and lecturing staff specific to this programme. Where additional support may be provided at an Institute level, departmental support may also be required to supplement this.

1.7 Will the impact of the programme on the Institute be positive?

Overall Finding: Yes

Finding(s): The proposed programme clearly aligns with departmental, school and overall Institute strategy and mission. Furthermore, clear alignment with regional, national and industry needs and priorities is evident.

2. Other Findings

The programme team are to be commended on developing a programme that has a strong alignment with industry needs at programme, module and at the teaching, learning and assessment level. The programme has potential to scale up in terms of its reach for the current programme, but also in terms of developing further iterations of this programme.

CONCLUSION

Based on the above findings, the Panel recommends to Academic Council:

That the Programme be validated for five academic years, or until the next programmatic review, whichever is soonest, and with due regard to the Recommendations made.

DEPARTMENTAL RESPONSE

Finding(s) and Recommendation(s)	Departmental Response
1.1 Is there a convincing need for the programme with a viable level of applications? Overall Finding: Yes **Finding(s):** A clear industry need, as initially identified by the regional skills forum, is addressed by this programme. This is further endorsed by support under the Springboard + programme. **Recommendation(s):** The panel encourage the team to consider future programme development potential in terms of variation of different data settings and other CPD and workshop opportunities in R and other relevant content.	1.1 The programme team wish to acknowledge the work of the panel and the staff of the Academic Quality Enhancement Office in CIT in assisting the development and validation of the newly proposed programme. The department thank the validation panel for their work on the day and their overall approval of the validation of this new programme. The programme development team has already held preliminary discussions around the extension of the programme to encompass other programming languages and industry settings for example. Further to this, the team have discussed specific CPD workshops on advanced industrial statistics and currently have a suite of such workshops ready to roll-out.
1.2 Are the level and type of the proposed award appropriate? Overall Finding: Yes **Finding(s):** The appended table below provides a mapping of the programme learning outcomes to CIT award standard – level 8 Science. The level and type of award are appropriate to the programme proposed, the graduate and the needs of industry.	1.2 The programme team thank the AQE office for guidance on the CIT Awards mapping process.
1.3 Is the learning experience of an appropriate level, standard and quality? Overall Finding: Yes **Finding(s):** The proposed programme meets the needs of the overall learning experience with a fully online delivery for the first cohort of 20, with the opportunity to scale up in terms of numbers in subsequent delivery plans. The teaching, learning and assessment strategies are suited to learner needs overall.	The programme team acknowledge that the comments from the validation panel in relation to scalability of the programme going forward. Industry representatives have flagged the relevance of the programme and by choosing to run the programme fully online, the department has allowed for future upscaling of the programme.
Recommendation(s): 1.3.1. Update documentation to reference internal CIT/MTU supports – TEL TLU	1.3.1 Documentation has been updated with specific sections relating to TEL and TLU now included.

