UNIVERSITY OF GLOUCESTERSHIRE

at Cheltenham and Gloucester

University of Gloucestershire

Science, Technology, Engineering and Mathematics (STEM) Strategy 2017 –2022

1. Introduction and Context

1.1 The current political, social, economic and technological environment is creating higher levels of uncertainty for policymakers and others. Universities are not immune from this uncertainty and need to respond to this changed operating environment in appropriate ways. One of the outcomes identified by current analysis is showing a dearth of suitably qualified people entering the labour market in so called STEM subjects. And Gloucestershire and its surrounding local economies is no different to other parts of the UK in having a deficit in STEM related skills, particularly at higher levels.

1.2 As the local anchor institution the University is clear that it plays a leadership role in developing the skills and learning of most use to our students, the communities they live in and the industries they work for. That is why the University's strategy for 2017-2022 is explicit in stating that *'we want each student, during their time at the University, to gain the skills, knowledge, insight and confidence to transform their own lives for the better. We want each graduate to leave equipped to achieve their potential more fully and ready to pursue their ambitions more successfully, for the benefit of society, their families and themselves.'*[1]

1.3 The University's strategy has four goals – mutually reinforcing and mutually interlinked. The fourth of these goals is *'To build partnerships which create opportunity, innovation and mutual benefit for the communities we serve and increase the range and impact of our partnerships with business, colleges, public services and international partners'*. The University does this by focusing on three areas in particular to build partnerships. With businesses and other enterprises to succeed through innovation, knowledge exchange and the supply of highly-skilled graduates; with public services such as schools and hospitals to recruit people with the right qualifications and aptitudes; with further education colleges to broaden opportunities for their students to progress as far as their talents can take them.

1.4 This means that our STEM strategy emerges from the University's overarching strategy and its four goals. And it locates action in developing STEM provision as a core element of making real the University's commitment to grow new skills' supply for high growth, high innovation businesses and industrial sectors. And already the University has around 30% of its provision in STEM subjects (as reported to HESA).

1.5 Nor is the University's STEM strategy pursued in isolation from a broader strategic intent that spans the UK economy. The Government's own industrial strategy is clear that *'the objective of our modern industrial strategy is to improve living standards and economic growth by increasing productivity and driving growth across the whole country.'*
The strategy is urgent in its identification that skills are critical to raising productivity and growing high value adding STEM businesses. As the strategy states, *'we must help people and businesses to thrive by: ensuring everyone has the basic skills needed in a modern economy;*

[1] http://www.glos.ac.uk/docs/download/Business/strategic-plan-2017-2022.pdf

building a new system of technical education to benefit the half of young people who do not go to university; boosting STEM (science, technology, engineering and maths) skills, digital skills and numeracy; and by raising skill levels in lagging areas'.[2]The University of Gloucestershire's STEM strategy addresses these challenges as they pertain to the local economic geographies in which the University currently operates (see below). Indeed we see our role as future-proofing the supply of skills into the industrial clusters identified below.

1.6 Furthermore if, as a result of Brexit, current levels of EU labour market migration fall across a number of key industrial sectors then higher levels of home grown talent will be required to plug these potential additional skills gaps and shortages. This is a particular concern in many STEM sectors and in areas with densities of STEM industries.[3]

1.7 Within the University of Gloucestershire's local economies a number of STEM intensive industries operate. The South West England and South East Wales Science and Innovation audit (SWW-SIA) evaluated scientific excellence innovation and growth potential. SWW-SIA reviewed activity across 5 themes identified as having the greatest industrial strength, research capacity and long term potential. They are:

- **Aerospace and advanced engineering**
- **Digital living innovation**
- **Resilience, environment and sustainability**
- **Next generation microelectronics**
- **New energy systems**

1.8 The university's STEM strategy addresses needs across several of these industrial clusters. For example research shows that Gloucestershire, Bath and North East Somerset, Swindon and Wiltshire have many companies involved in STEM areas. These range from SMEs such as AGD Systems, Heber and ABB Ltd, through to large international companies such as Schlumberger, EDF, GE Aviation, and Dowty. Our industry partners are experiencing severe skills gaps and skills shortages in engineering in particular. Nationally the UK needs over 18,000 more engineers a year up to 2022.