1.3.2 Consider the use of R studio cloud to assist with uniform installation of software [eg https://rstudio.cloud/]	1.3.2 The programme team will ensure that uniform installation instructions are provided to students in advance of the commencement of the programme. Further to this, the team will create an installation on RStudio Cloud for students. It should be noted as well that virtual machines are available to students of the institute.
1.3.3 Consider mentioning other scripting language in lectures, as another scripting language, Python, was mentioned in the main text. The focus on a single scripting programming language in the offered modules is wholly appropriate as it will provide a solid ground in statistical programming. It is also possible to hint at R's bindings and integrations for other languages, such as the libraries 'rccp' for C++ and 'reticulate' for Python. a. https://cran.r-project.org/web/packages/reticulate/vignettes/calling_python.html b. https://www.r-project.org/nosvn/pandoc/Rcpp.html	1.3.3 Other scripting languages (including Python) and commercially available software will be discussed within the programme (for example in the Introduction to Data Analytics module). The programme team thank the validation panel for their consideration of the rationale for using a single scripting language within the programme and also thank them for highlighting the possible use of a Python binding within RStudio. As the programme will focus on R, the proposing team will endeavour to weaver the use of these bindings into the programme.
1.3.4. Consider the use of github classrooms when teaching version control through RStudio's integration of git. The majority of assessments across the programme are individual projects, the addition of group work in the assessment approach should be considered in future delivery notwithstanding the challenge of implementing group work in an online part time context. [https://classroom.github.com/]	1.3.4 The programme team acknowledge the challenges of implementing group work in an online part-time environment. Furthermore the programme team will explore the usability of GitHub Classroom in the assessment of group projects going forward with the plan to implement this in future iterations of the programme.
1.3.5 As Communicating, story telling, presentation skills are key skill requirements, the inclusion of presentations where possible across modules is recommended.	1.3.5 The art of communication, storytelling and presentation skill are core within the programme and a number of the modules in the second semester have presentation assessment pieces included in them. At present the semester 1 modules focus on embedded good scientific writing in the learning while the semester 2 modules integrate the story-telling/presentation skills into the programme.
1.3.6 Introduction to Data Analytics - foundational module for the programme with one hour lab contact time to facilitate access and exposure to trial and free license software.	1.3.6 All software used in the programme will be freely available to students.
1.3.7 Process Data with R – The inclusion of data cleaning and compliance in this module is to be commended here.	
1.3.8 Regression Analysis – existing approved module. Students will use Excel and R only. SPSS not covered for this programme.	1.3.8 The programme team will focus solely on R as a statistical language with some use of Excel for some basic data manipulation.

1.3.9 Data Mining and Visualisation – broad module covering a range of topics to provide a general overview of content with depth in specific areas where relevant. 1.3.10. Data Analytics Case Study – the industry specific focus of this module is to be commended. The self-directed nature of the student work allows a customised learning output based on work/industry specific context, needs, tools and software. Where industry projects and data are not available, alternative project scenarios and data sets will be made available at department level.	1.3.10 The programme team acknowledge the commendation of the validation panel in relation to this module and will ensure that all learners will be aware that they will have the opportunity to use their software of choice within the case study module.
Recommendation(s): 1.6.1 While the resources are in place for the first cohort of learners , the programme team needs to consider the IT/remote support needs of learners and lecturing staff specific to this programme. Where additional support may be provided at an Institute level, departmental support may also be required to supplement this	1.6 The programme team will liaise with IT Services, SoSI IT technicians and the Department of TEL to discuss additional supports that may need to be put in place as the programme grows.
The programme team are to be commended on developing a programme that has a strong alignment with industry needs at programme, module and at the teaching, learning and assessment level. The programme has potential to scale up in terms of its reach for the current programme, but also in terms of developing further iterations of this programme.	The programme team acknowledge the work of the validation panel and the AQE office, in particular over the duration of this programme validation. Furthermore the team would like to thank the panel for their support of the proposed programme and that they share the programme team's vision on scaling up the programme going forward.