1.9 In Gloucestershire studies conducted by GFirst (2016) , the Local Enterprise Partnership, indicated that in engineering and the rest of manufacturing, employment is projected to shift away from employment in skilled trades and among process/machine operatives and towards higher-level (Managerial, Professional and Technical) occupations. Indeed the data indicates that within the Gloucestershire LEP area, 55% of the net requirement, or 6,000 of the 10,900 employees that need to be recruited into Engineering and the rest of Manufacturing, are projected to be in managerial, professional or associate professional occupations.

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/611705/building-our-industrial-strategy-green-paper.pdf
[3] http://www.centreforcities.org/publication/brexit-trade-economic-impacts-uk-cities/?gclid=EAIaIQobChMI8qTfkdTl1QIVqbztCh11CgiZEAMYAiAAEgINYvD_BwE

1.10 Meanwhile in recent skills surveys engineering employers reported that:
30% of these vacancies were hard to fill, compared with 23% of vacancies across the economy as a whole; 24% of these vacancies were hard to fill due to a lack of applicants with appropriate skills, compared with 16% of vacancies across the whole economy; 17% of Manufacturing employers reported that they had one or more members of staff who had a skills gap. Moreover the engineering workforce is ageing and many highly-skilled engineers are retiring leaving a short-fall in the supply of technicians and engineers trained to Levels three and four while Gloucestershire is in the bottom third for the percentage of A levels entered that are STEM (27.8%) and the percentage of STEM A levels entered by girls (41.22%).

1.11 Moreover in response to this demand-side need, the University is delivering the STEM strategy already through partnerships with FE Colleges, Businesses and others and through a wide range of programmes from traditional undergraduate programmes to a broad range of degree apprenticeships. These new courses enable the University to reach a wider pool of talent including many people already active in the workplace.

2. OUR STEM CLUSTERS AND EXISTING AREAS OF ACTIVITY

2.1 The University has organised its STEM activity into three clusters and five activity areas. It works with and through partners to build communities to deliver the outcomes in each cluster area and through one or more distinct area of activity. The three clusters are:

- **Bio, physical and social sciences**
- **Digital and Creative Technologies**
- **Engineering**

2.2 The five activity areas include:

- Taught undergraduate provision
- Taught postgraduate provision
- Degree apprenticeships
- Research
- Knowledge transfer and exchange driven through the Growth Hub and specific research centres (see below)

2.3 Much of this development work is happening, and will be developed with and through, partnerships with local businesses and with and through delivery partners including FE Colleges. Such a strategy ensures economies of scale; sharing of suitable facilities and strong progression routes for every type of student.

2.4 The matrix below (Table 1) describes the existing and already in development provision against each of the three clusters

Table 1: Existing STEM Provision	Bio, Physical and Social Sciences	Digital and Creative Technologies	Engineering
BSc/BEng	Biology Animal Biology Ecology Environmental Science Geography Sport and Exercise Sciences Applied Social Sciences Policing Criminology Sociology Psychology Nursing	Business Information Technology Computer Games Design Computing Computer Games Programming Forensic Computing Information Technology Multimedia Web Design Cyber and Computer Security Digital Media and Web Technologies	Product Design Integrated Engineering
PG (taught)	Applied Ecology Criminology Forensic Psychology Occupational Psychology Professional Practice in Sports Coaching Professional Practice in Sports Therapy Psychology	Computing Cyber Security	
PG (Research)	Biological Sciences Countryside and Community Geography and Environmental Studies Health Social Science Sport and Exercise Sustainability	Computing and IT	

Higher Education and Degree Apprenticeships	Healthcare Assistant Practitioner Nursing Associate Nursing Nursing (Mental Health)	Cyber Security Technical Professional	Product design and development engineer Internet of Things (IoT) and cyber systems engineer
Research programmes	Research outputs in Units of Assessment: • Architecture, Built Environment, Planning • Geography, Environmental Studies • Sport and Exercise, Leisure and Tourism • Psychology, Psychiatry and Neuroscience	Research outputs in Units of Assessment: • Communication, Cultural & Media	Research outputs in Units of Assessment: • General Engineering
Research Centres	Advanced Renewables Research Centre (ARRC) (proposed) Centre for Environmental Change and Quaternary Research Centre for Research in Applied Cognition, Knowledge, Learning and Emotion (CRACKLE) Countryside and Community Research Institute (CCRI) Exercise and Sport Research Centre (ESRC)		Advanced Renewables Research Centre (ARRC) (proposed)