APPENDIX – PROPOSED PROGRAMME OUTCOMES MAPPED TO CIT AWARD STANDARD SCIENCE LEVEL 8

		Mapping of CIT Programme Outcomes to:	
		CIT Award Standard – Science Level 8	
Generic Standard Level 9	Science Standard Level 8	Certificate in Process Data Analytics Programme Outcomes	Supporting Statement
Knowledge-Breadth			
The graduate should be able to demonstrate: *An understanding of the theory, concepts and methods pertaining to a field (or fields) of learning*	The learner is expected to have a detailed knowledge and understanding of: 1. the essential facts, major concepts, principles and theories associated with a particular subfield, or sub-fields of science.	Demonstrate detailed knowledge and understanding of areas of Data Analytics, Programming, Regression, Data Mining and Data Visualisation relevant to those working on process data in a manufacturing site.	In this programme, the learner will develop enhanced specialised knowledge and an in-depth understanding of topics relevant to the field of data analytics with a particular focus on applications within the manufacturing environment. The modules "Process Data Analytics with R", "Data Mining and Visualisation" and "Regression Analysis" will provide learners with the opportunity to gain an understanding of and expertise in topics including statistical programming, regression analysis, data mining and data visualisation. Furthermore, the learner will develop the ability to critically assess and analyse instances of data science within their chosen domain allowing them to appraise business and corporate level strategies in relation to competitive and global changes arising from the data revolution, with these skills developed in particular through the modules "Introduction to Data Analytics" and "Process Data Case Study". These two modules, which bookend the programme, provide the overarching understanding and view of the field and the opportunity to synthesise the learning acquired in the exploration of a real world case study.
Knowledge-Kind			
The graduate should be able to demonstrate: *Detailed knowledge and understanding in one or more specialised areas, some of it at the current boundaries of the field(s)*	The learner is expected to have a detailed knowledge of: 1. the terminology, nomenclature, and/or classification systems appropriate to the subject area; 2. the theories, paradigms, defining concepts and underlying principles of the subject area; 3. advanced methods for acquiring, interpreting and analysing subject-specific information, with a critical understanding of the appropriate contexts for their use through the study of texts and original papers; 4. the identification, definition and resolution of complex problems; 5. relevant legal, quality and regulatory frameworks; 6. current issues of concern to society and an understanding of the philosophical and ethical issues involved; 7. some aspects of the defining elements of	Demonstrate understanding of the terminology, defining concepts and theories underlying the Analytics field; demonstrate knowledge of the advanced methods and technologies for acquiring, interpreting and analysing process data.	Throughout the programme the learner will develop detailed knowledge of the fields of data analytics and statistical modelling – in particular in the modules "Process Data Analytics with R" and "Regression Analysis", the learner will gain insights into the fundamental principles of these knowledge fields. Through analysis of real-world data, throughout the programme, the learner will develop critical understanding of both context and application of domain data and knowledge in solving complex problems. The module "Introduction to Data Analytics" will provide learners with an understanding of the implications of relevant legal, quality and regulatory frameworks on data analytics. Data integrity is currently a key societal concern and within the programme a focus on ethical data collection, storage and appropriate analysis persists throughout all modules. The module "Process Data Analytics Case Study" provides the learner with a self-directed opportunity to research, explore and analyse a specific data analytics problem within their own field of expertise.

	the subject area as a result of in-depth individual study or research; 8. the current knowledge and development of the subject area (including current limits of theoretical and applied knowledge).		
Know-How & Skill-range			
The graduate should be able to demonstrate: *Mastery of a complex and specialised area of skills and tools; use and modify advanced skills and tools to conduct closely guided research, professional or advanced technical activity*	The learner will be able to: 1. solve complex technical problems; 2. employ advanced data analysing, synthesising and summarising skills in a scientific work setting; 3. source, interpret and apply appropriate and referenced literature and other information sources; 4. work independently within defined time and resource boundaries; 5. effectively and safely operate a range of complex laboratory and other relevant equipment; 6. apply advanced numerical and statistical analysis skills; 7. maintain detailed records of activities; 8. communicate scientific information in a variety of forms to specialist and non-specialist audiences. 9. design a relevant programme of investigation	Demonstrate ability of relevant skills and tools in Programming, Data Analytics, Data Mining, Regression and Data Visualisation; use these to solve problems involving process data sets; work independently within defined time and resource boundaries; communicate in a variety of forms to specialist and non-specialist audiences.	Throughout this course learner will enhance their abilities to describe, analyse and solve complex data problems. The programme provides learners with enhanced skills in data collection and analysis while synthesising their learning through various projects, presentations, reports and case study analysis. Modules have been designed to provide students with assessments that reflect modern day applications and learners will be required to submit scientific reports as part of their assignments, for example see assessment breakdown in "Process Data Analytics with R". The programme is designed to be run online and learners will need to work independently constrained by time and resources in producing their assessments. The modules "Process Data Analytics with R", "Data Mining and Visualisation" and "Regression Analysis", again, will provide learners with the opportunity to develop an understanding of and expertise in topics including statistical programming, regression analysis, data mining and data visualisation – this will give learners the opportunity to apply newly acquired advanced numerical, statistical and computational skills in the analysis of complex data problems. As part of "Process Data Analytics with R", learners will be introduced to reproducible documentation and version control providing them with methods of maintaining detailed records of their work. Learners will, throughout the programme, be required to present their work in both written and oral format with a strong focus on the story-telling aspect of data analytics.
Know-How & Skill-Selectivity			
The graduate should be able to demonstrate: *Exercising appropriate judgement in a number of complex planning, design, technical and/or management functions related to products, services, operations or processes, including resourcing*	The learner will be able to: 1. think independently and make effective decisions; 2. recognise and respect the views of others; 3. contribute fully to the day-to-day operations of a scientific industry, or other scientific work setting; 4. make decisions in relation to a complex, or highly regulated environment; 5. formulate and test hypotheses; 6. appreciate limits of knowledge in a scientific area and respond appropriately	Formulate and test hypotheses; contribute fully to the day-to-day operations of the manufacturing work setting.	Learners on the programme will develop the ability to independently critically assess and analyse instances of data science within their own work setting allowing them to appraise and critique business and corporate level strategies in relation to competitive and global changes arising from the data revolution. Graduates of the programme will make significant contributions to the day-to-day operations within their manufacturing environment, many of which will be specifically in highly regulated industries. Through the programme, learners will learn to formula and test statistical hypotheses and will examine real world applications of these statistical methods. Key within this will be the module "Regression Analysis" in which learners will study advanced statistical techniques, with a particular emphasis on large data sets.

Competence-Context			
The graduate should be able to demonstrate: *Use of advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for all related decision making; transfer and apply diagnostic and creative skills in a range of contexts*	The learner will be able to: 1. use advanced scientific skills to critically interpret existing knowledge and apply in new situations; 2. make and report appropriate decisions and take responsibility for such decisions; 3. behave ethically, in a range of work settings; 4. present and engage in debate relating to general scientific issues	Apply data analysis skills and technologies in a range of contexts in order to critically interpret existing knowledge and apply in new situations; make and report appropriate decisions in a responsible and ethical manner.	The module "Process Data Analysis with R" will introduce learners to the requirements of regulators in different fields including discussing GDPR and data integrity. This overview will ensure that learners will behave in an ethical manner in a range of data related environments. Via the remaining modules on the programme, the learners will develop advanced scientific skills in the understanding and critical analysis and interpretation of process data within the manufacturing industry. Students will also present and engage in debate in relation to the presentation of their own work in the programme.
Competence-role			
The graduate should be able to demonstrate: *Acting effectively under guidance in a peer relationship with qualified practitioners; lead multiple, complex and heterogeneous groups*	The learner will be able to: 1. plan for effective project implementation and manage the organisation of tasks, people and resources; 2. participate constructively in a complex team environment within a scientific field; 3. reflect on own practices; 4. accept responsibility for the work of self and others; 5. develop and train staff to meet changing technical needs.	Act effectively under guidance in a peer relationship with qualified practitioners; participate constructively in a complex interdisciplinary team environment; reflect on own practices.	As part of the programme the learner will undertake a "Process Data Analytics Case Study" in which they will develop a plan for a data analytics project implementation within their own industry. The "Introduction to Data Analytics" and "Process Data Analytics" modules within the programme will enable learners to reflect critically on data lead practices within their companies. As the dependence and reliance on data drive decisions increases the programme aims to develop enhanced skillsets within learners to meet the changing technical needs of Industry 4.0.
Competence-Learning to Learn			
The graduate should be able to demonstrate: *Learning to act in variable and unfamiliar learning contexts; learn to manage learning tasks independently, professionally and ethically*	The learner will be able to: 1. identify knowledge gaps and source and undertake self-learning to fill the gaps; 2. demonstrate an awareness of the need for enhanced technical competencies and continuing professional development; 3. evince a commitment to continuing education and lifelong learning	N/A	
Competence-Insight			
The graduate should be able to demonstrate: *Expression of a comprehensive, internalised, personal world view, manifesting solidarity with others*	The learner will be able to: 1. develop a capacity for social responsibility; 2. contribute to the development of the role of the scientist in society; 3. demonstrate the capacity to draw	N/A	

	complex information together and present in an understandable format; 4. demonstrate the capacity to acknowledge the current issues of concern to society and an understanding of the philosophical and ethical issues involved; 5. demonstrate a questioning attitude to the assumptions, both overt and covert, underlying modern science.		