3. Future Developments

3.1 As can be seen from Table 1 above there is considerable existing provision in the first cluster Bio, Physical and Social Sciences; some in Digital and Creative Technologies and some in Engineering. The University is particularly concerned to develop its range of offerings in Digital and Creative Technologies and Engineering as such expansion will help the University to deliver excellence in: (1) teaching and learning, (2) support for employability, (3) its contribution to the economic growth and well-being of Gloucestershire and other economies it works in. As importantly an increase in the technology and engineering provision and capability at the University will also support the key strategic objective to further develop a close partnership with GFirst LEP and support economic growth in the priority sectors for Gloucestershire.

3.2 As can be seen from the industrial areas identified as high growth potential (see above) engineering is a core component and an area in which the University has an emergent capability. Through its partnerships with FE Colleges it now has access to industry-standard equipment and facilities. It has started to build its portfolio of undergraduate, postgraduate and apprenticeship degrees. And as will be described below, through the establishment of the Growth Hub with GFirst LEP, has a burgeoning relationship across a wide range of STEM related employers eager to develop pertinent courses and training.

3.3 Some of the University's STEM initiatives have focused on developing the former nuclear power station site at Berkeley Green working with SGS and GFirst LEP. This development is committed to turning Berkeley Green into an advanced science park for teaching, training and research. It brings together educational institutions, start-up businesses, SMEs and larger commercial companies and helps to provide to the County a supply-chain of skilled workforce and support product innovation and development. This will be a springboard for the University to expand its provision in STEM and helps provide a skilled workforce to attract businesses to the County, thereby enhancing the University's reputation.

3.4 In addition to capital funds to support cyber security training and conference facilities, the University has also received initial approval for a £4m bid to establish an Advanced Renewable Energy Research Centre (ARRC) and incorporating a visitor centre. ARRC complements the University's other STEM research centres referenced in Table 1 and will align the university's research development with local economic growth sectors (in this case resilience, environment and sustainability industries).

3.5 Another focus at Berkeley is research and curriculum development for advanced cyber security training. Significant investment is already in place to ensure facilities and staffing expertise is available to support curriculum expansion and research excellence. At Berkeley the project is being delivered through a partnership between SGS and other key stakeholders in the area of public and private security.

3.6 The prospective £4m investment in renewable energy research at Berkeley is being supported by two key RPAs at the University working in collaboration. The Applied Design for Business RPA covers the Unit of Assessment in Engineering, which is focused on the engineering and science needed to provide state-of-the art research through the planned laboratory and testing facilities and encourage inward investment for business growth and technology research to look for new and improved methods for energy harvesting and storage. The University will seek revenue to recruit expertise and researchers through sponsorship, rental income and income through relevant engineering apprenticeships and degree courses being developed to feed into the research centre's activity (see Tables 1 and 2)

3.7 The other RPA that supports developments in renewable energy research is the Environmental Dynamics and Governance (EDG) RPA. EDG focuses on ways to engage the public and small business in adopting renewable energy technology and practices, and to influence public policy to support this.

3.8 Much of the curriculum development in STEM will be focused on Degree Apprenticeships as these are seen as a more direct way of upskilling the existing STEM workforce and offering a supply of skilled candidates into the future STEM workforce.

Table 2: Future Curriculum Developments in STEM

Future STEM Provision	**Bio, Physical and Social Sciences**	**Digital and Creative Technologies**	**Engineering**	**Potential Student Numbers and total apprenticeship Income feeding into ARRC**
Degree Apprenticeships being scoped as additions to the portfolio	Advanced Nursing Practice Physiotherapy/occupational physiotherapy Pharmacy	Digital Media Practitioner Creative Digital Designer	Systems Engineering (L7) Postgraduate Engineer (L7) Embedded electronic systems design and development engineer (L6) Control/technical Support (L6) Digital Technology Solutions Professional (L6) ***Already in development:*** ***Product design and development engineer*** ***Internet of Things (IoT) and cyber systems engineer***	10 £270K 10 £270K 15 £405K 15 £405K 15 £405K 15 £405K 15 £405K
Research Centres	Advanced Renewables Research Centre (ARRC)		Advanced Renewables Research Centre (ARRC)	